Application Data Sheet 37 CFR 1.76	Attorney Docket Number	NC77198US-NP
	Application Number	
Title of Invention	METHOD FOR CODING AND AN APPARATUS	

The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.
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Secrecy Order 37 CFR 5.2

☐ Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)

Applicant Information:

Applicant 1 Remove

Applicant Authority	◉ Inventor	◯ Legal Representative under 35 U.S.C. 117	◯ Party of Interest under 35 U.S.C. 118	
Prefix	**Given Name**	**Middle Name**	**Family Name**	**Suffix**
	Mehmet	Oguz	BICI	
Residence Information (Select One)	◯ US Residency	◉ Non US Residency	◯ Active US Military Service	
City	Tampere	**Country Of Residence** i	TR	
Citizenship under 37 CFR 1.41(b) i	FI			
Mailing Address of Applicant:				
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Address 2				
City	Tampere	**State/Province**		
Postal Code	33500	**Country** i	FI	

Applicant 2 Remove

Applicant Authority	◉ Inventor	◯ Legal Representative under 35 U.S.C. 117	◯ Party of Interest under 35 U.S.C. 118	
Prefix	**Given Name**	**Middle Name**	**Family Name**	**Suffix**
	Jani		LAINEMA	
Residence Information (Select One)	◯ US Residency	◉ Non US Residency	◯ Active US Military Service	
City	Tampere	**Country Of Residence** i	FI	
Citizenship under 37 CFR 1.41(b) i	FI			
Mailing Address of Applicant:				
Address 1	Kisakentankatu 12 B 6			
Address 2				
City	Tampere	**State/Province**		
Postal Code	33230	**Country** i	FI	

Applicant 3 Remove

Applicant Authority	◉ Inventor	◯ Legal Representative under 35 U.S.C. 117	◯ Party of Interest under 35 U.S.C. 118	
Prefix	**Given Name**	**Middle Name**	**Family Name**	**Suffix**
	Kemal		UGUR	
Residence Information (Select One)	◯ US Residency	◉ Non US Residency	◯ Active US Military Service	
City	Tampere	**Country Of Residence** i	FI	

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Title of Invention	METHOD FOR CODING AND AN APPARATUS

Citizenship under 37 CFR 1.41(b) i	TR		
Mailing Address of Applicant:			
Address 1	Lapintie 6D 25		
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City	Tampere	**State/Province**	
Postal Code	33100	**Country**i	FI
All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the **Add** button.			Add

Correspondence Information:

Enter either Customer Number or complete the Correspondence Information section below. For further information see 37 CFR 1.33(a).			
☐ **An Address is being provided for the correspondence Information of this application.**			
Customer Number	73658		
Email Address	ipr.inhouse@nokia.com	Add Email	Remove Email

Application Information:

Title of the Invention	METHOD FOR CODING AND AN APPARATUS		
Attorney Docket Number	NC77198US-NP	**Small Entity Status Claimed** ☐	
Application Type	Nonprovisional		
Subject Matter	Utility		
Suggested Class (if any)		**Sub Class (if any)**	
Suggested Technology Center (if any)			
Total Number of Drawing Sheets (if any)	13	**Suggested Figure for Publication (if any)**	

Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)

☐ **Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application **has not and will not** be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32). Enter either Customer Number or complete the Representative Name section below. If both sections are completed the Customer Number will be used for the Representative Information during processing.

Please Select One:	◉ Customer Number	○ US Patent Practitioner	○ Limited Recognition (37 CFR 11.9)

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	NC77198US-NP
	Application Number	
Title of Invention	METHOD FOR CODING AND AN APPARATUS	

Customer Number	73658

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, or 365(c) or indicate National Stage entry from a PCT application. Providing this information in the application data sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78(a)(2) or CFR 1.78(a)(4), and need not otherwise be made part of the specification.

Prior Application Status		Remove	
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)
	non provisional of	61/555703	2011-11-04

Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the **Add** button. Add

Foreign Priority Information:

This section allows for the applicant to claim benefit of foreign priority and to identify any prior foreign application for which priority is not claimed. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55(a).

Remove

Application Number	Country i	Parent Filing Date (YYYY-MM-DD)	Priority Claimed
			(●) Yes ( ) No

Additional Foreign Priority Data may be generated within this form by selecting the **Add** button. Add

Assignee Information:

Providing this information in the application data sheet does not substitute for compliance with any requirement of part 3 of Title 37 of the CFR to have an assignment recorded in the Office.

Assignee 1 Remove

If the Assignee is an Organization check here. ☒

Organization Name	Nokia Corporation		
Mailing Address Information:			
Address 1	Keilalahdentie 4		
Address 2			
City	Espoo	**State/Province**	
Country i	FI	Postal Code	02150
Phone Number		Fax Number	
Email Address			

Additional Assignee Data may be generated within this form by selecting the **Add** button. Add

Signature:

A signature of the applicant or representative is required in accordance with 37 CFR 1.33 and 10.18. Please see 37 CFR 1.4(d) for the form of the signature.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	NC77198US-NP
	Application Number	

Title of Invention	METHOD FOR CODING AND AN APPARATUS

Signature	/Thomas J. Arria/			Date (YYYY-MM-DD)	2012-11-01
First Name	Thomas J.	Last Name	Arria	Registration Number	60223

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4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

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7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

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9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Claims:

1. A method comprising:

receiving a block of pixels including a prediction unit;

determining a set of spatial motion vector prediction candidates for the block of pixels; the spatial motion vector prediction candidates being provided with motion information;

selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit;

determining a subset of spatial motion vector predictions based on the location of the block associated with the first spatial motion vector prediction candidate;

comparing motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates;

if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other, excluding the first spatial motion vector prediction candidate from the merge list.

2. The method according to claim 1 comprising selecting spatial motion vector prediction candidates from the set of spatial motion vector prediction candidates as the potential spatial motion vector prediction candidate in a predetermined order.

3. The method according to claim 1 , comprising comparing motion information of the potential spatial motion vector prediction candidate with motion information of at most one other spatial motion vector prediction candidate of the set of spatial motion vector prediction candidates.

4. The method according to claim 1 comprising examining whether the received block of pixels is divided into a first prediction unit and a second prediction unit; and if so, excluding the potential spatial motion vector prediction candidate from the merge list if the prediction unit is the second prediction unit.

5. The method according to claim 1, further comprising

determining a maximum number of spatial motion vector prediction candidates to be included in a merge list; and

limiting the number of spatial motion vector prediction candidates in the merge list smaller or equal to the maximum number .

6. The method according to claim 1 comprising:

examining, if the number of spatial motion vector prediction candidates in the merge list smaller than the maximum number;

if so, examining whether a prediction unit to which the potential spatial motion vector prediction candidate belongs is available for motion prediction;

if so, performing at least one of the following:

for the potential spatial motion vector prediction candidate on the left side of the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled:

- the received block of pixels is vertically divided into a first prediction unit and a second prediction unit, and the prediction unit is the second prediction unit;
- the received block of pixels is horizontally divided into a first prediction unit and a second prediction unit, and if the prediction unit is the second prediction unit, and the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate above the prediction unit;

for the potential spatial motion vector prediction candidate above the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled:

- the received block of pixels is horizontally divided into a first prediction unit and a second prediction unit, and the prediction unit is the second prediction unit;

– the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit;

for the potential spatial motion vector prediction candidate, which is on the right side of the potential spatial motion vector prediction candidate above the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate above the prediction unit;

for the potential spatial motion vector prediction candidate, which is below the potential spatial motion vector prediction candidate on the left side of the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit;

for the potential spatial motion vector prediction candidate cornerwise neighbouring the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled:

– all the other potential spatial motion vector prediction candidates have been included in the merge list;

– the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate above the prediction unit;

– the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit.

7. The method according to claim 1 further comprising including a temporal motion prediction candidate into the merge list.

8. The method according to claim 1 comprising selecting one motion vector prediction candidate from the merge list to represent a motion vector prediction for the block of pixels.

9. A method comprising:

receiving an encoded block of pixels including a prediction unit;

determining a set of spatial motion vector prediction candidates for the encoded block of pixels; the spatial motion vector prediction candidates being provided with motion information;

selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit;

determining a subset of spatial motion vector predictions based on the location of the block associated with the first spatial motion vector prediction candidate;

comparing motion information of the first spatial motion vector prediction candidate with motion information of another spatial motion vector prediction candidate of the set of spatial motion vector prediction candidates;

if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other, excluding the first spatial motion vector prediction candidate from the merge list.

10. The method according to claim 9 comprising comparing motion information of the potential spatial motion vector prediction candidate with motion information of at most one other spatial motion vector prediction candidate of the set of spatial motion vector prediction candidates.

11. The method according to claim 9 comprising examining whether the received encoded block of pixels is divided into a first prediction unit and a second prediction unit; and if so, excluding the potential spatial motion vector prediction candidate from the merge list if the prediction unit is the second prediction unit.

12. The method according to claim 9 further comprising

determining a maximum number of spatial motion vector prediction candidates to be included in a merge list; and limiting the number of spatial motion vector prediction candidates in the merge list smaller or equal to the maximum number.

13. The method according to claim 9 comprising:

examining, if the number of spatial motion vector prediction candidates in the merge list smaller than the maximum number;

if so, examining whether a prediction unit to which the potential spatial motion vector prediction candidate belongs is available for motion prediction;

if so, performing at least one of the following:

for the potential spatial motion vector prediction candidate on the left side of the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled:

– the received encoded block of pixels is vertically divided into a first prediction unit and a second prediction unit, and the prediction unit is the second prediction unit;

– the received encoded block of pixels is horizontally divided into a first prediction unit and a second prediction unit, and if the prediction unit is the second prediction unit, and the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate above the prediction unit;

for the potential spatial motion vector prediction candidate above the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled:

– the received encoded block of pixels is horizontally divided into a first prediction unit and a second prediction unit, and the prediction unit is the second prediction unit;

– the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit;

for the potential spatial motion vector prediction candidate, which is on the right side of the potential spatial motion vector prediction candidate above the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate above the prediction unit;

for the potential spatial motion vector prediction candidate, which is below the potential spatial motion vector prediction candidate on the left side of the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit;

for the potential spatial motion vector prediction candidate cornerwise neighbouring the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled:

- all the other potential spatial motion vector prediction candidates have been included in the merge list;
- the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate above the prediction unit;
- the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit.

14. The method according to claim 9 comprising selecting one motion vector prediction candidate from the merge list to represent a motion vector prediction for the received encoded block of pixels.

15. An apparatus comprising a processor and a memory including computer program code, the memory and the computer program code configured to, with the processor, cause the apparatus to:

receiving a block of pixels including a prediction unit;

determining a set of spatial motion vector prediction candidates for the block of pixels; the spatial motion vector prediction candidates being provided with motion information;

selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit;

determining a subset of spatial motion vector predictions based on the location of the block associated with the first spatial motion vector prediction candidate;

comparing motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates;

if at least one the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other, excluding the first spatial motion vector prediction candidate from the merge list.

16. An apparatus comprising a processor and a memory including computer program code, the memory and the computer program code configured to, with the processor, cause the apparatus to:

receive an encoded block of pixels including a prediction unit;

determine a set of spatial motion vector prediction candidates for the encoded block of pixels; the spatial motion vector prediction candidates being provided with motion information;

select a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit;

determine a subset of spatial motion vector predictions based on the location of the block associated with the first spatial motion vector prediction candidate;

compare motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates;

exclude the first spatial motion vector prediction candidate from the merge list, if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other

17. A storage medium having stored thereon a computer executable program code for use by an encoder, said program codes comprise instructions for use by an encoder, said program code comprises instructions for:

receiving a block of pixels including a prediction unit;

determining a set of spatial motion vector prediction candidates for the block of pixels; the spatial motion vector prediction candidates being provided with motion information;

selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit;

determining a subset of spatial motion vector predictions based on the location of the block associated with the first spatial motion vector prediction candidate;

comparing motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates;

if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other, excluding the first spatial motion vector prediction candidate from the merge list.

18. A storage medium having stored thereon a computer executable program code for use by an encoder, said program codes comprise instructions for use by an encoder, said program code comprises instructions for:

receiving an encoded block of pixels including a prediction unit;

determining a set of spatial motion vector prediction candidates for the encoded block of pixels; the spatial motion vector prediction candidates being provided with motion information;

selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit;

determining a subset of spatial motion vector predictions based on the location of the block associated with the first spatial motion vector prediction candidate;

comparing motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates;

if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other, excluding the first spatial motion vector prediction candidate from the merge list.

19. An apparatus comprising:

means for receiving a block of pixels including a prediction unit;

means for determining a set of spatial motion vector prediction candidates for the block of pixels; the spatial motion vector prediction candidates being provided with motion information;

means for selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit;

means for determining a subset of spatial motion vector predictions based on the location of the block associated with the first spatial motion vector prediction candidate;

means for comparing motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates;

means for excluding the first spatial motion vector prediction candidate from the merge list, if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other.

20. An apparatus comprising:

means for receiving an encoded block of pixels including a prediction unit;

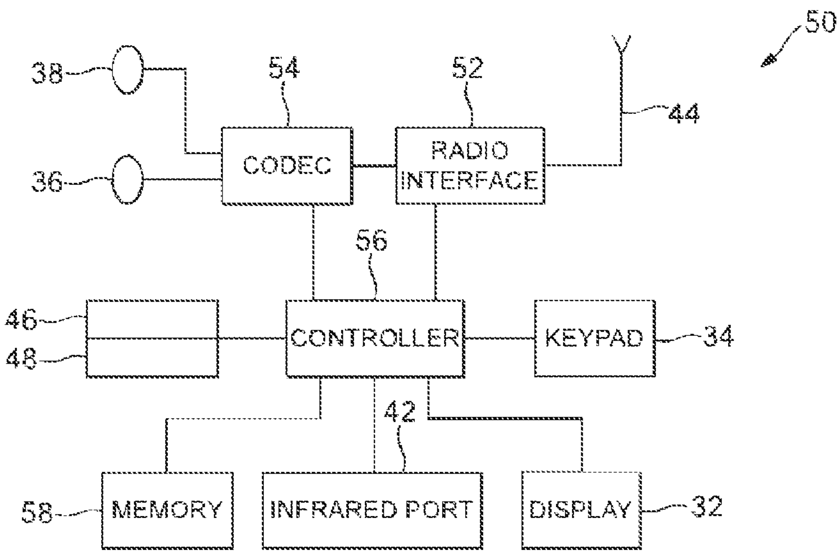
means for determining a set of spatial motion vector prediction candidates for the encoded block of pixels; the spatial motion vector prediction candidates being provided with motion information;

means for selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit;

means for determining a subset of spatial motion vector predictions based on the location of the block associated with the first spatial motion vector prediction candidate;

means for comparing motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates;

means for excluding the first spatial motion vector prediction candidate from the merge list, if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other.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CODEC
RADIO
INTERFACE
36
56
46
CONTROLLER
KEYPAD
34
48
42
58
MEMORY
INFRARED PORT
DISPLAY
32

FIG.1

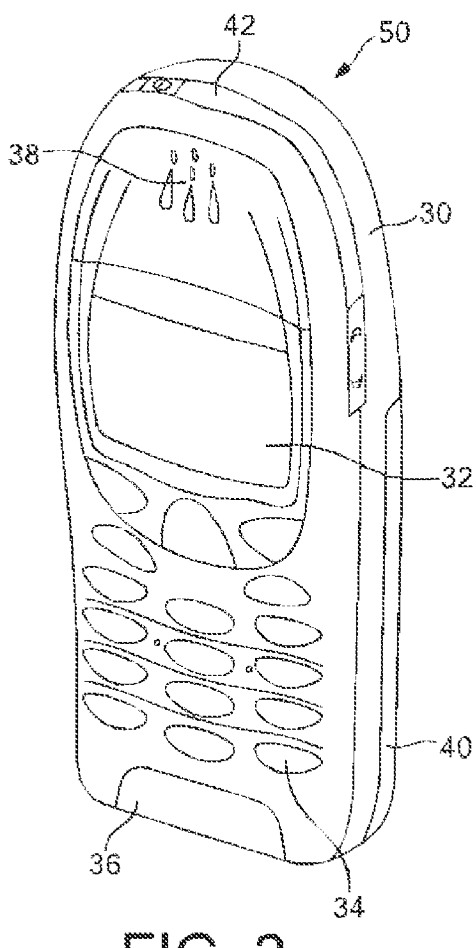
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FIG. 2

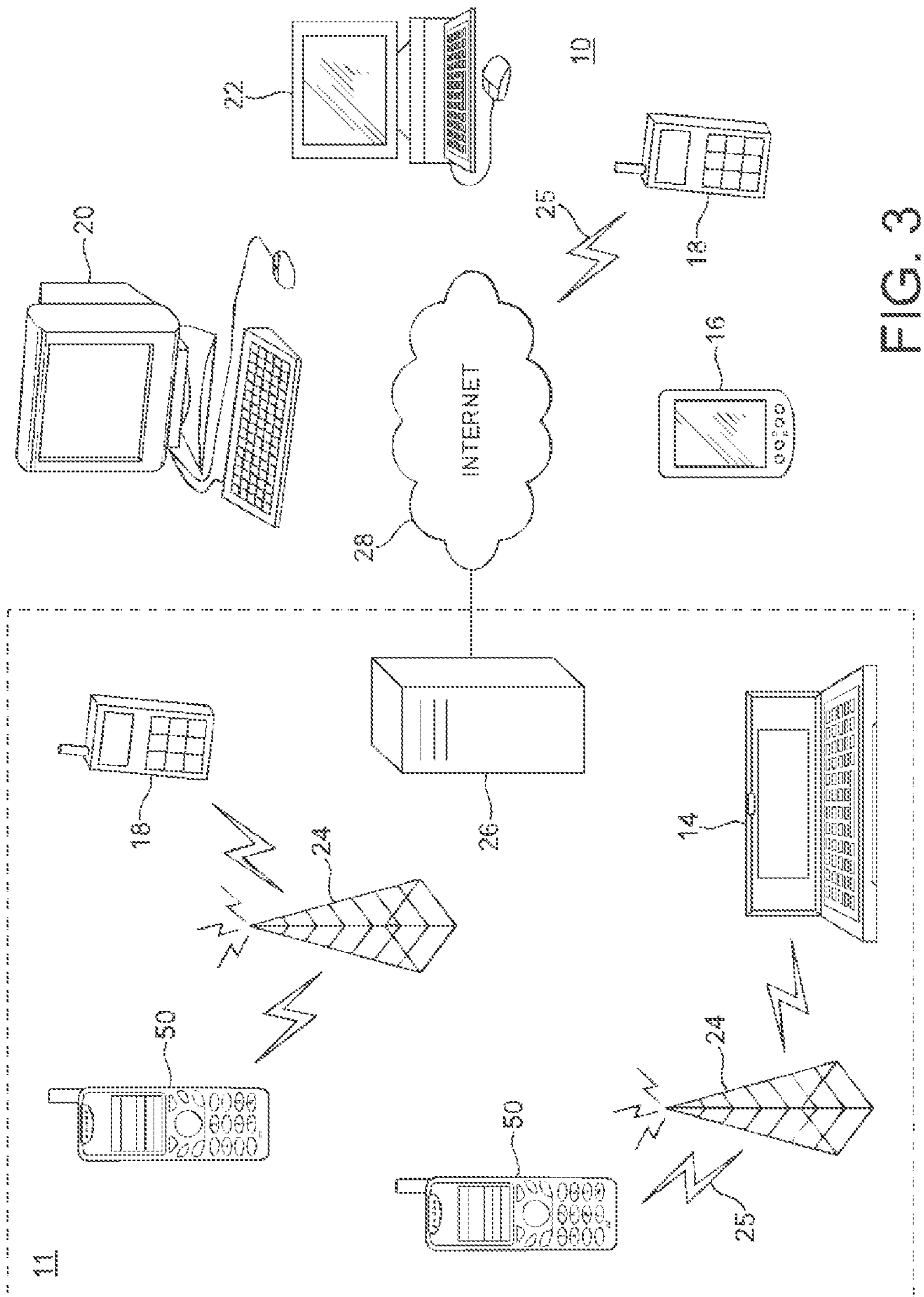
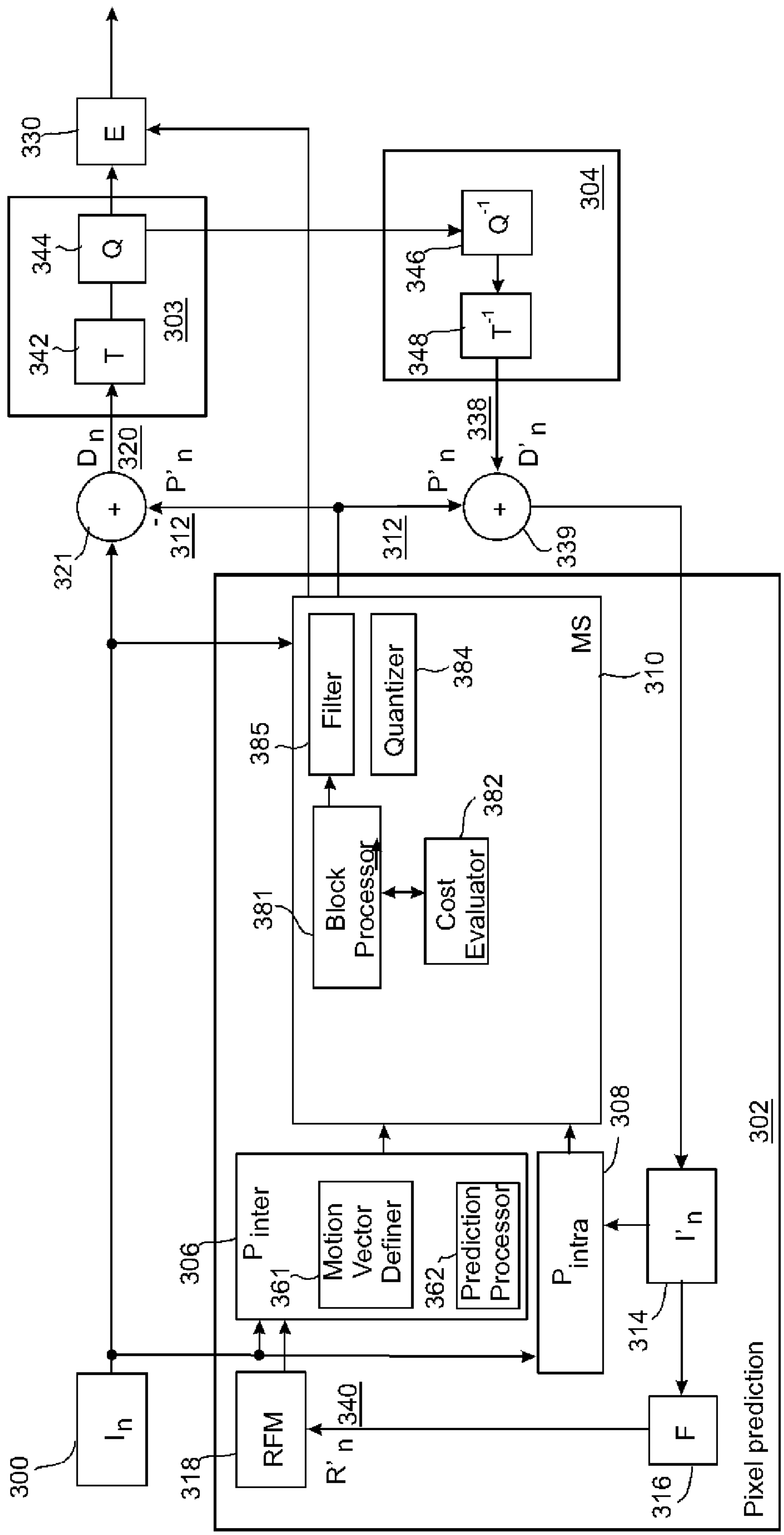


FIG. 3



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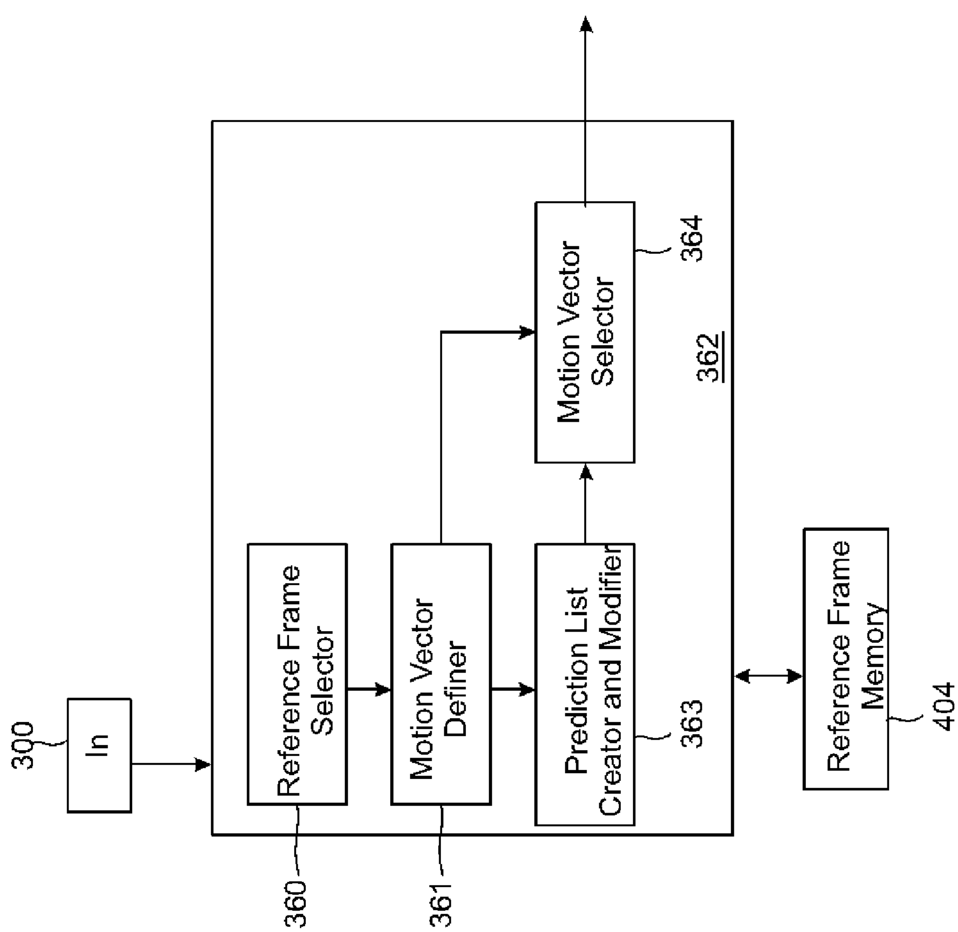
I_n
318
RFM
R'_n
340
306
P_{inter}
361
Motion Vector Definer
362
Prediction Processor
P_{intra}
308
I'_n
314
F
316
Pixel prediction
302
MS
310
381
Block Processor
Cost Evaluator
382
385
Filter
Quantizer
384
321
+
-
312
P'_n
D_n
320
342
T
344
Q
303
330
E
346
Q^{-1}
348
T^{-1}
304
338
D'_n
P'_n
312
+
339

Fig. 4a



300
In
Reference Frame Selector
360
Motion Vector Definer
361
Prediction List Creator and Modifier
363
Motion Vector Selector
364
362
Reference Frame Memory
404

Fig. 4b

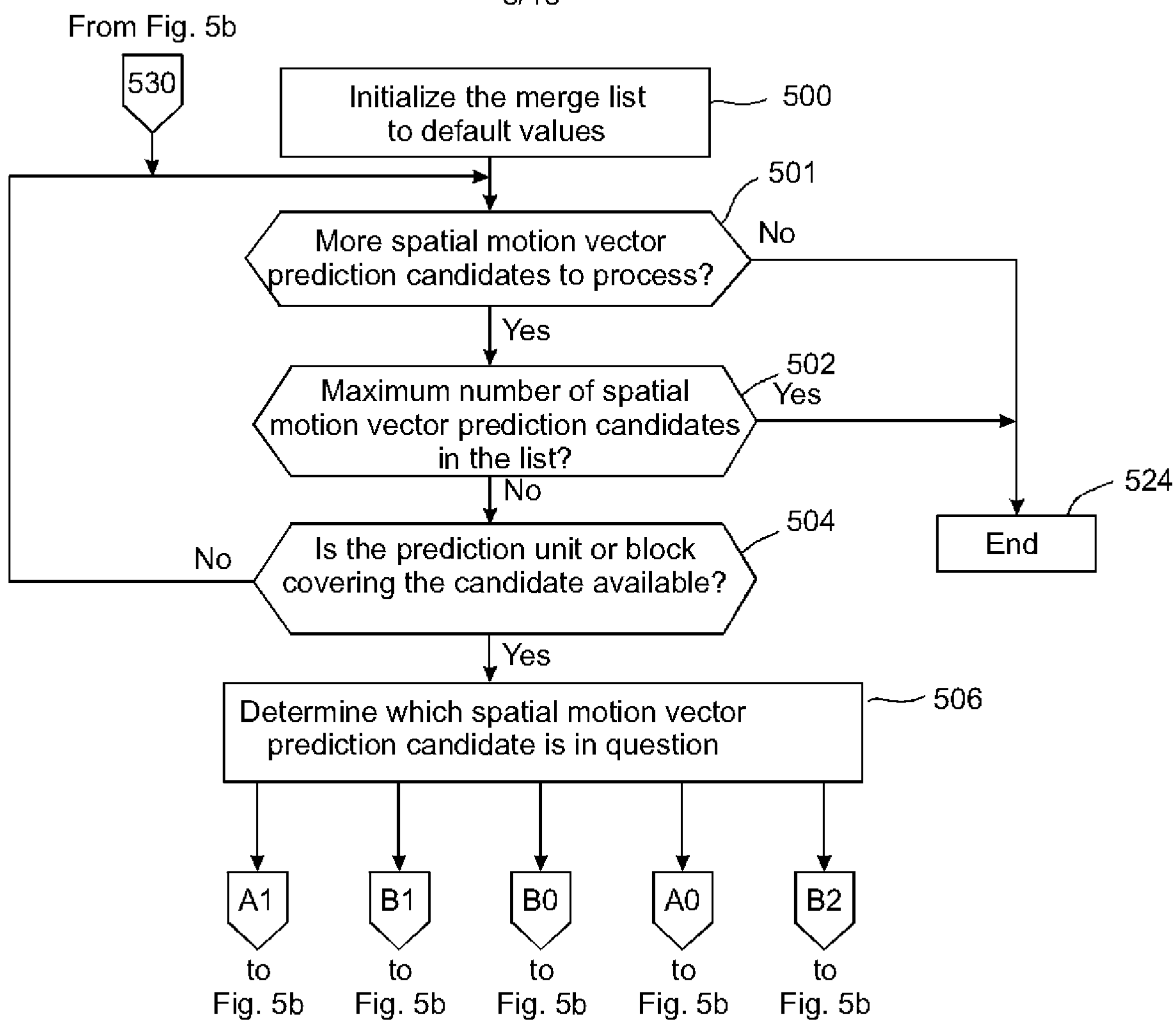

From Fig. 5b
530
Initialize the merge list to default values
500
501
More spatial motion vector prediction candidates to process?
No
Yes
502
Yes
Maximum number of spatial motion vector prediction candidates in the list?
No
524
End
504
No
Is the prediction unit or block covering the candidate available?
Yes
Determine which spatial motion vector prediction candidate is in question
506
A1
B1
B0
A0
B2
to Fig. 5b
to Fig. 5b
to Fig. 5b
to Fig. 5b
to Fig. 5b

Fig. 5a

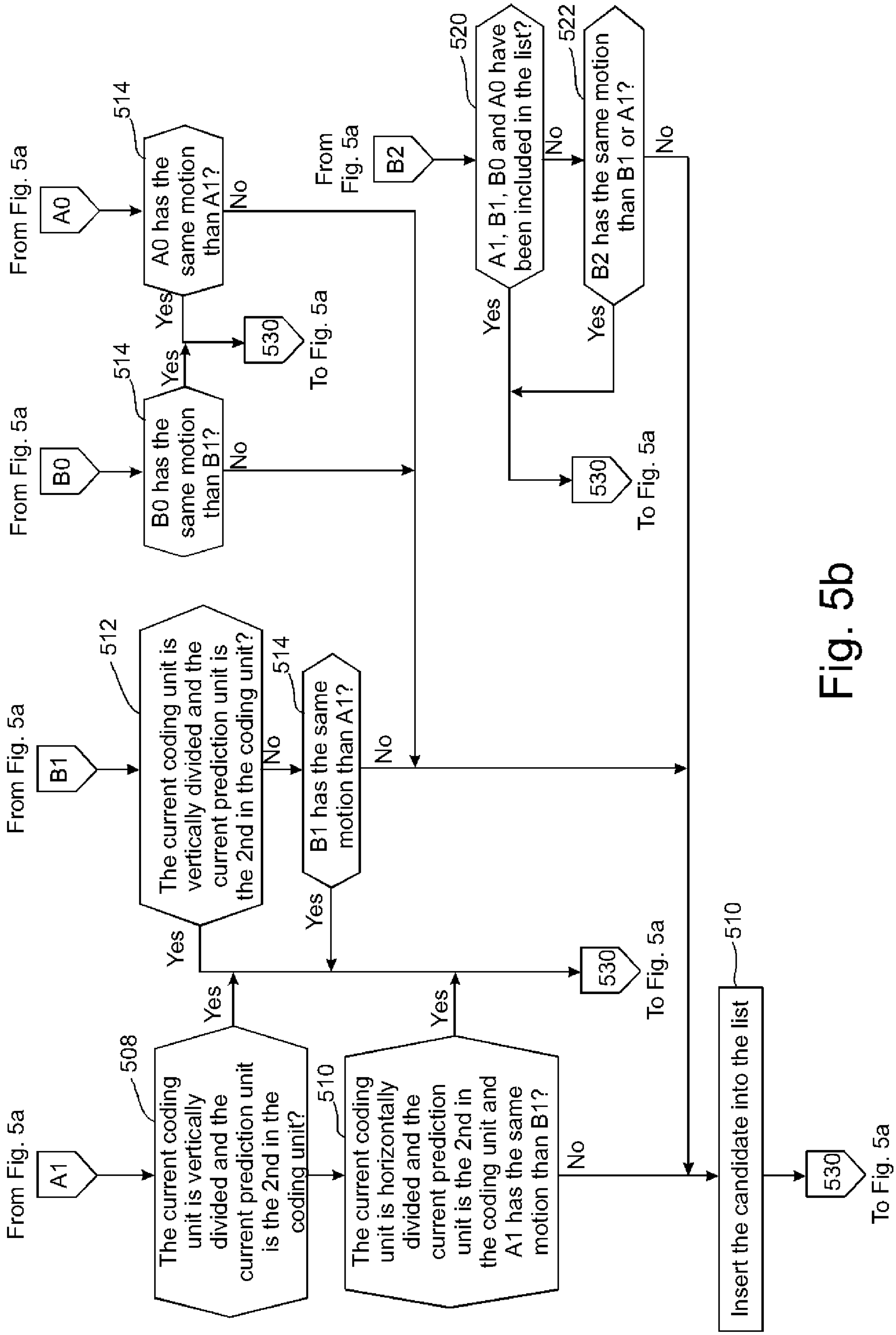

From Fig. 5a
A1
508
The current coding unit is vertically divided and the current prediction unit is the 2nd in the coding unit?
Yes
510
The current coding unit is horizontally divided and the current prediction unit is the 2nd in the coding unit and A1 has the same motion than B1?
Yes
No
From Fig. 5a
B1
512
The current coding unit is vertically divided and the current prediction unit is the 2nd in the coding unit?
Yes
No
514
B1 has the same motion than A1?
Yes
No
530
To Fig. 5a
From Fig. 5a
B0
514
B0 has the same motion than B1?
Yes
No
From Fig. 5a
A0
514
A0 has the same motion than A1?
Yes
No
530
To Fig. 5a
From Fig. 5a
B2
520
A1, B1, B0 and A0 have been included in the list?
Yes
No
522
B2 has the same motion than B1 or A1?
Yes
No
530
To Fig. 5a
510
Insert the candidate into the list
530
To Fig. 5a

Fig. 5b

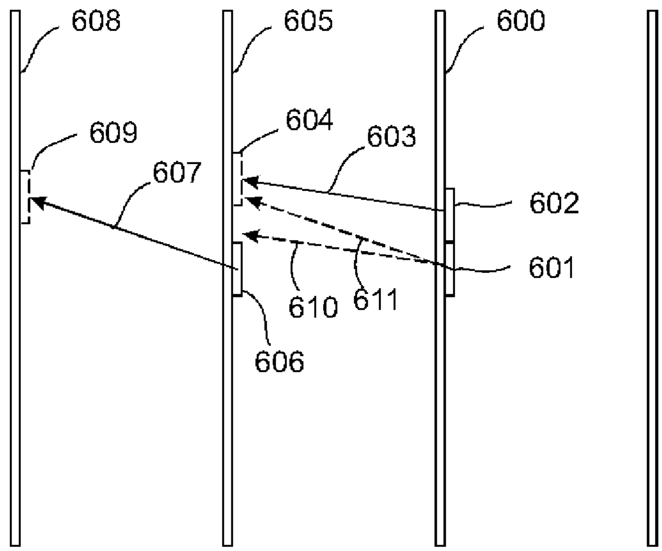

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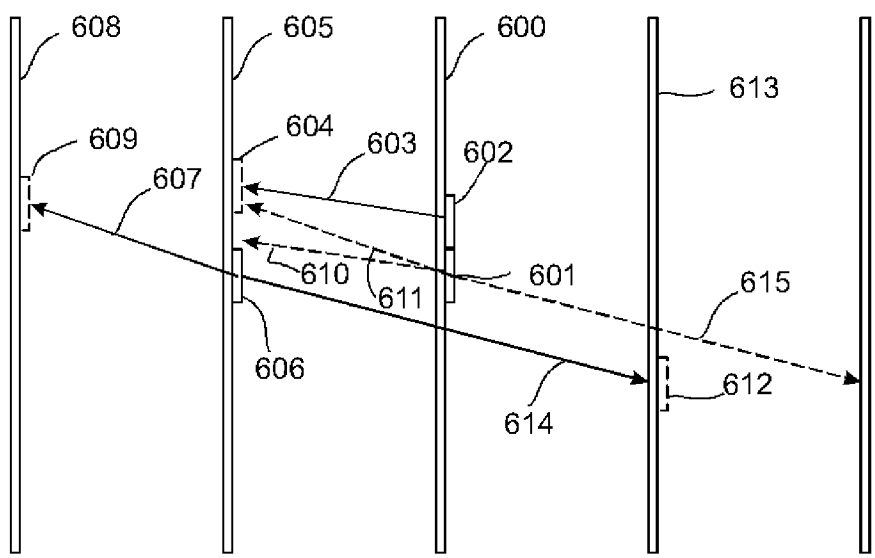
Fig. 6a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614

Fig. 6b

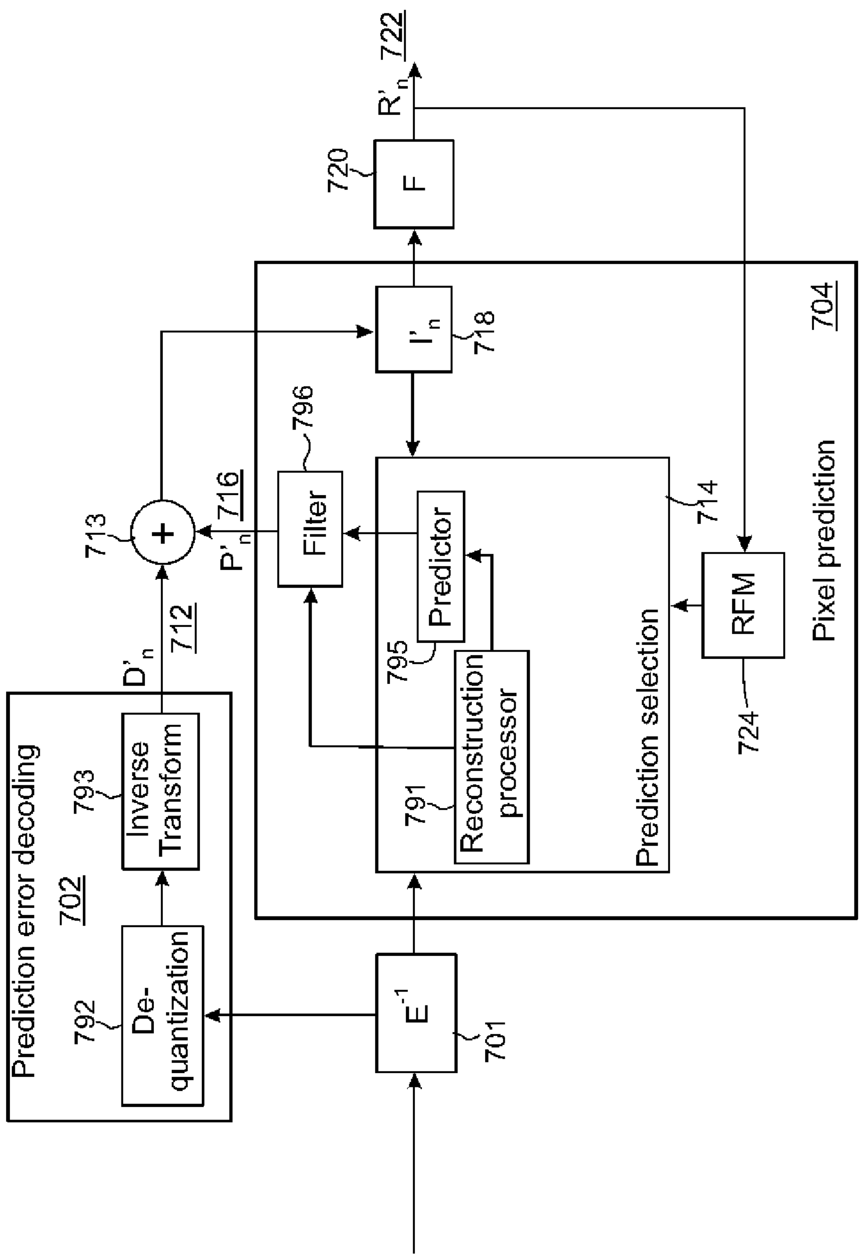
Prediction error decoding
702
792
De-quantization
793
Inverse Transform
D'n
712
713
+
P'n
716
Filter
796
E-1
701
Prediction selection
791
Reconstruction processor
795
Predictor
714
RFM
724
Pixel prediction
704
I'n
718
F
720
R'n
722

Fig. 7

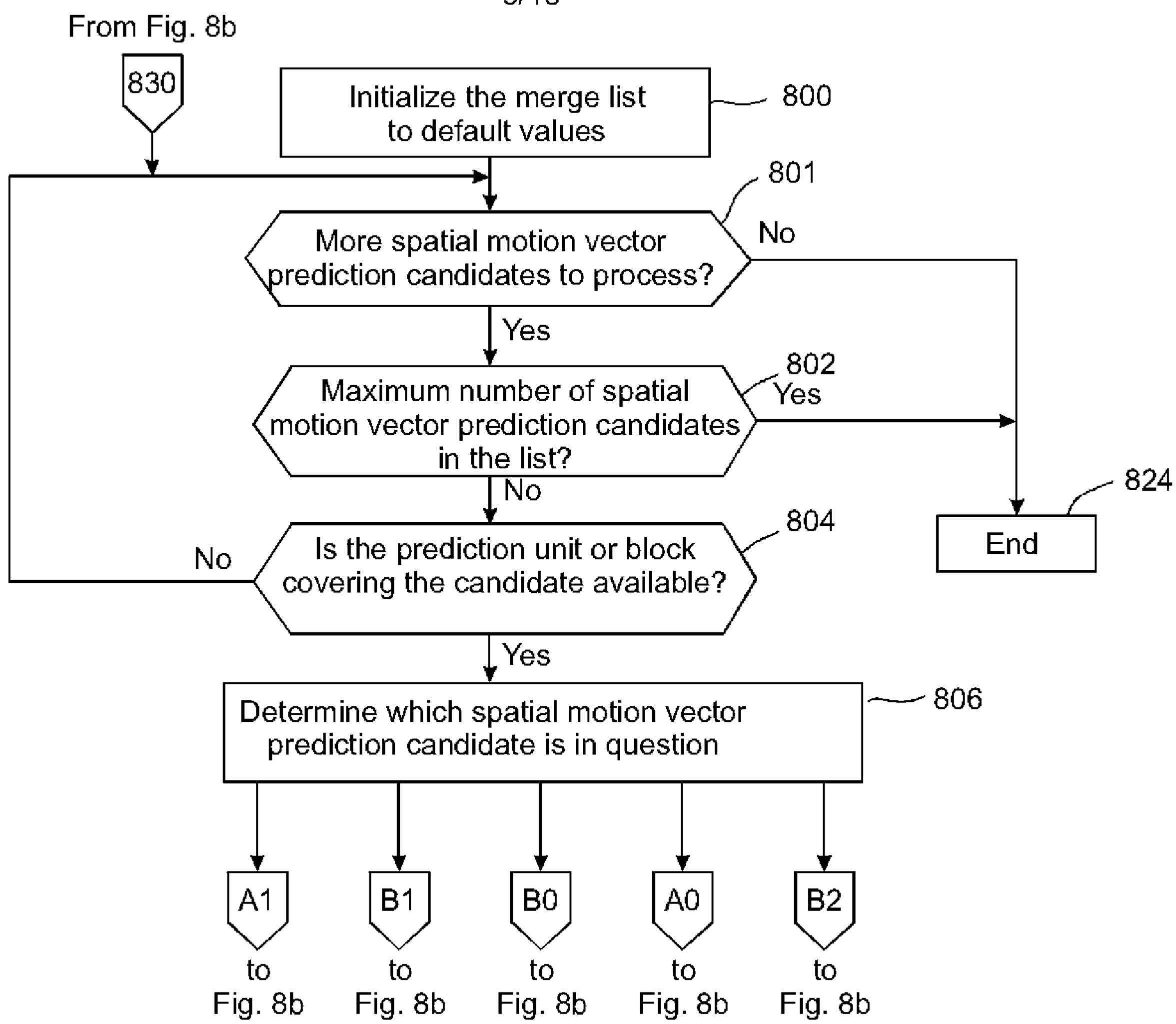
From Fig. 8b
830
Initialize the merge list to default values
800
801
More spatial motion vector prediction candidates to process?
No
Yes
802
Yes
Maximum number of spatial motion vector prediction candidates in the list?
No
824
End
804
No
Is the prediction unit or block covering the candidate available?
Yes
Determine which spatial motion vector prediction candidate is in question
806
A1
to Fig. 8b
B1
to Fig. 8b
B0
to Fig. 8b
A0
to Fig. 8b
B2
to Fig. 8b

Fig. 8a

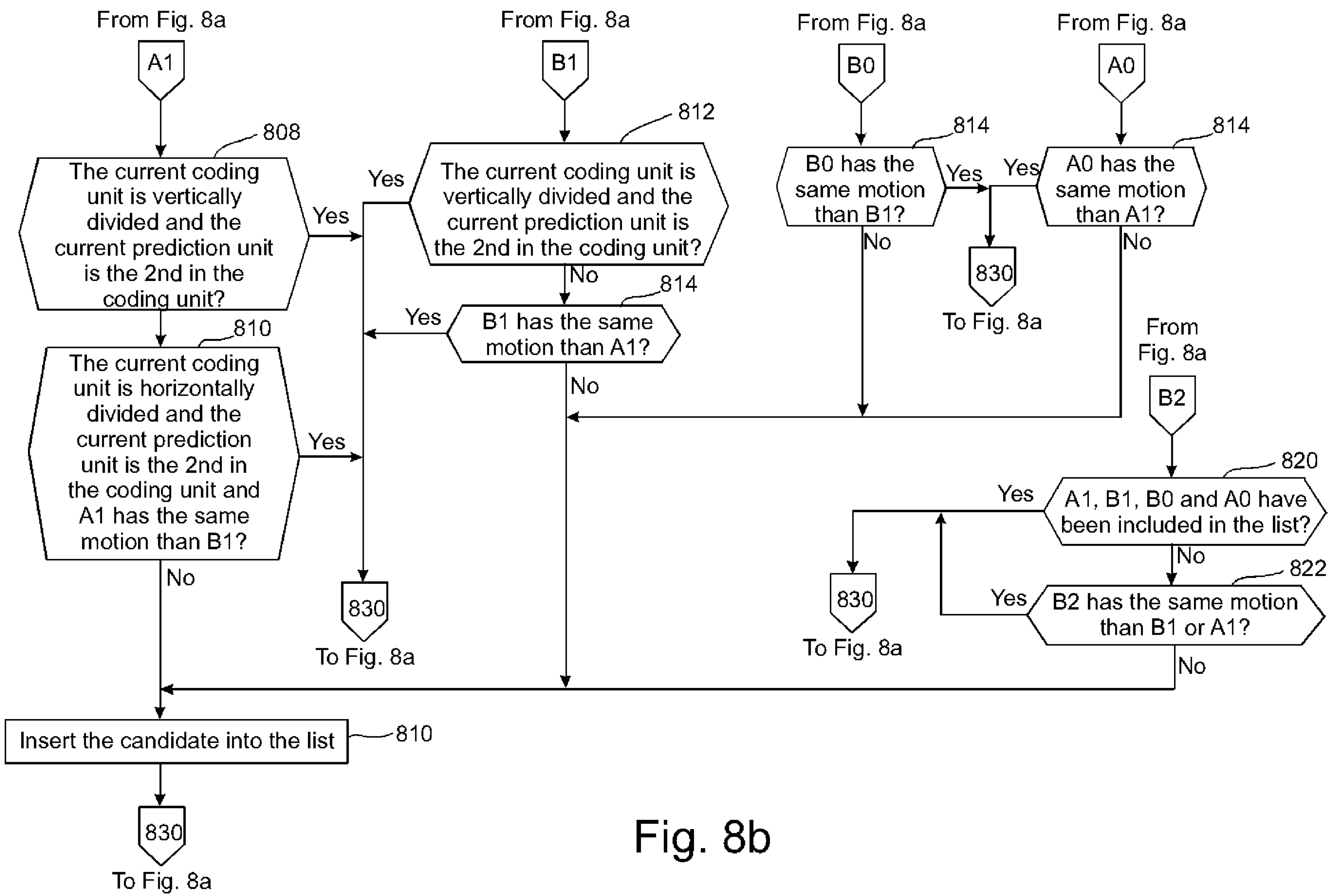
From Fig. 8a
A1
808
The current coding unit is vertically divided and the current prediction unit is the 2nd in the coding unit?
Yes
810
The current coding unit is horizontally divided and the current prediction unit is the 2nd in the coding unit and A1 has the same motion than B1?
Yes
No
From Fig. 8a
B1
812
The current coding unit is vertically divided and the current prediction unit is the 2nd in the coding unit?
Yes
No
814
B1 has the same motion than A1?
Yes
No
830
To Fig. 8a
From Fig. 8a
B0
814
B0 has the same motion than B1?
Yes
No
830
To Fig. 8a
From Fig. 8a
A0
814
A0 has the same motion than A1?
Yes
No
From Fig. 8a
B2
820
A1, B1, B0 and A0 have been included in the list?
Yes
No
822
B2 has the same motion than B1 or A1?
Yes
No
830
To Fig. 8a
Insert the candidate into the list
810
830
To Fig. 8a

Fig. 8b

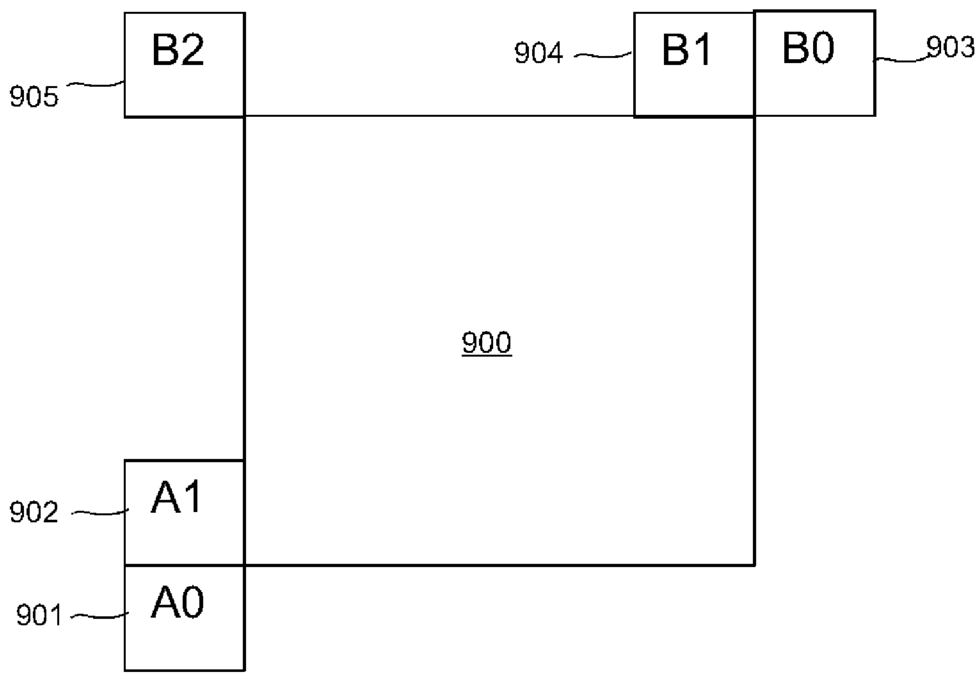

Fig. 9

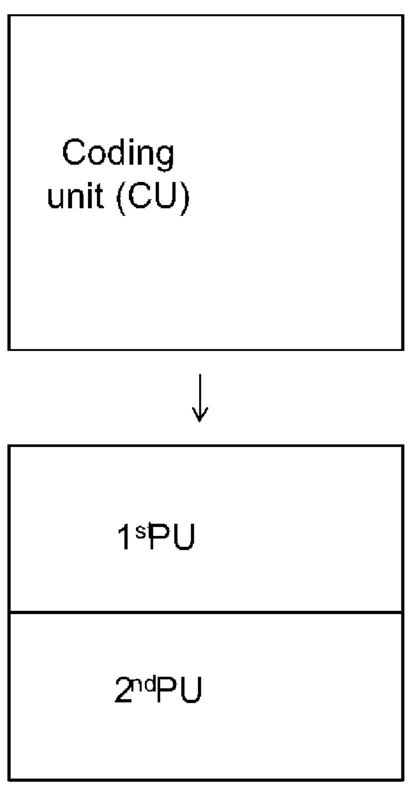

Fig. 10a

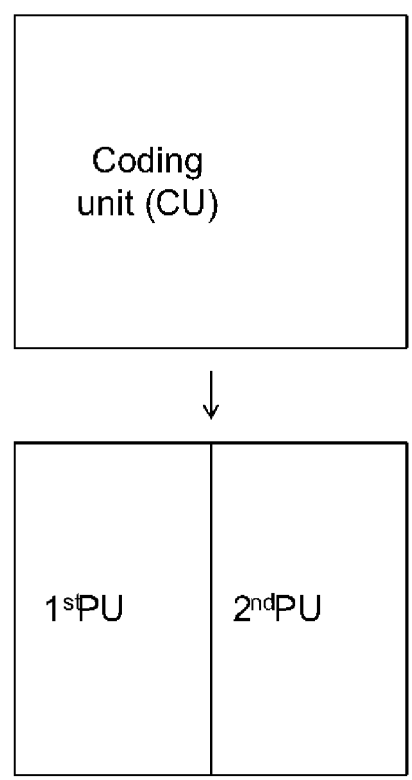

Fig. 10b

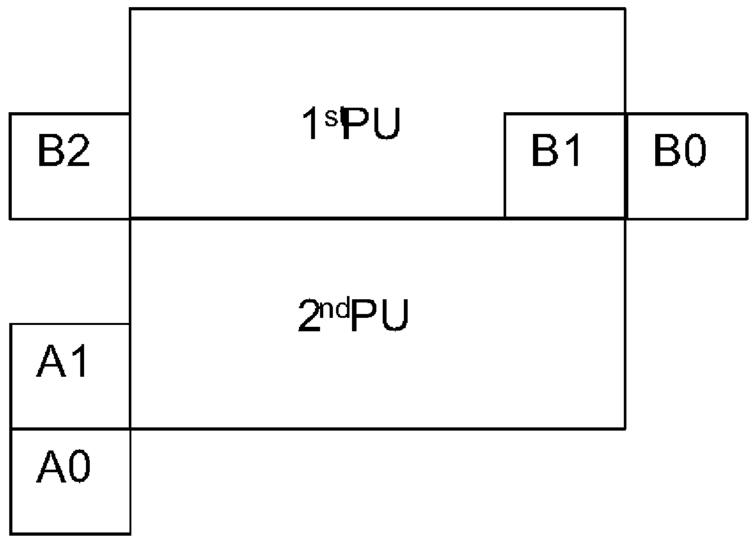

Fig. 11a

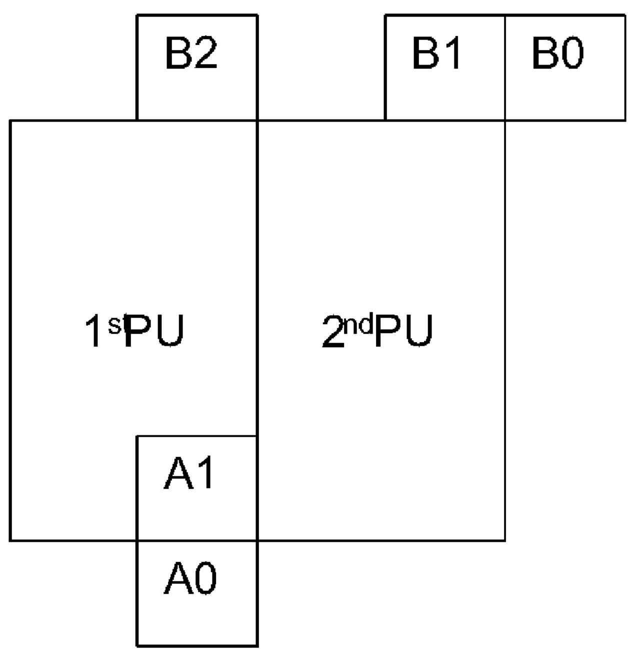

Fig. 11b

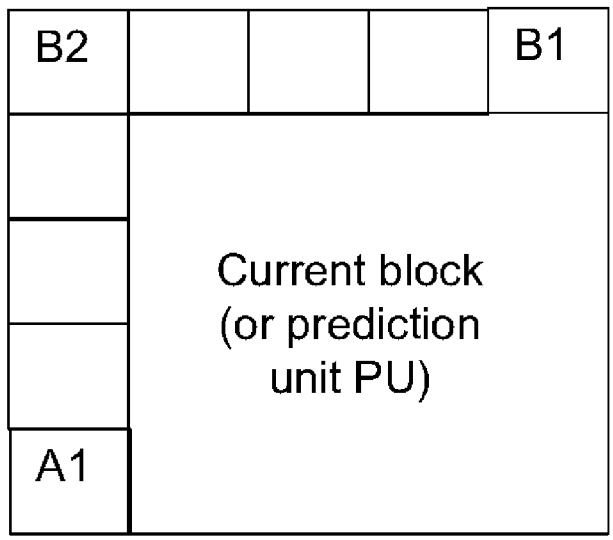

Fig. 12

Electronic Acknowledgement Receipt

EFS ID:	14129936
Application Number:	13666680
International Application Number:	
Confirmation Number:	4782
Title of Invention:	METHOD FOR CODING AND AN APPARATUS
First Named Inventor/Applicant Name:	Mehmet Oguz BICI
Customer Number:	73658
Filer:	Thomas Joseph Arria/thao pham
Filer Authorized By:	Thomas Joseph Arria
Attorney Docket Number:	NC77198US-NP
Receipt Date:	01-NOV-2012
Filing Date:	
Time Stamp:	17:52:47
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$2510
RAM confirmation Number	4958
Deposit Account	500270
Authorized User	

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Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Application Data Sheet	77198_ADS.pdf	837045 cc4bfb4c800fa962613531be16b54866bd271ba7	no	5
Warnings:					
Information:					
2		77198US-NP_Specification.pdf	231397 6e610cea7fea41e52a4bdd06cb679afbceee123e	yes	56

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Specification	1	45
	Claims	46	55
	Abstract	56	56

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
Warnings:					
Information:					
3	Drawings-only black and white line drawings	77198_drawings.pdf	157966 d0f31e08b0ec09fdccf729907fae7a17633a6799	no	13
Warnings:					
Information:					
4	Fee Worksheet (SB06)	fee-info.pdf	36587 5c191f1951b5032e2ac44f62defeeebc36a4ff21	no	2
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METHOD FOR CODING AND AN APPARATUS

TECHNICAL FIELD

[0001] There is provided a method for encoding, a method for decoding, an apparatus, computer program products, an encoder and a decoder.

BACKGROUND INFORMATION

[0002] This section is intended to provide a background or context to the invention that is recited in the claims. The description herein may include concepts that could be pursued, but are not necessarily ones that have been previously conceived or pursued. Therefore, unless otherwise indicated herein, what is described in this section is not prior art to the description and claims in this application and is not admitted to be prior art by inclusion in this section

[0003] A video codec may comprise an encoder which transforms input video into a compressed representation suitable for storage and/or transmission and a decoder that can uncompress the compressed video representation back into a viewable form, or either one of them. The encoder may discard some information in the original video sequence in order to represent the video in a more compact form, for example at a lower bit rate.

[0004] Many hybrid video codecs, operating for example according to the International Telecommunication Union's ITU-T H.263 and H.264 coding standards, encode video information in two phases. In the first phase, pixel values in a certain picture area or "block" are predicted. These pixel values can be predicted, for example, by motion compensation mechanisms, which involve finding and indicating an area in one of the previously encoded video frames (or a later coded video frame) that corresponds closely to the block being coded. Additionally, pixel values can be predicted by spatial mechanisms which involve finding and indicating a spatial region relationship, for example by using pixel values around the block to be coded in a specified manner.

[0005] Prediction approaches using image information from a previous (or a later) image can also be called as Inter prediction methods, and prediction approaches using image information within the same image can also be called as Intra prediction methods.

[0006] The second phase is one of coding the error between the predicted block of pixels and the original block of pixels. This may be accomplished by transforming the difference in pixel values using a specified transform. This transform may be e.g. a Discrete Cosine Transform (DCT) or a variant thereof. After transforming the difference, the transformed difference may be quantized and entropy encoded.

[0007] By varying the fidelity of the quantization process, the encoder can control the balance between the accuracy of the pixel representation, (in other words, the quality of the picture) and the size of the resulting encoded video representation (in other words, the file size or transmission bit rate).

[0008] The decoder reconstructs the output video by applying a prediction mechanism similar to that used by the encoder in order to form a predicted representation of the pixel blocks (using the motion or spatial information created by the encoder and stored in the compressed representation of the image) and prediction error decoding (the inverse operation of the prediction error coding to recover the quantized prediction error signal in the spatial domain).

[0009] After applying pixel prediction and error decoding processes the decoder combines the prediction and the prediction error signals (the pixel values) to form the output video frame.

[0010] The decoder (and encoder) may also apply additional filtering processes in order to improve the quality of the output video before passing it for display and/or storing as a prediction reference for the forthcoming frames in the video sequence.

[0011] In some video codecs, such as High Efficiency Video Coding Working Draft 4, video pictures may be divided into coding units (CU) covering the area of a picture. A coding unit consists of one or more prediction units (PU) defining the prediction process for the samples within the coding unit and one or more transform units (TU) defining the prediction error coding process for the samples in the coding unit. A coding unit may consist of a square block of samples with a size selectable from a predefined set of possible coding unit sizes. A coding unit with the maximum allowed size can be named as a largest coding unit (LCU) and the video picture may be divided into non-overlapping largest coding units. A largest coding unit can further be split into a combination of smaller coding units, e.g. by recursively splitting the largest coding unit and resultant coding units. Each resulting coding unit may have at least one prediction unit and at least one transform unit associated with it. Each prediction unit and transform unit can further be split into smaller prediction units and transform units in order to increase granularity of the prediction and prediction error coding processes, respectively. Each prediction unit may have prediction information associated with it defining what kind of a prediction is to be applied for the pixels within that prediction unit (e.g. motion vector information for inter predicted prediction units and intra prediction directionality information for intra predicted prediction units). Similarly, each transform unit may be associated with information describing the prediction error decoding process for samples within the transform unit (including e.g. discrete cosine transform (DCT) coefficient information). It may be signalled at coding unit level whether prediction error coding is applied or not for each coding unit. In the case there is no prediction error residual associated with the coding unit, it can be considered there are no transform units for the coding unit. The division of the image into coding units, and division of coding units into prediction units and transform units may be signalled in the bitstream allowing the decoder to reproduce the intended structure of these units.

[0012] In some video codecs, motion information is indicated by motion vectors associated with each motion compensated image block. These motion vectors represent the displacement of the image block in the picture to be coded (in the encoder) or decoded (at the decoder) and the prediction source block in one of the previously coded or decoded images (or pictures). In order to represent motion vectors efficiently, motion vectors may be coded differentially with respect to block specific predicted motion vector. In some video codecs, the predicted motion vectors are created in a predefined way, for example by calculating the median of the encoded or decoded motion vectors of the adjacent blocks.

[0013] Another way to create motion vector predictions is to generate a list or a set of candidate predictions from blocks in the current frame and/or co-located or other blocks in temporal reference pictures and signalling the chosen candidate as the motion vector prediction. A spatial motion vector prediction is a prediction obtained only on the basis of information of one or more blocks of the same frame than the current frame whereas temporal motion vector prediction is a prediction obtained on the basis of information of one or more blocks of a frame different from the current frame. It may also be possible to obtain motion vector predictions by combining both spatial and temporal prediction information of one or more encoded blocks. These kinds of motion vector predictions are called as spatio-temporal motion vector predictions.

[0014] In addition to predicting the motion vector values, the reference index in the reference picture list can be predicted. The reference index may be predicted from blocks in the current frame and/or co-located or other blocks in a temporal reference picture. Moreover, some high efficiency video codecs employ an additional motion information coding/decoding mechanism, often called merging/merge mode, where all the motion field information, which includes motion vector and corresponding reference picture index for each available reference picture list, may be predicted and used without any modification or correction. Similarly, predicting the motion field information may be carried out using the motion field information of blocks in the current frame and/or co-located or other blocks in temporal reference pictures and the used motion field information is signalled among a list of motion field candidate list filled with motion field information of available blocks in the current frame and/or co-located or other blocks in temporal reference pictures.

[0015] In some video codecs the prediction residual after motion compensation is first transformed with a transform kernel (like DCT) and then coded. The reason for this is that often there still exists some correlation among the residual and transform can in many cases help reduce this correlation and provide more efficient coding.

[0016] Some video encoders utilize Lagrangian cost functions to find optimal coding modes, e.g. the desired Macroblock mode and associated motion vectors. This kind of cost function uses a weighting factor λ to tie together the (exact or estimated) image distortion due to lossy coding methods and the (exact or estimated) amount of information that is required to represent the pixel values in an image area:

$$C = D + \lambda R \quad (1)$$

where C is the Lagrangian cost to be minimized, D is the image distortion (e.g. Mean Squared Error) with the mode and motion vectors considered, and R the number of bits needed to represent the required data to reconstruct the image block in the decoder (including the amount of data to represent the candidate motion vectors).

[0017] Some video codecs such as hybrid video codecs may generate a list of motion vector predictions (MVP) consisting of motion vectors of spatial adjacent blocks (spatial MVP) and/or motion vectors of blocks in a previously decoded frame (temporal MVP). One of the candidate motion vectors in the list is signalled to be used as the motion vector prediction of the current block. After the list is generated, some of the motion vector prediction candidates may have the same motion information. In this case, the identical motion vector prediction candidates may be removed to reduce redundancy. During the decoding, if the temporal motion vector prediction information is unavailable due to e.g. loss of reference frame, the decoder may not know if the temporal motion vector prediction candidate in the list is to be removed. This may lead to uncertainty for mapping the decoded candidate index to the candidates whose removal decision is based on comparing motion information with the temporal motion vector prediction. As a result, false assignment of motion vector prediction candidates may occur which may lead to degradation in the picture quality and drift of false motion information throughout the decoding process.

SUMMARY

[0018] The present invention introduces a method for generating a motion vector prediction list for an image block. In some embodiments video codecs employ in a motion prediction candidate list construction a way to reduce the complexity of the implementation. This can be achieved by performing a limited number of motion information comparisons between candidate pairs to remove the redundant candidates rather than comparing every available candidate pair. The decision of whether comparing two candidates may depend on the order of the candidates to be considered for the list and/or coding/prediction mode and/or location of the blocks associated with the candidates. In some embodiments a video codec employs a merge process for motion information coding and creates a list of motion prediction candidates from which one of the candidates is to be signalled as the motion information for the current coding or prediction unit. The motion prediction candidates may consist of several spatial motion predictions and a temporal motion prediction. The spatial candidates are obtained from the motion information of e.g. spatial neighbour blocks.

[0019] According to a first aspect of the present invention there is provided a method comprising:

receiving a block of pixels including a prediction unit; determining a set of spatial motion vector prediction candidates for the block of pixels; the spatial motion vector prediction candidates being provided with motion information;

selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit;

determining a subset of spatial motion vector predictions based on the location of the block associated with the first spatial motion vector prediction candidate;

comparing motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates;

if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other, excluding the first spatial motion vector prediction candidate from the merge list.

[0020] According to a second aspect of the present invention there is provided a method comprising:

receiving an encoded block of pixels including a prediction unit;

determining a set of spatial motion vector prediction candidates for the encoded block of pixels; the spatial motion vector prediction candidates being provided with motion information;

selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit;

determining a subset of spatial motion vector predictions based on the location of the block associated with the first spatial motion vector prediction candidate;

comparing motion information of the first spatial motion vector prediction candidate with motion information of another spatial motion vector prediction candidate of the set of spatial motion vector prediction candidates;

if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other, excluding the first spatial motion vector prediction candidate from the merge list.

[0021] According to a third aspect of the present invention there is provided an apparatus comprising a processor and a memory including computer program code, the memory and the computer program code configured to, with the processor, cause the apparatus to:

receive a block of pixels

including a prediction unit;

determining a set of spatial motion vector prediction candidates for the block of pixels; the spatial motion vector prediction candidates being provided with motion information;

selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit;

determining a subset of spatial motion vector predictions based on the location of the block associated with the first spatial motion vector prediction candidate;

comparing motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates;

if at least one the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other, excluding the first spatial motion vector prediction candidate from the merge list.

[0022] According to a fourth aspect of the present invention there is provided an apparatus comprising a processor and a memory including computer program code, the memory and the computer program code configured to, with the processor, cause the apparatus to:

receive an encoded block of pixels

including a prediction unit;

determining a set of spatial motion vector prediction candidates for the encoded block of pixels; the spatial motion vector prediction candidates being provided with motion information;

selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit;

determining a subset of spatial motion vector predictions based on the location of the block associated with the first spatial motion vector prediction candidate;

comparing motion information of the first spatial motion vector prediction candidate with motion information of another spatial motion vector prediction candidate of the set of spatial motion vector prediction candidates;

if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other, excluding the first spatial motion vector prediction candidate from the merge list.

[0023] According to a fifth aspect of the present invention there is provided a storage medium having stored thereon a computer executable program code for use by an encoder, said program code comprises instructions for:

receiving a block of pixels including a prediction unit;

determining a set of spatial motion vector prediction candidates for the block of pixels; the spatial motion vector prediction candidates being provided with motion information;

select a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit;

determine a subset of spatial motion vector predictions based on the location of the block associated with the first spatial motion vector prediction candidate;

compare motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates;

exclude the first spatial motion vector prediction candidate from the merge list, if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other

[0024] According to a sixth aspect of the present invention there is provided a storage medium having stored thereon a computer executable program code for use by a decoder, said program code comprises instructions for:

receiving an encoded block of pixels including a prediction unit;

determining a set of spatial motion vector prediction candidates for the encoded block of pixels; the spatial motion vector prediction candidates being provided with motion information;

selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit;

determining a subset of spatial motion vector predictions based on the location of the block associated with the first spatial motion vector prediction candidate;

comparing motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates;

if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other, excluding the first spatial motion vector prediction candidate from the merge list.

[0025] According to a seventh aspect of the present invention there is provided an apparatus comprising:

means for receiving a block of pixels including a prediction unit;

means for determining a set of spatial motion vector prediction candidates for the block of pixels; the spatial motion vector prediction candidates being provided with motion information;

selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit;

determining a subset of spatial motion vector predictions based on the location of the block associated with the first spatial motion vector prediction candidate;

comparing motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates;

if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other, excluding the first spatial motion vector prediction candidate from the merge list.

[0026] According to an eighth aspect of the present invention there is provided an apparatus comprising:

means for receiving an encoded block of pixels including a prediction unit;

means for determining a set of spatial motion vector prediction candidates for the encoded block of pixels; the spatial motion vector prediction candidates being provided with motion information;

means for selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit;

means for determining a subset of spatial motion vector predictions based on the location of the block associated with the first spatial motion vector prediction candidate;

means for comparing motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates;

means for excluding the first spatial motion vector prediction candidate from the merge list, if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other.

DESCRIPTION OF THE DRAWINGS

[0027] For better understanding of the present invention, reference will now be made by way of example to the accompanying drawings in which:

[0028] Figure 1 shows schematically an electronic device employing some embodiments of the invention;

[0029] Figure 2 shows schematically a user equipment suitable for employing some embodiments of the invention;

[0030] Figure 3 further shows schematically electronic devices employing embodiments of the invention connected using wireless and wired network connections;

[0031] Figure 4a shows schematically an embodiment of the invention as incorporated within an encoder;

[0032] Figure 4b shows schematically an embodiment of a prediction reference list generation and modification according to some embodiments of the invention;

[0033] Figures 5a and 5b show a flow diagram showing the operation of an embodiment of the invention with respect to the encoder as shown in figure 4a;

[0034] Figure 6a illustrates an example of spatial and temporal prediction of a prediction unit;

[0035] Figure 6b illustrates another example of spatial and temporal prediction of a prediction unit;

[0036] Figure 7 shows schematically an embodiment of the invention as incorporated within a decoder;

[0037] Figures 8a and 8b show a flow diagram of showing the operation of an embodiment of the invention with respect to the decoder shown in figure 7;

[0038] Figure 9 illustrates an example of a coding unit and some neighbour blocks of the coding unit;

[0039] Figure 10a illustrates an example of a horizontal division of the coding unit;

[0040] Figure 10b illustrates an example of a vertical division of the coding unit;

[0041] Figure 11a illustrates locations of five spatial neighbours A0, A1, B0, B1, B2 for a prediction unit generated as the second prediction unit of a horizontally divided coding unit;

[0042] Figure 11b illustrates locations of five spatial neighbours for a prediction unit generated as the second prediction unit of a vertically divided coding unit; and

[0043] Figure 12 illustrates an example of blocks between some spatial neighbours of a coding unit.

DETAILED DESCRIPTION OF SOME EXAMPLE EMBODIMENTS

[0044] The following describes in further detail suitable apparatus and possible mechanisms for the provision of improving the prediction accuracy and hence possibly reducing information to be transmitted in video coding systems. In this regard reference is first made to Figure 1 which shows a schematic block diagram of an exemplary apparatus or electronic device 50, which may incorporate a codec according to an embodiment of the invention.

[0045] The electronic device 50 may for example be a mobile terminal or user equipment of a wireless communication system. However, it would be appreciated that embodiments of the invention may be implemented within any electronic device or apparatus which may require encoding and decoding or encoding or decoding video images.

[0046] The apparatus 50 may comprise a housing 30 for incorporating and protecting the device. The apparatus 50 further may comprise a display 32 in the form of a liquid crystal display. In other embodiments of the invention the display may be any suitable display technology suitable to display an image or video. The apparatus 50 may further comprise a keypad 34. In other embodiments of the invention any suitable data or user interface mechanism may be employed. For example the user interface may be implemented as a virtual keyboard or data entry system as part of a touch-sensitive display. The apparatus may comprise a microphone 36 or any suitable audio input which may be a digital or analogue signal input. The apparatus 50 may further comprise an audio output device which in embodiments of the invention may be any one of: an earpiece 38, speaker, or an analogue audio or digital audio output connection. The apparatus 50 may also comprise a battery 40 (or in other embodiments of the invention the device may be powered by any suitable mobile energy device such as solar cell, fuel cell or clockwork generator). The apparatus may further comprise an infrared port 42 for short range line of sight communication to other devices. In other embodiments the apparatus 50 may further comprise any suitable short range communication solution such as for example a Bluetooth wireless connection or a USB/firewire wired connection.

[0047] The apparatus 50 may comprise a controller 56 or processor for controlling the apparatus 50. The controller 56 may be connected to memory 58 which in embodiments of the invention may store both data in the form of image and audio data and/or may also store instructions for implementation on the controller 56. The controller 56 may further be connected to codec circuitry 54 suitable for carrying out coding and decoding of audio and/or video data or assisting in coding and decoding carried out by the controller 56.

[0048] The apparatus 50 may further comprise a card reader 48 and a smart card 46, for example a UICC and UICC reader for providing user information and being suitable for providing authentication information for authentication and authorization of the user at a network.

[0049] The apparatus 50 may comprise radio interface circuitry 52 connected to the controller and suitable for generating wireless communication signals for example for communication with a cellular communications network, a wireless communications system or a wireless local area network. The apparatus 50 may further comprise an antenna 44 connected to the radio interface circuitry 52 for transmitting radio frequency signals generated at the radio interface circuitry 52 to other apparatus(es) and for receiving radio frequency signals from other apparatus(es).

[0050] In some embodiments of the invention, the apparatus 50 comprises a camera capable of recording or detecting individual frames which are then passed to the codec 54 or controller for processing. In some embodiments of the invention, the apparatus may receive the video image data for processing from another device prior to transmission and/or storage. In some embodiments of the invention, the apparatus 50 may receive either wirelessly or by a wired connection the image for coding/decoding.

[0051] With respect to Figure 3, an example of a system within which embodiments of the present invention can be utilized is shown. The system 10 comprises multiple communication devices which can communicate through one or more networks. The system 10 may comprise any combination of wired or wireless networks including, but not limited to a wireless cellular telephone network (such as a GSM, UMTS, CDMA network etc), a wireless local area network (WLAN) such as defined by any of the IEEE 802.x standards, a Bluetooth personal area network, an Ethernet local area network, a token ring local area network, a wide area network, and the Internet.

[0052] The system 10 may include both wired and wireless communication devices or apparatus 50 suitable for implementing embodiments of the invention.

[0053] For example, the system shown in Figure 3 shows a mobile telephone network 11 and a representation of the internet 28. Connectivity to the internet 28 may include, but is not limited to, long range wireless connections, short range wireless connections, and various wired connections including, but not limited to, telephone lines, cable lines, power lines, and similar communication pathways.

[0054] The example communication devices shown in the system 10 may include, but are not limited to, an electronic device or apparatus 50, a combination of a personal digital assistant (PDA) and a mobile telephone 14, a PDA 16, an integrated messaging device (IMD) 18, a desktop computer 20, a notebook computer 22. The apparatus 50 may be stationary or mobile when carried by an individual who is moving. The apparatus 50 may also be located in a mode of transport including, but not limited to, a car, a truck, a taxi, a bus, a train, a boat, an airplane, a bicycle, a motorcycle or any similar suitable mode of transport.

[0055] Some or further apparatuses may send and receive calls and messages and communicate with service providers through a wireless connection 25 to a base station 24. The base station 24 may be connected to a network server 26 that allows communication between the mobile telephone network 11 and the internet 28. The system may include additional communication devices and communication devices of various types.

[0056] The communication devices may communicate using various transmission technologies including, but not limited to, code division multiple access (CDMA), global systems for mobile communications (GSM), universal mobile telecommunications system (UMTS), time divisional multiple access (TDMA), frequency division multiple access (FDMA), transmission control protocol-internet protocol (TCP-IP), short messaging service (SMS), multimedia messaging service (MMS), email, instant messaging service (IMS), Bluetooth, IEEE 802.11 and any similar wireless communication technology. A communications device involved in implementing various embodiments of the present invention may communicate using various media including, but not limited to, radio, infrared, laser, cable connections, and any suitable connection.

[0057] With respect to Figure 4a, a block diagram of a video encoder suitable for carrying out embodiments of the invention is shown. Furthermore, with respect to Figures 5a and 5b, the operation of the encoder exemplifying embodiments of the invention specifically with respect to construction of the list of candidate predictions is shown as a flow diagram.

[0058] Figure 4a shows the encoder as comprising a pixel predictor 302, prediction error encoder 303 and prediction error decoder 304. Figure 4a also shows an embodiment of the pixel predictor 302 as comprising an inter-predictor 306, an intra-predictor 308, a mode selector 310, a filter 316, and a reference frame memory 318. In this embodiment the mode selector 310 comprises a block processor 381 and a cost evaluator 382. The encoder may further comprise an entropy encoder 330 for entropy encoding the bit stream.

[0059] Figure 4b depicts an embodiment of the inter predictor 306. The inter predictor 306 comprises a reference frame selector 360 for selecting reference frame or frames, a motion vector definer 361, a prediction list modifier 363 and a motion vector selector 364. These elements or some of them may be part of a prediction processor 362 or they may be implemented by using other means.

[0060] The pixel predictor 302 receives the image 300 to be encoded at both the inter-predictor 306 (which determines the difference between the image and a motion compensated reference frame 318) and the intra-predictor 308 (which determines a prediction for an image block based only on the already processed parts of the current frame or picture). The output of both the inter-predictor and the intra-predictor may be passed to the mode selector 310. The intra-predictor 308 may have more than one intra-prediction modes. Hence, each mode may perform the intra-prediction and provide the predicted signal to the mode selector 310. The mode selector 310 also receives a copy of the image 300.

[0061] The mode selector 310 determines which encoding mode to use to encode the current block. If the mode selector 310 decides to use an inter-prediction mode it will pass the output of the inter-predictor 306 to the output of the mode selector 310. If the mode selector 310 decides to use an intra-prediction mode it will pass the output of one of the intra-predictor modes to the output of the mode selector 310.

[0062] The output of the mode selector is passed to a first summing device 321. The first summing device may subtract the pixel predictor 302 output from the image 300 to produce a first prediction error signal 320 which is input to the prediction error encoder 303.

[0063] The pixel predictor 302 further receives from a preliminary reconstructor 339 the combination of the prediction representation of the image block 312 and the output 338 of the prediction error decoder 304. The preliminary reconstructed image 314 may be passed to the intra-predictor 308 and to a filter 316. The filter 316 receiving the preliminary representation may filter the preliminary representation and output a final reconstructed image 340 which may be saved in a reference frame memory 318. The reference frame memory 318 may be connected to the inter-predictor 306 to be used as the reference image against which the future image 300 is compared in inter-prediction operations.

[0064] The operation of the pixel predictor 302 may be configured to carry out any known pixel prediction algorithm known in the art.

[0065] The pixel predictor 302 may also comprise a filter 385 to filter the predicted values before outputting them from the pixel predictor 302.

[0066] The operation of the prediction error encoder 302 and prediction error decoder 304 will be described hereafter in further detail. In the following examples the encoder generates images in terms of 16x16 pixel macroblocks which go to form the full image or picture. Thus, for the following examples the pixel predictor 302 outputs a series of predicted macroblocks of size 16x16 pixels and the first summing device 321 outputs a series of 16x16 pixel residual data macroblocks which may represent the difference between a first macro-block in the image 300 against a predicted macro-block (output of pixel predictor 302). It would be appreciated that other size macro blocks may be used.

[0067] The prediction error encoder 303 comprises a transform block 342 and a quantizer 344. The transform block 342 transforms the first prediction error signal 320 to a transform domain. The transform is, for example, the DCT transform. The quantizer 344 quantizes the transform domain signal, e.g. the DCT coefficients, to form quantized coefficients.

[0068] The prediction error decoder 304 receives the output from the prediction error encoder 303 and performs the opposite processes of the prediction error encoder 303 to produce a decoded prediction error signal 338 which when combined with the prediction representation of the image block 312 at the second summing device 339 produces the preliminary reconstructed image 314. The prediction error decoder may be considered to comprise a dequantizer 346, which dequantizes the quantized coefficient values, e.g. DCT coefficients, to reconstruct the transform signal and an inverse transformation block 348, which performs the inverse transformation to the reconstructed transform signal wherein the output of the inverse transformation block 348 contains reconstructed block(s). The prediction error decoder may also comprise a macroblock filter (not shown) which may filter the reconstructed macroblock according to further decoded information and filter parameters.

[0069] In the following the operation of an example embodiment of the inter predictor 306 will be described in more detail. The inter predictor 306 receives the current block for inter prediction. It is assumed that for the current block there already exists one or more neighbouring blocks which have been encoded and motion vectors have been defined for them. For example, the block on the left side and/or the block above the current block may be such blocks. Spatial motion vector predictions for the current block can be formed e.g. by using the motion vectors of the encoded neighbouring blocks and/or of non-neighbour blocks in the same slice or frame, using linear or non-linear functions of spatial motion vector predictions, using a combination of various spatial motion vector predictors with linear or non-linear operations, or by any other appropriate means that do not make use of temporal reference information. It may also be possible to obtain motion vector predictors by combining both spatial and temporal prediction information of one or more encoded blocks. These kinds of motion vector predictors may also be called as spatio-temporal motion vector predictors.

[0070] Reference frames used in encoding the neighbouring blocks have been stored to the reference frame memory 404. The reference frames may be short term references or long term references and each reference frame may have a unique index indicative of the location of the reference frame in the reference frame memory. When a reference frame is no longer used as a reference frame it may be removed from the reference frame memory or marked as a non-reference frame wherein the storage location of that reference frame may be occupied for a new reference frame. In addition to the reference frames of the neighbouring blocks the reference frame selector 360 may also select one or more other frames as potential reference frames and store them to the reference frame memory.

[0071] Motion vector information of encoded blocks is also stored into the memory so that the inter predictor 306 is able to retrieve the motion vector information when processing motion vector candidates for the current block.

[0072] In some embodiments the motion vectors are stored into one or more lists. For example, motion vectors of uni-directionally predicted frames (e.g. P-frames) may be stored to a list called as list 0. For bi-directionally predicted frames (e.g. B-frames) there may be two lists (list 0 and list 1) and for multi-predicted frames there may be more than two lists. Reference frame indices possibly associated with the motion vectors may also be stored in one or more lists.

[0073] In some embodiments there may be two or more motion vector prediction procedures and each procedure may have its own candidate set creation process. In one procedure, only the motion vector values are used. In another procedure, which may be called as a Merge Mode, each candidate element may comprise 1) The information whether 'block was uni-predicted using only list0' or 'block was uni-predicted using only list1' or 'block was bi-predicted using list0 and list1' 2) motion vector value for list0 3) Reference picture index in list0 4) motion vector value for list1 5) Reference picture index list1. Therefore, whenever two prediction candidates are to be compared, not only the motion vector values are compared, but also the five values mentioned above may be compared to determine whether they correspond with each other or not. On the other hand, if any of the comparisons indicate that the prediction candidates do not have equal motion information, no further comparisons need be performed.

[0074] The motion vector definer 361 defines candidate motion vectors for the current frame by using one or more of the motion vectors of one or more neighbour blocks and/or other blocks of the current block in the same frame and/or co-located blocks and/or other blocks of the current block in one or more other frames. These candidate motion vectors can be called as a set of candidate predictors or a predictor set. Each candidate predictor thus represents the motion vector of one or more already encoded block. In some embodiments the motion vector of the candidate predictor is set equal to the motion vector of a neighbour block for the same list if the current block and the neighbour block refer to the same reference frames for that list. Also for temporal prediction there may be one or more previously encoded frames wherein motion vectors of a co-located block or other blocks in a previously encoded frame can be selected as candidate predictors for the current block. The temporal motion vector predictor candidate can be generated by any means that make use of the frames other than the current frame.

[0075] The candidate motion vectors can also be obtained by using more than one motion vector of one or more other blocks such as neighbour blocks of the current block and/or co-located blocks in one or more other frames. As an example, any combination of the motion vector of the block to the left of the current block, the motion vector of the block above the current block, and the motion vector of the block at the up-right corner of the current block may be used (i.e. the block to the right of the block above the current block). The combination may be a median of the motion vectors or calculated by using other formulas. For example, one or more of the motion vectors to be used in the combination may be scaled by a scaling factor, an offset may be added, and/or a constant motion vector may be added. In some embodiments the combined motion vector is based on both temporal and spatial motion vectors, e.g. the motion vector of one or more of the neighbour block or other block of the current block and the motion vector of a co-located block or other block in another frame.

[0076] If a neighbour block does not have any motion vector information a default motion vector such as a zero motion vector may be used instead.

[0077] Figure 9 illustrates an example of a coding unit 900 and some neighbour blocks 901—905 of the coding unit. As can be seen from Figure 9, if the coding unit 900 represents the current block, the neighbouring blocks 901—905 labelled A0, A1, B0, B1 and B2 could be such neighbour blocks which may be used when obtaining the candidate motion vectors.

[0078] Creating additional or extra motion vector predictions based on previously added predictors may be needed when the current number of candidates is limited or insufficient. This kind of creating additional candidates can be performed by combining previous two predictions and/or processing one previous candidate by scaling or adding offset and/or adding a zero motion vector with various reference indices. Hence, the motion vector definer 361 may examine how many motion vector candidates can be defined and how many potential candidate motion vectors exist for the current block. If the number of potential motion vector candidates is smaller than a threshold, the motion vector definer 361 may create additional motion vector predictions.

[0079] In some embodiments the combined motion vector can be based on motion vectors in different lists. For example, one motion vector may be defined by combining one motion vector from the list 0 and one motion vector from the list 1 e.g. when the neighbouring or co-located block is a bi-directionally predicted block and there exists one motion vector in the list 0 and one motion vector in the list 1 for the bi-directionally predicted block.

[0080] To distinguish the current block from the encoded/decoded blocks the motion vectors of which are used as candidate motion vectors, those encoded/decoded blocks are also called as reference blocks in this application.

[0081] In some embodiments not only the motion vector information of the reference block(s) is obtained (e.g. by copying) but also a reference index of the reference block in the reference picture list may be copied to the candidate list. The information whether the block was uni-predicted using only list0 or the block was uni-predicted using only list1 or the block was bi-predicted using list0 and list1 may also be copied. The candidate list may also be called as a candidate set or a set of motion vector prediction candidates.

[0082] Figure 6a illustrates an example of spatial and temporal prediction of a prediction unit. There is depicted the current block 601 in the frame 600 and a neighbour block 602 which already has been encoded. The motion vector definer 361 has defined a motion vector 603 for the neighbour block 602 which points to a block 604 in the previous frame 605. This motion vector can be used as a potential spatial motion vector prediction 610 for the current block. Figure 6a depicts that a co-located block 606 in the previous frame 605, i.e. the block at the same location than the current block but in the previous frame, has a motion vector 607 pointing to a block 609 in another frame 608. This motion vector 607 can be used as a potential temporal motion vector prediction-611 for the current frame.

[0083] Figure 6b illustrates another example of spatial and temporal prediction of a prediction unit. In this example the block 606 of the previous frame 605 uses bi-directional prediction based on the block 609 of the frame preceding the frame 605 and on the block 612 succeeding the current frame 600. The temporal motion vector prediction for the current block 601 may be formed by using both the motion vectors 607, 614 or either of them.

[0084] The operation of the prediction list modifier 363 will now be described in more detail with reference to the flow diagram of Figures 5a and 5b. The prediction list modifier 363 initializes a motion vector prediction list to default values in block 500 of Figure 5a. The prediction list modifier 363 may also initialize a list index to an initial value such as zero. Then, in block 501 the prediction list modifier checks whether there are any motion vector candidates to process. If there is at least one motion vector candidate in the predictor set for processing, the prediction list modifier 363 generates the next motion vector candidate which may be a temporal motion vector or a spatial motion vector. The comparison can be an identicality/equivalence check or comparing the (absolute) difference against a threshold or any other similarity metric.

[0085] In the following, a merge process for motion information coding according to an example embodiment will be described in more detail. The encoder creates a list of motion prediction candidates from which one of the candidates is to be signalled as the motion information for the current coding unit or prediction unit. The motion prediction candidates may consist of several spatial motion predictions and a temporal motion prediction. The spatial candidates can be obtained from the motion information of e.g. the spatial neighbour blocks A0, A1, B0, B1, B2, whose motion information is used as spatial candidate motion predictions. The temporal motion prediction candidate may be obtained by processing the motion of a block in a frame other than the current frame. In this example embodiment, the encoder operations to construct the merge list for the spatial candidates may include the following. The operations may be carried out by the prediction list modifier 363, for example.

[0086] A maximum number of spatial motion prediction candidates to be included in the merge list may be defined. This maximum number may have been stored, for example, to the memory 58 of the apparatus 50, or to another appropriate place. It is also possible to determine the maximum number by using other means, or it may be determined in the software of the encoder of the apparatus 50.

[0087] In some embodiments the maximum number of spatial motion prediction candidates to be included in the merge list is four but in some embodiments the maximum number may be less than four or greater than four.

[0088] In this example the spatial motion prediction candidates are the spatial neighbour blocks A0, A1, B0, B1, B2. The spatial motion vector prediction candidate A1 is located on the left side of the prediction unit when the encoding/decoding order is from left to right and from top to bottom of the frame, slice or another entity to be encoded/decoded. Respectively, the spatial motion vector prediction candidate B1 is located above the prediction unit. third; the spatial motion vector prediction candidate B0 is on the right side of the spatial motion vector prediction candidate B1; the spatial motion vector prediction candidate A0 is below the spatial motion vector prediction candidate A1; and the spatial motion vector prediction candidate B2 is located on the same column than spatial motion vector prediction candidate A1 and on the same row than the spatial motion vector prediction candidate B1. In other words, the spatial motion vector prediction candidate B2 is cornerwise neighbouring the prediction unit as can be seen e.g. from Figure 9.

[0089] These spatial motion prediction candidates can be processed in a predetermined order, for example, A1, B1, B0, A0 and B2. The first spatial motion prediction candidate to be selected for further examination is thus A1. Before further examination is performed for the selected spatial motion prediction candidate, it may be determined whether the merge list already contains a maximum number of spatial motion prediction candidates. Hence, the prediction list modifier 363 compares 502 the number of spatial motion prediction candidates in the merge list with the maximum number, and if the number of spatial motion prediction candidates in the merge list is not less than the maximum number, the selected spatial motion prediction candidate is not included in the merge list and the process of constructing the merge list can be stopped 526. On the other hand, if the number of spatial motion prediction candidates in the merge list is less than the maximum number, a further analyses of the selected spatial motion prediction candidate is performed (blocks 504-522).

[0090] For all the spatial motion prediction candidates for which the further analyses is to be performed, some or all of the following conditions below may be tested for determining whether to include the spatial motion prediction candidate in the merge list.

[0091] The prediction list modifier 363 examines 504 if the prediction unit or block covering the spatial motion prediction candidate block is not available for motion prediction. If so, the candidate is not included in the merge list. The reason that the block is not available may be that the block is either coded in intra mode or resides in a different slice or outside of the picture area.

[0092] In addition to the common conditions above, for each spatial motion prediction candidate, if any of the following conditions holds, then the candidate is not included in the merge list, otherwise, it is included.

[0093] The prediction list modifier 363 determines 506 which spatial motion prediction candidate of the set of spatial motion prediction candidates is in question. If the spatial motion prediction candidate is the block A1, one or more of the following conditions may be examined 508, 510 to determine whether to include this spatial motion prediction candidate in the merge list or not. If the current coding unit 100 is vertically split into two rectangle prediction units 103, 104 as depicted in Figure 10b and the current prediction unit is the second prediction unit 104 in the coding/decoding order (508), this spatial motion prediction candidate is not included in the merge list. If the current coding unit 100 is not vertically split into two rectangle prediction units but it is horizontally split into two rectangle prediction units 101, 102 as depicted in Figure 10a and the current prediction unit is the second prediction unit in the coding/decoding order and the block A1 has the same motion information as the block B1 (510), this spatial motion prediction candidate (block A1) is not included in the merge list. In the example of Figure 10a the second prediction unit is the lower prediction unit 102 of the coding unit 100 and in the example of Figure 10b the second prediction unit is the rightmost prediction unit 104 of the coding unit 100. If none of the conditions above is fulfilled the block A1 is included in the merge list as a spatial motion prediction candidate (524).

[0094] If the spatial motion prediction candidate is the block B1, one or more of the following conditions may be examined 512, 514 to determine whether to include this spatial motion prediction candidate in the merge list or not. If the current coding unit 100 is horizontally split into two rectangle prediction units 101, 102 as depicted in Figure 10a and the current prediction unit is the second prediction unit 104 in the coding/decoding order (512), this spatial motion prediction candidate is not included in the merge list. If the current coding unit 100 is not horizontally split into two rectangle prediction units and if the block B1 has the same motion information than the block A1 (514), this spatial motion prediction candidate (block B1) is not included in the merge list. If none of the conditions above is fulfilled the block B1 is included in the merge list as a spatial motion prediction candidate (524).

[0095] If the spatial motion prediction candidate is the block B0, this spatial motion prediction candidate is not included in the merge list if the block B0 has the same motion information than the block B1 (516). Otherwise, if the number of spatial motion prediction candidates in the merge list is less than the maximum number of spatial motion prediction candidates, this spatial motion prediction candidate (block B0) is included in the merge list (524).

[0096] If the spatial motion prediction candidate is the block A0, this spatial motion prediction candidate is not included in the merge list if the block A0 has the same motion information than the block A1 (518). Otherwise, if the number of spatial motion prediction candidates in the merge list is less than the maximum number of spatial motion prediction candidates, this spatial motion prediction candidate (block A0) is included in the merge list (524).

[0097] If the spatial motion prediction candidate is the block B2, this spatial motion prediction candidate is not included in the merge list if the maximum number of spatial motion prediction candidates is four and the other blocks A0, A1, B0, and B1 are all decided to be included in the merge list (520). Otherwise, if the number of spatial motion prediction candidates in the merge list is less than the maximum number of spatial motion prediction candidates, the block B2 is not included in the merge list if the block B2 has the same motion information than the block B1 or the block A1 (522).

[0098] Then, after processing the blocks A1, B1, B0, A0 and B2 and including a subset of them in the merge list based on the above described conditions, no more redundancy check between these candidates are performed and remaining temporal motion prediction candidate and/or other possible additional candidates may be processed.

[0099] Comparing two blocks whether they have the same motion may be performed by comparing all the elements of the motion information, namely 1) The information whether 'the prediction unit is uni-predicted using only reference picture list0' or 'the prediction unit is uni-predicted using only reference picture list1' or 'the prediction unit is bi-predicted using both reference picture list0 and list1' 2) Motion vector value corresponding to the reference picture list0 3) Reference picture index in the reference picture list0 4) Motion vector value corresponding to the reference picture list1 5) Reference picture index in the reference picture list1.

[00100] In some embodiments similar restrictions for comparing candidate pairs can be applied if the current coding unit is coded/decoded by splitting into four or any number of prediction units.

[00101] The maximum number of merge list candidates can be any non-zero value. In the example above the merger list candidates were the spatial neighbour blocks A0, A1, B0, B1, B2 and the temporal motion prediction candidate, but there may be more than one temporal motion prediction candidate and also other spatial motion prediction candidates than the spatial neighbour blocks. In some embodiments there may also be other spatial neighbour blocks than the blocks A0, A1, B0, B1, B2.

[00102] It is also possible that the maximum number of spatial motion prediction candidates included in the list can be different than four.

[00103] In some embodiments the maximum number of merge list candidates and maximum number of spatial motion prediction candidates included in the list can depend on whether a temporal motion vector candidate is included in the list or not.

[00104] A different number of spatial motion prediction candidates located at various locations in the current frame can be processed. The locations can be the same as or different than A1, B1, B0, A0 and B2.

[00105] The decision of including which spatial motion prediction candidates in the list can be realized in two steps. In the first step, some of the candidates are eliminated by checking whether the candidate block is available and/or the candidate block's prediction mode is intra and/or whether the current block is a second prediction unit of a coding unit coded with two prediction units and the candidate has the same motion with the first prediction unit. In the second step, remaining candidates are examined and some or all of them are included in the merge list. The examination in the second step does not include comparing motion information of each possible candidate pair but includes a subset of the possible comparison combinations.

[00106] The decisions for the candidates can be taken in any order of A1, B1, B0, A0 and B2 or independently in parallel.

[00107] For each candidate and/or a subset of the candidates, the following conditions may also be checked: Whether the candidate block has the same motion as the first prediction unit of the current coding unit when the current coding unit is split into two rectangle prediction units and the current prediction unit is the second prediction unit in the coding/decoding order.

[00108] Additional conditions related to various properties of current and/or previous slices and/or current and/or neighbour blocks can be utilized for determining whether to include a candidate in the list.

[00109] Motion comparison can be realized by comparing a subset of the whole motion information. For example, only the motion vector values for some or all reference picture lists and/or reference indices for some or all reference picture lists and/or an identifier value assigned to each block to represent its motion information can be compared. The comparison can be an identicality or an equivalence check or comparing the (absolute) difference against a threshold or any other similarity metric.

[00110] Conditions for deciding whether a candidate is to be included in the list can include motion information comparison with any subset of the candidates as long as not all possible candidate pairs are compared eventually.

[00111] Deciding whether a temporal motion vector candidate is to be included in the list can be based on comparing its motion information with motion information of a subset of the spatial motion vector prediction candidates.

[00112] When comparing motion information of two blocks, motion information of additional blocks can be considered too. For example, when comparing the block B2 and the block A1, all the blocks between the block B2 and the block A1 (illustrated in Figure 12) are checked whether they have the same motion; and when comparing the block B2 and the block B1, all the blocks between the block B2 and the block B1 (illustrated in Figure 12) are checked whether they have the same motion. This embodiment can be implemented so that the right-most block of each prediction unit or all blocks of each prediction unit may store the information of how many consecutive blocks to the above have the same motion information. Also the bottom-most block of each prediction unit or all blocks of each prediction unit may store the information of how many consecutive blocks to the left have the same motion information. Using this information the condition for not including B0 in the list can be realized by checking if the number of consecutive blocks with the same motion to the left of B0 is greater than 0. The condition for not including A0 in the list can be realized by checking if the number of consecutive blocks with same motion to the above of A0 is greater than 0. The conditions for not including B2 can be modified as follows:

[00113] It is not examined whether the block B2 has same motion as the block B1 or whether the block B2 has same motion as the block A1, but how many consecutive blocks exists to the left of the block B1 with the same motion than the block B1 and/or how many consecutive blocks exist above the block A1 with the same motion. If the number of consecutive blocks with the same motion to the left of the block B1 is greater than the number of blocks between B2 and B1, or if the number of consecutive blocks with the same motion above the block A1 is greater than the number of blocks between the block B2 and the block A1, the block B2 is not included in the merge list.

[00114] If the above implementation is used, the value of how many consecutive blocks to the left/above have the same motion information can be determined by direct comparison of motion information or checking the prediction mode and/or the merge index if the block employs a merge process.

[00115] When coding/decoding the selected merge index, the information whether the merge process is employed for coding/decoding a Skip mode coding unit or an Inter Merge mode prediction unit can be taken into account. For example, if a context adaptive binary arithmetic coder (CABAC) is used for entropy coding/decoding, different contexts can be used for the bins depending on the coding mode (Skip mode or inter merge mode) of the current block. Furthermore, assigning two contexts depending on whether the merge process is employed in a Skip mode coding unit or an inter Merge mode prediction unit can be applied for only the most significant bin of the merge index.

[00116] During the process of removal of redundant candidates, comparison between motion vector predictor candidates can also be based on any other information than the motion vector values. For example, it can be based on linear or non-linear functions of motion vector values, coding or prediction types of the blocks used to obtain the motion information, block size, the spatial location in the frame/(largest) coding unit/macroblock, the information whether blocks share the same motion with a block, the information whether blocks are in the same coding/prediction unit, etc.

[00117] The following pseudo code illustrates an example embodiment of the invention for constructing the merging list.

[00118] Inputs to this process are

- a luma location (xP, yP) specifying the top-left luma sample of the current prediction unit relative to the top-left sample of the current picture;
- variables specifying the width and the height of the prediction unit for luma, nPSW and nPSH; and
- a variable PartIdx specifying the index of the current prediction unit within the current coding unit.

[00119] Outputs of this process are (with N being replaced by A_0, A_1, B_0, B_1 or B_2 and with X being replaced by 0 or 1)

- the availability flags availableFlagN of the neighbouring prediction units,
- the reference indices refIdxLXN of the neighbouring prediction units,
- the prediction list utilization flags predFlagLXN of the neighbouring prediction units,
- the motion vectors mvLXN of the neighbouring prediction units.

[00120] For the derivation of availableFlagN, with N being A_0, A_1, B_0, B_1 or B_2 and (xN, yN) being (xP−1, yP + nPSH), (xP−1, yP + nPSH−1), (xP + nPSW, yP−1), (xP+nPSW−1, yP−1) or (xP−1, yP−1), the following applies.

- If one of the following conditions is true, the availableFlagN is set equal to 0, both components mvLXN are set equal to 0, refIdxLXN and predFlagLX[xN, yN] of the prediction unit covering luma location (xN, yN) are assigned respectively to mvLXN, refIdxLXN and predFlagLXN.
  - N is equal to B_2 and availableFlagA_0 + availableFlagA_1 + availableFlagB_0 + availableFlagB_1 is equal to 4.
  - The prediction unit covering luma location (xN, yN) is not available or PredMode is MODE_INTRA.

- N is equal to A1 and PartMode of the current prediction unit is PART_Nx2N or PART_nLx2N or PART_nRx2N and PartIdx is equal to 1.
- N is equal to A1 and PartMode of the current prediction unit is PART_2NxN or PART_2NxnU or PART_2NxnD and PartIdx is equal to 1 and the prediction units covering luma location (xP+nPSW−1, yP−1) (N = B1) and luma location (xN, yN) (Cand. N) have identical motion parameters:
  - mvLX[xP+nPSW−1, yP−1] == mvLX[xN, yN]
  - refIdxLX[xP+nPSW−1, yP−1] == refIdxLX[xN, yN]
  - predFlagLX[xP+nPSW−1, yP−1] == predFlagLX[xN, yN]
- N is equal to B1 and PartMode of the current prediction unit is 2NxN or PART_2NxnU or PART_2NxnD and PartIdx is equal to 1.
- N is equal to B1 and the prediction units covering luma location (xP−1, yP+nPSH−1) (N = A1) and luma location (xN, yN) (Cand. N) have identical motion parameters:
  - mvLX[xP−1, yP+nPSH−1] == mvLX[xN, yN]
  - refIdxLX[xP−1, yP+nPSH−1] == refIdxLX[xN, yN]
  - predFlagLX[xP−1, yP+nPSH−1] == predFlagLX[xN, yN]
- N is equal to B0 and the prediction units covering luma location (xP+nPSW−1, yP−1) (N = B1) and luma location (xN, yN) (Cand. N) have identical motion parameters:
  - mvLX[xP+nPSW−1, yP−1] == mvLX[xN, yN]
  - refIdxLX[xP+nPSW−1, yP−1] == refIdxLX[xN, yN]
  - predFlagLX[xP+nPSW−1, yP−1] == predFlagLX[xN, yN]
- N is equal to A0 and the prediction units covering luma location (xP−1, yP+nPSH−1) (N = A1) and luma location (xN, yN) (Cand. N) have identical motion parameters:
  - mvLX[xP−1, yP+nPSH−1] == mvLX[xN, yN]
  - refIdxLX[xP−1, yP+nPSH−1] == refIdxLX[xN, yN]
  - predFlagLX[xP−1, yP+nPSH−1] == predFlagLX[xN, yN]
- N is equal to B2 and the prediction units covering luma location (xP+nPSW−1, yP−1) (N = B1) and luma location (xN, yN) (Cand. N) have identical motion parameters:
  - mvLX[xP+nPSW−1, yP−1] == mvLX[xN, yN]
  - refIdxLX[xP+nPSW−1, yP−1] == refIdxLX[xN, yN]
  - predFlagLX[xP+nPSW−1, yP−1] == predFlagLX[xN, yN]

– N is equal to B2 and the prediction units covering luma location (xP−1, yP+nPSH−1) (N = A1) and luma location (xN, yN) (Cand. N) have identical motion parameters:
  – mvLX[xP−1, yP+nPSH−1] == mvLX[xN, yN]
  – refIdxLX[xP−1, yP+nPSH−1] == refIdxLX[xN, yN]
  – predFlagLX[xP−1, yP+nPSH−1] == predFlagLX[xN, yN]
– PartMode of the current prediction unit is PART_NxN and PartIdx is equal to 3 and the prediction units covering luma location (xP−1, yP) (PartIdx = 2) and luma location (xP−1, yP−1) (PartIdx = 0) have identical motion parameters:
  – mvLX[xP−1, yP] == mvLX[xP−1, yP−1]
  – refIdxLX[xP−1, yP] == refIdxLX[xP−1, yP−1]
  – predFlagLX[xP−1, yP] == predFlagLX[xP−1, yP−1]

  and the prediction units covering luma location (xP, yP−1) (PartIdx = 1) and luma location (xN, yN) (Cand. N) have identical motion parameters:
  – mvLX[xP, yP−1] == mvLX[xN, yN]
  – refIdxLX[xP, yP−1] == refIdxLX[xN, yN]
  – predFlagLX[xP, yP−1] == predFlagLX[xN, yN]
– PartMode of the current prediction unit is PART_NxN and PartIdx is equal to 3 and the prediction units covering luma location (xP, yP−1) (PartIdx = 1) and luma location (xP−1, yP−1) (PartIdx = 0) have identical motion parameters:
  – mvLX[xP, yP−1] == mvLX[xP−1, yP−1]
  – refIdxLX[xP, yP−1] == refIdxLX[xP−1, yP−1]
  – predFlagLX[xP, yP−1] == predFlagLX[xP−1, yP−1]

  and the prediction units covering luma location (xP−1, yP) (PartIdx = 2) and luma location (xN, yN) (Cand. N) have identical motion parameters:
  – mvLX[xP−1, yP] == mvLX[xN, yN]
  – refIdxLX[xP−1, yP] == refIdxLX[xN, yN]
  – predFlagLX[xP−1, yP] == predFlagLX[xN, yN]

– Otherwise, availableFlagN is set equal to 1 and the variables mvLX[xN, yN], refIdxLX[xN, yN] and predFlagLX[xN, yN] of the prediction unit covering luma location (xN, yN) are assigned respectively to mvLXN, refIdxLXN and predFlagLXN.

[00121] For the motion vector predictor candidate list generation process, each list candidate can include more information than the motion vector value, such as the reference lists used, the reference frames used in each list and motion vector for each list.

[00122] When all motion vector candidates have been examined, one motion vector is selected to be used as the motion vector for the current block. The motion vector selector 364 may examine different motion vectors in the list and determine which motion vector provides the most efficient encoding result, or the selection of the motion vector may be based on to other criteria as well. Information of the selected motion vector is provided for the mode selector for encoding and transmission to the decoder or for storage when the mode selector determines to use inter prediction for the current block. The information may include the index of the motion vector in the list, and/or motion vector parameters or other appropriate information.

[00123] The selected motion vector and the block relating to the motion vector is used to generate the prediction representation of the image block 312 which is provided as the output of the mode selector. The output may be used by the first summing device 321 to produce the first prediction error signal 320, as was described above.

[00124] The selected motion vector predictor candidate can be modified by adding a motion vector difference or can be used directly as the motion vector of the block. Moreover, after the motion compensation is performed by using the selected motion vector predictor candidate, the residual signal of the block can be transform coded or skipped to be coded.

[00125] Although the embodiments above have been described with respect to the size of the macroblock being 16x16 pixels, it would be appreciated that the methods and apparatus described may be configured to handle macroblocks of different pixel sizes.

[00126] In the following the operation of an example embodiment of the decoder 600 is depicted in more detail with reference to Figure 7.

[00127] At the decoder side similar operations are performed to reconstruct the image blocks. Figure 7 shows a block diagram of a video decoder 700 suitable for employing embodiments of the invention and Figures 8a and 8b show a flow diagram of an example of a method in the video decoder. The bitstream to be decoded may be received from the encoder, from a network element, from a storage medium or from another source. The decoder is aware of the structure of the bitstream so that it can determine the meaning of the entropy coded codewords and may decode the bitstream by an entropy decoder 701 which performs entropy decoding on the received signal. The entropy decoder thus performs the inverse operation to the entropy encoder 330 of the encoder described above. The entropy decoder 701 outputs the results of the entropy decoding to a prediction error decoder 702 and a pixel predictor 704.

[00128] In some embodiments the entropy coding may not be used but another channel encoding may be in use, or the encoded bitstream may be provided to the decoder 700 without channel encoding. The decoder 700 may comprise a corresponding channel decoder to obtain the encoded codewords from the received signal.

[00129] The pixel predictor 704 receives the output of the entropy decoder 701. The output of the entropy decoder 701 may include an indication on the prediction mode used in encoding the current block. A predictor selector 714 within the pixel predictor 704 determines that an intra-prediction or an inter-prediction is to be carried out. The predictor selector 714 may furthermore output a predicted representation of an image block 716 to a first combiner 713. The predicted representation of the image block 716 is used in conjunction with the reconstructed prediction error signal 712 to generate a preliminary reconstructed image 718. The preliminary reconstructed image 718 may be used in the predictor 714 or may be passed to a filter 720. The filter 720, if used, applies a filtering which outputs a final reconstructed signal 722. The final reconstructed signal 722 may be stored in a reference frame memory 724, the reference frame memory 724 further being connected to the predictor 714 for prediction operations.

[00130] Also the prediction error decoder 702 receives the output of the entropy decoder 701. A dequantizer 792 of the prediction error decoder 702 may dequantize the output of the entropy decoder 701 and the inverse transform block 793 may perform an inverse transform operation to the dequantized signal output by the dequantizer 792. The output of the entropy decoder 701 may also indicate that prediction error signal is not to be applied and in this case the prediction error decoder produces an all zero output signal.

[00131] The decoder selects the 16x16 pixel residual macroblock to reconstruct. This residual macroblock is also called as a current block.

[00132] The decoder may receive information on the encoding mode used in encoding of the current block. The indication is decoded, when necessary, and provided to the reconstruction processor 791 of the prediction selector 714. The reconstruction processor 791 examines the indication and selects one of the intra-prediction mode(s), if the indication indicates that the block has been encoded using intra-prediction, or the inter-prediction mode, if the indication indicates that the block has been encoded using inter-prediction.

[00133] For inter-prediction mode the reconstruction processor 791 may comprise one or more elements corresponding to the prediction processor 362 of the encoder, such as a motion vector definer, a prediction list modifier and/or a motion vector selector.

[00134] The reconstruction processor 791 initializes a motion vector prediction list to default values in block 800. As was the case in the encoding part, in this example the spatial motion prediction candidates are the spatial neighbour blocks A0, A1, B0, B1, B2 and these spatial motion prediction candidates are processed in the same predetermined order than in the encoder: A1, B1, B0, A0 and B2. The first spatial motion prediction candidate to be selected for further examination is thus A1. Before further examination is performed for the selected spatial motion prediction candidate, it is examined whether the merge list already contains a maximum number of spatial motion prediction candidates. If the number of spatial motion prediction candidates in the merge list is not less than the maximum number, the selected spatial motion prediction candidate is not included in the merge list and the process of constructing the merge list can be stopped 826. On the other hand, if the number of spatial motion prediction candidates in the merge list is less than the maximum number, a further analyses of the selected spatial motion prediction candidate is performed (blocks 804-822).

[00135] The decoder examines 804 if the prediction unit or block covering the spatial motion prediction candidate block is not available for motion prediction. If so, the candidate is not included in the merge list. The reason that the block is not available may be that the block is either coded in intra mode or resides in a different slice or outside of the picture area.

[00136] In addition to the common conditions above, for each spatial motion prediction candidate, if any of the following conditions holds, then the candidate is not included in the merge list, otherwise, it is included.

[00137] The decoder determines 806 which spatial motion prediction candidate of the set of spatial motion prediction candidates is in question. If the spatial motion prediction candidate is the block A1, one or more of the following conditions may be examined 808, 810 to determine whether to include this spatial motion prediction candidate in the merge list or not. If the current coding unit 100 is vertically split into two rectangle prediction units 103, 104 as depicted in Figure 10b and the current prediction unit is the second prediction unit 104 in the coding/decoding order (808), this spatial motion prediction candidate is not included in the merge list. If the current coding unit 100 is not vertically split into two rectangle prediction units but it is horizontally split into two rectangle prediction units 101, 102 as depicted in Figure 10a and the current prediction unit is the second prediction unit in the coding/decoding order and the block A1 has the same motion information as the block B1 (810), this spatial motion prediction candidate (block A1) is not included in the merge list. In the example of Figure 10a the second prediction unit is the lower prediction unit 102 of the coding unit 100 and in the example of Figure 10b the second prediction unit is the rightmost prediction unit 104 of the coding unit 100. If none of the conditions above is fulfilled the block A1 is included in the merge list as a spatial motion prediction candidate (824).

[00138] If the spatial motion prediction candidate is the block B1, one or more of the following conditions may be examined 812, 814 to determine whether to include this spatial motion prediction candidate in the merge list or not. If the current coding unit 100 is horizontally split into two rectangle prediction units 101, 102 as depicted in Figure 10a and the current prediction unit is the second prediction unit 104 in the coding/decoding order (812), this spatial motion prediction candidate is not included in the merge list. If the current coding unit 100 is not horizontally split into two rectangle prediction units and if the block B1 has the same motion information than the block A1 (814), this spatial motion prediction candidate (block B1) is not included in the merge list. If none of the conditions above is fulfilled the block B1 is included in the merge list as a spatial motion prediction candidate (824).

[00139] If the spatial motion prediction candidate is the block B0, this spatial motion prediction candidate is not included in the merge list if the block B0 has the same motion information than the block B1 (816). Otherwise, if the number of spatial motion prediction candidates in the merge list is less than the maximum number of spatial motion prediction candidates, this spatial motion prediction candidate (block B0) is included in the merge list (824).

[00140] If the spatial motion prediction candidate is the block A0, this spatial motion prediction candidate is not included in the merge list if the block A0 has the same motion information than the block A1 (818). Otherwise, if the number of spatial motion prediction candidates in the merge list is less than the maximum number of spatial motion prediction candidates, this spatial motion prediction candidate (block A0) is included in the merge list (824).

[00141] If the spatial motion prediction candidate is the block B2, this spatial motion prediction candidate is not included in the merge list if the maximum number of spatial motion prediction candidates is four and the other blocks A0, A1, B0, and B1 are all decided to be included in the merge list (820). Otherwise, if the number of spatial motion prediction candidates in the merge list is less than the maximum number of spatial motion prediction candidates, the block B2 is not included in the merge list if the block B2 has the same motion information than the block B1 or the block A1 (822).

[00142] Then, after processing the blocks A1, B1, B0, A0 and B2 and including a subset of them in the merge list based on the above described conditions, no more redundancy check between these candidates are performed and remaining temporal motion prediction candidate and/or other possible additional candidates may be processed.

[00143] When the merge list has been constructed the decoder may use 828 the indication of the motion vector received from the encoder to select the motion vector for decoding the current block. The indication may be, for example, an index to the merge list.

[00144] Basically, after the reconstruction processor 791 has constructed the merge list, it would correspond with the merge list constructed by the encoder if the reconstruction processor 791 has the same information available than the encoder had. If some information has been lost during transmission the information from the encoder to the decoder, it may affect the generation of the merge list in the decoder 700.

[00145] The above examples describe the operation mainly in the merge mode but the encoder and decoder may also operate in other modes.

[00146] The embodiments of the invention described above describe the codec in terms of separate encoder and decoder apparatus in order to assist the understanding of the processes involved. However, it would be appreciated that the apparatus, structures and operations may be implemented as a single encoder-decoder apparatus/structure/operation. Furthermore in some embodiments of the invention the coder and decoder may share some or all common elements.

[00147] Although the above examples describe embodiments of the invention operating within a codec within an electronic device, it would be appreciated that the invention as described below may be implemented as part of any video codec. Thus, for example, embodiments of the invention may be implemented in a video codec which may implement video coding over fixed or wired communication paths.

[00148] Thus, user equipment may comprise a video codec such as those described in embodiments of the invention above.

[00149] It shall be appreciated that the term user equipment is intended to cover any suitable type of wireless user equipment, such as mobile telephones, portable data processing devices or portable web browsers.

[00150] Furthermore elements of a public land mobile network (PLMN) may also comprise video codecs as described above.

[00151] In general, the various embodiments of the invention may be implemented in hardware or special purpose circuits, software, logic or any combination thereof. For example, some aspects may be implemented in hardware, while other aspects may be implemented in firmware or software which may be executed by a controller, microprocessor or other computing device, although the invention is not limited thereto. While various aspects of the invention may be illustrated and described as block diagrams, flow charts, or using some other pictorial representation, it is well understood that these blocks, apparatus, systems, techniques or methods described herein may be implemented in, as non-limiting examples, hardware, software, firmware, special purpose circuits or logic, general purpose hardware or controller or other computing devices, or some combination thereof.

[00152] The embodiments of this invention may be implemented by computer software executable by a data processor of the mobile device, such as in the processor entity, or by hardware, or by a combination of software and hardware. Further in this regard it should be noted that any blocks of the logic flow as in the Figures may represent program steps, or interconnected logic circuits, blocks and functions, or a combination of program steps and logic circuits, blocks and functions. The software may be stored on such physical media as memory chips, or memory blocks implemented within the processor, magnetic media such as hard disk or floppy disks, and optical media such as for example DVD and the data variants thereof, CD.

[00153] The memory may be of any type suitable to the local technical environment and may be implemented using any suitable data storage technology, such as semiconductor based memory devices, magnetic memory devices and systems, optical memory devices and systems, fixed memory and removable memory. The data processors may be of any type suitable to the local technical environment, and may include one or more of general purpose computers, special purpose computers, microprocessors, digital signal processors (DSPs) and processors based on multi core processor architecture, as non limiting examples.

[00154] Embodiments of the inventions may be practiced in various components such as integrated circuit modules. The design of integrated circuits is by and large a highly automated process. Complex and powerful software tools are available for converting a logic level design into a semiconductor circuit design ready to be etched and formed on a semiconductor substrate.

[00155] Programs, such as those provided by Synopsys, Inc. of Mountain View, California and Cadence Design, of San Jose, California automatically route conductors and locate components on a semiconductor chip using well established rules of design as well as libraries of pre stored design modules. Once the design for a semiconductor circuit has been completed, the resultant design, in a standardized electronic format (e.g., Opus, GDSII, or the like) may be transmitted to a semiconductor fabrication facility or "fab" for fabrication.

[00156] The foregoing description has provided by way of exemplary and non-limiting examples a full and informative description of the exemplary embodiment of this invention. However, various modifications and adaptations may become apparent to those skilled in the relevant arts in view of the foregoing description, when read in conjunction with the accompanying drawings and the appended claims. However, all such and similar modifications of the teachings of this invention will still fall within the scope of this invention.

[00157] In the following some examples will be provided.

[00158] In some embodiments a method comprises:

receiving a block of pixels including a prediction unit; determining a set of spatial motion vector prediction candidates for the block of pixels; the spatial motion vector prediction candidates being provided with motion information;

selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit;

determining a subset of spatial motion vector predictions based on the location of the block associated with the first spatial motion vector prediction candidate;

comparing motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates;

if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other, excluding the first spatial motion vector prediction candidate from the merge list.

[00159] In some embodiments the method comprises including neighbouring blocks of the received block of pixels in the set of spatial motion vector prediction candidates.

[00160] In some embodiments the method comprises constructing the set of spatial motion vector predictions by using motion vectors of one or more encoded blocks in a same frame than the block of pixels.

[00161] In some embodiments the method comprises selecting spatial motion vector prediction candidates from the set of spatial motion vector prediction candidates as the potential spatial motion vector prediction candidate in a predetermined order.

[00162] In some embodiments the method comprises comparing motion information of the potential spatial motion vector prediction candidate with motion information of at most one other spatial motion vector prediction candidate of the set of spatial motion vector prediction candidates.

[00163] In some embodiments the method comprises prediction unit and a second prediction unit; and if so, excluding the potential spatial motion vector prediction candidate from the merge list if the prediction unit is the second prediction unit.

[00164] In some embodiments the method comprises

determining a maximum number of spatial motion vector prediction candidates to be included in a merge list; and

limiting the number of spatial motion vector prediction candidates in the merge list smaller or equal to the maximum number .

[00165] In some embodiments the method comprises

examining, if the number of spatial motion vector prediction candidates in the merge list smaller than the maximum number;

if so, examining whether a prediction unit to which the potential spatial motion vector prediction candidate belongs is available for motion prediction;

if so, performing at least one of the following:

for the potential spatial motion vector prediction candidate on the left side of the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled:

– the received block of pixels is vertically divided into a first prediction unit and a second prediction unit, and the prediction unit is the second prediction unit;

– the received block of pixels is horizontally divided into a first prediction unit and a second prediction unit, and if the prediction unit is the second prediction unit, and the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate above the prediction unit;

for the potential spatial motion vector prediction candidate above the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled:

– the received block of pixels is horizontally divided into a first prediction unit and a second prediction unit, and the prediction unit is the second prediction unit;

– the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit;

for the potential spatial motion vector prediction candidate, which is on the right side of the potential spatial motion vector prediction candidate above the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate above the prediction unit;

for the potential spatial motion vector prediction candidate, which is below the potential spatial motion vector prediction candidate on the left side of the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit;

for the potential spatial motion vector prediction candidate cornerwise neighbouring the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled:

- all the other potential spatial motion vector prediction candidates have been included in the merge list;
- the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate above the prediction unit;
- the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit.

[00166] In some embodiments the method comprises including a temporal motion prediction candidate into the merge list.

[00167] In some embodiments the method comprises selecting one motion vector prediction candidate from the merge list to represent a motion vector prediction for the block of pixels.

[00168] In some embodiments a method according to the second aspect comprises:

receiving an encoded block of pixels including a prediction unit;

determining a set of spatial motion vector prediction candidates for the encoded block of pixels; the spatial motion vector prediction candidates being provided with motion information;

selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit;

determining a subset of spatial motion vector predictions based on the location of the block associated with the first spatial motion vector prediction candidate;

comparing motion information of the first spatial motion vector prediction candidate with motion information of another spatial motion vector prediction candidate of the set of spatial motion vector prediction candidates;

if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other, excluding the first spatial motion vector prediction candidate from the merge list.

[00169] In some embodiments the method comprises including neighbouring blocks of the received encoded block of pixels in the set of spatial motion vector prediction candidates.

[00170] In some embodiments the method comprises constructing the set of spatial motion vector predictions by using motion vectors of one or more decoded blocks in a same frame than the received encoded block of pixels.

[00171] In some embodiments the method comprises selecting spatial motion vector prediction candidates from the set of spatial motion vector prediction candidates as the potential spatial motion vector prediction candidate in a predetermined order.

[00172] In some embodiments the method comprises comparing motion information of the potential spatial motion vector prediction candidate with motion information of at most one other spatial motion vector prediction candidate of the set of spatial motion vector prediction candidates.

[00173] In some embodiments the method comprises examining whether the received encoded block of pixels is divided into a first prediction unit and a second prediction unit; and if so, excluding the potential spatial motion vector prediction candidate from the merge list if the prediction unit is the second prediction unit.

[00174] In some embodiments the method comprises

determining a maximum number of spatial motion vector prediction candidates to be included in a merge list; and

limiting the number of spatial motion vector prediction candidates in the merge list smaller or equal to the maximum number.

[00175] In some embodiments the method comprises

examining, if the number of spatial motion vector prediction candidates in the merge list smaller than the maximum number;

if so, examining whether a prediction unit to which the potential spatial motion vector prediction candidate belongs is available for motion prediction;

if so, performing at least one of the following:

for the potential spatial motion vector prediction candidate on the left side of the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled:

- the received encoded block of pixels is vertically divided into a first prediction unit and a second prediction unit, and the prediction unit is the second prediction unit;
- the received encoded block of pixels is horizontally divided into a first prediction unit and a second prediction unit, and if the prediction unit is the second prediction unit, and the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate above the prediction unit;

for the potential spatial motion vector prediction candidate above the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled:

- the received encoded block of pixels is horizontally divided into a first prediction unit and a second prediction unit, and the prediction unit is the second prediction unit;
- the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit;

for the potential spatial motion vector prediction candidate, which is on the right side of the potential spatial motion vector prediction candidate above the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate above the prediction unit;

for the potential spatial motion vector prediction candidate, which is below the potential spatial motion vector prediction candidate on the left side of the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit;

for the potential spatial motion vector prediction candidate cornerwise neighbouring the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled:

- all the other potential spatial motion vector prediction candidates have been included in the merge list;
- the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate above the prediction unit;
- the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit.

[00176] In some embodiments the method comprises including a temporal motion prediction candidate into the merge list.

[00177] In some embodiments the method comprises selecting one motion vector prediction candidate from the merge list to represent a motion vector prediction for the received encoded block of pixels.

[00178] In some embodiments an apparatus according to the third aspect comprises a processor and a memory including computer program code, the memory and the computer program code configured to, with the processor, cause the apparatus to:

receive a block of pixels

including a prediction unit;

determining a set of spatial motion vector prediction candidates for the block of pixels; the spatial motion vector prediction candidates being provided with motion information;

selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit;

determining a subset of spatial motion vector predictions based on the location of the block associated with the first spatial motion vector prediction candidate;

comparing motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates;

if at least one the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other, excluding the first spatial motion vector prediction candidate from the merge list.

[00179] In some embodiments an apparatus according to the fourth aspect comprises a processor and a memory including computer program code, the memory and the computer program code configured to, with the processor, cause the apparatus to:

receive an encoded block of pixels including a prediction unit;

determine a set of spatial motion vector prediction candidates for the encoded block of pixels; the spatial motion vector prediction candidates being provided with motion information;

select a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit;

determine a subset of spatial motion vector predictions based on the location of the block associated with the first spatial motion vector prediction candidate;

compare motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates;

exclude the first spatial motion vector prediction candidate from the merge list, if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other

[00180] In some embodiments a storage medium having stored thereon a computer program code a computer executable program code for use by an encoder, said program codes comprise instructions for use by an encoder, said program code comprises instructions for:

receiving a block of pixels including a prediction unit;

determining a set of spatial motion vector prediction candidates for the block of pixels; the spatial motion vector prediction candidates being provided with motion information;

selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit;

determining a subset of spatial motion vector predictions based on the location of the block associated with the first spatial motion vector prediction candidate;

comparing motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates;

if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other, excluding the first spatial motion vector prediction candidate from the merge list.

[00181] In some embodiments a storage medium having stored thereon a computer program code a computer executable program code for use by an encoder, said program codes comprise instructions for use by an encoder, said program code comprises instructions for:

receiving an encoded block of pixels including a prediction unit;

determining a set of spatial motion vector prediction candidates for the encoded block of pixels; the spatial motion vector prediction candidates being provided with motion information;

selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit;

determining a subset of spatial motion vector predictions based on the location of the block associated with the first spatial motion vector prediction candidate;

comparing motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates;

if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other, excluding the first spatial motion vector prediction candidate from the merge list.

[00182] In some embodiments an apparatus comprises:

means for receiving a block of pixels including a prediction unit;

means for selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit;

means for determining a subset of spatial motion vector predictions based on the location of the block associated with the first spatial motion vector prediction candidate;

means for comparing motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates;

means for excluding the first spatial motion vector prediction candidate from the merge list, if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other.

[00183] In some embodiments an apparatus comprises:

means for receiving an encoded block of pixels including a prediction unit;

means for determining a set of spatial motion vector prediction candidates for the encoded block of pixels; the spatial motion vector prediction candidates being provided with motion information;

means for selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit;

means for determining a subset of spatial motion vector predictions based on the location of the block associated with the first spatial motion vector prediction candidate;

means for comparing motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates;

means for excluding the first spatial motion vector prediction candidate from the merge list, if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other.

ABSTRACT

The invention relates to a method for encoding, a method for decoding, an apparatus, computer program products, an encoder and a decoder for video information. The motion vector for a block in a video image is predicted from a set of motion vector prediction candidates determined based on previously-coded motion vectors. A motion vector prediction candidate is included in the set based on the location of the block associated with the first spatial motion vector prediction candidate and in comparison with motion vector prediction candidates already in the set.

Electronic Patent Application Fee Transmittal

Application Number:	
Filing Date:	
Title of Invention:	METHOD FOR CODING AND AN APPARATUS
First Named Inventor/Applicant Name:	Mehmet Oguz BICI
Filer:	Thomas Joseph Arria/thao pham
Attorney Docket Number:	NC77198US-NP

Filed as Large Entity

Utility under 35 USC 111(a) Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Utility application filing	1011	1	390	390
Utility Search Fee	1111	1	620	620
Utility Examination Fee	1311	1	250	250
Pages:				
Claims:				
Independent claims in excess of 3	1201	5	250	1250
Miscellaneous-Filing:				
Petition:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
	Total in USD ($)			**2510**

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
13/666,680	11/01/2012	2631	2510	NC77198US-NP	20	8

CONFIRMATION NO. 4782

FILING RECEIPT

OC000000057716267

73658
Nokia, Inc.
Attn: Intellectual Property Rights Docketing
200 South Mathilda Ave
Sunnyvale, CA 94086

Date Mailed: 11/26/2012

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Inventor(s)

Mehmet Oguz BICI, Tampere, TURKEY;
Jani LAINEMA, Tampere, FINLAND;
Kemal UGUR, Tampere, FINLAND;

Applicant(s)

Mehmet Oguz BICI, Tampere, TURKEY;
Jani LAINEMA, Tampere, FINLAND;
Kemal UGUR, Tampere, FINLAND;

Assignment For Published Patent Application

NOKIA CORPORATION, Espoo, FINLAND

Power of Attorney: None

Domestic Priority data as claimed by applicant

This appln claims benefit of 61/555,703 11/04/2011

Foreign Applications for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.) - None.
Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.

If Required, Foreign Filing License Granted: 11/20/2012
The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 13/666,680**
Projected Publication Date: 05/09/2013
Non-Publication Request: No

Early Publication Request: No
Title

METHOD FOR CODING AND AN APPARATUS

Preliminary Class

375

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at http://www.uspto.gov/web/offices/pac/doc/general/index.html.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, http://www.stopfakes.gov. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4158).

LICENSE FOR FOREIGN FILING UNDER

Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

GRANTED

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign AssetsControl, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
13/666,680	11/01/2012	Mehmet Oguz BICI	NC77198US-NP

CONFIRMATION NO. 4782

FORMALITIES LETTER

OC000000057716268

73658
Nokia, Inc.
Attn: Intellectual Property Rights Docketing
200 South Mathilda Ave
Sunnyvale, CA 94086

Date Mailed: 11/26/2012

NOTICE TO FILE MISSING PARTS OF NONPROVISIONAL APPLICATION

FILED UNDER 37 CFR 1.53(b)

Filing Date Granted

Items Required To Avoid Abandonment:

An application number and filing date have been accorded to this application. The item(s) indicated below, however, are missing.

Applicant is given **TWO MONTHS** from the date of this Notice within which to file all required items below to avoid abandonment. Extensions of time may be obtained by filing a petition accompanied by the extension fee under the provisions of 37 CFR 1.136(a).

- A surcharge (for late submission of the basic filing fee, search fee, examination fee or inventor's oath or declaration) as set forth in 37 CFR 1.16(f) of $ **130** for a non-small entity, must be submitted.

SUMMARY OF FEES DUE:

Total fee(s) required within **TWO MONTHS** from the date of this Notice is $ **130** for a non-small entity
- $ **130** Surcharge.

Items Required To Avoid Processing Delays:

Applicant is notified that the above-identified application contains the deficiencies noted below. No period for reply is set forth in this notice for correction of these deficiencies. However, if a deficiency relates to the inventor's oath or declaration, the applicant must file an oath or declaration in compliance with 37 CFR 1.63, or a substitute statement in compliance with 37 CFR 1.64, executed by or with respect to each actual inventor no later than the expiration of the time period set in the "Notice of Allowability" to avoid abandonment. See 37 CFR 1.53(f).

- A properly executed inventor's oath or declaration has not been received for the following inventor(s):
  all
  Applicant may submit the inventor's oath or declaration at any time before the Notice of Allowance and Fee(s) Due, PTOL-85, is mailed.

Replies must be received in the USPTO within the set time period or must include a proper Certificate of Mailing or Transmission under 37 CFR 1.8 with a mailing or transmission date within the set time period. For more information and a suggested format, see Form PTO/SB/92 and MPEP 512.

Replies should be mailed to:

Mail Stop Missing Parts
Commissioner for Patents
P.O. Box 1450
Alexandria VA 22313-1450

Registered users of EFS-Web may alternatively submit their reply to this notice via EFS-Web.
https://sportal.uspto.gov/authenticate/AuthenticateUserLocalEPF.html

For more information about EFS-Web please call the USPTO Electronic Business Center at **1-866-217-9197** or visit our website at http://www.uspto.gov/ebc.

If you are not using EFS-Web to submit your reply, you must include a copy of this notice.

/smunpanthovong/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 13/666,680

APPLICATION AS FILED - PART I

FOR	NUMBER FILED (Column 1)		NUMBER EXTRA (Column 2)	SMALL ENTITY RATE($)	SMALL ENTITY FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY FEE($)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A		N/A	N/A			N/A	390
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A		N/A	N/A			N/A	620
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A		N/A	N/A			N/A	250
TOTAL CLAIMS (37 CFR 1.16(i))	20	minus 20 =	*			OR	x 62 =	0.00
INDEPENDENT CLAIMS (37 CFR 1.16(h))	8	minus 3 =	* 5				x 250 =	1250
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).							0.00
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))								0.00
				TOTAL			TOTAL	2510

* If the difference in column 1 is less than zero, enter "0" in column 2.

APPLICATION AS AMENDED - PART II

AMENDMENT A		CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

AMENDMENT B		CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	RATE($)	ADDITIONAL FEE($)	OR	RATE($)	ADDITIONAL FEE($)
	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.

Electronic Acknowledgement Receipt

EFS ID:	14597236
Application Number:	13666680
International Application Number:	
Confirmation Number:	4782
Title of Invention:	METHOD FOR CODING AND AN APPARATUS
First Named Inventor/Applicant Name:	Mehmet Oguz BICI
Customer Number:	73658
Filer:	Thomas Joseph Arria/thao pham
Filer Authorized By:	Thomas Joseph Arria
Attorney Docket Number:	NC77198US-NP
Receipt Date:	02-JAN-2013
Filing Date:	01-NOV-2012
Time Stamp:	15:16:04
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$130
RAM confirmation Number	1609
Deposit Account	500270
Authorized User	

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Oath or Declaration filed	77198_executed_declaration.pdf	268093 0df10ceb9f01d2e1b415cfb34f4031e3cf6351c8	no	3

Warnings:

Information:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
2		77198_POA_373b.pdf	378033 2a71d054ee4ec5f0e34ccb017d1ff096fe0b6141	yes	7

Multipart Description/PDF files in .zip description

Document Description	Start	End
Power of Attorney	1	2
Assignee showing of ownership per 37 CFR 3.73.	3	7

Warnings:

Information:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
3	Fee Worksheet (SB06)	fee-info.pdf	30297 4e38822359718c4cd9a4820faa6e6fd59c1598db	no	2

Warnings:

Information:

Total Files Size (in bytes):	676423

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PTO/AIA/01 (06-12)
Approved for use through 01/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

Title of Invention	METHOD FOR CODING AND AN APPARATUS

As the below named inventor, I hereby declare that:

This declaration is directed to:

☐ The attached application, or

☒ United States application or PCT international application number 13/666680

filed on November 1, 2012.

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

WARNING:

Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.

LEGAL NAME OF INVENTOR

Inventor: Mehmet Oguz BICI Date (Optional) : NOV - 05 - 2012

Signature: MOBici

Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form.
Use an additional PTO/AIA/01 form for each additional inventor.

DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

Title of Invention	METHOD FOR CODING AND AN APPARATUS

As the below named inventor, I hereby declare that:

This declaration is directed to:

☐ The attached application, or

☒ United States application or PCT international application number 13/666680

filed on November 1, 2012.

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

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LEGAL NAME OF INVENTOR

Inventor: Jani LAINEMA Date (Optional): NOV-02-2012

Signature:

Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form. Use an additional PTO/AIA/01 form for each additional inventor.

PTO/AIA/01 (06-12)
Approved for use through 01/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

Title of Invention	METHOD FOR CODING AND AN APPARATUS

As the below named inventor, I hereby declare that:

This declaration is directed to:

☐ The attached application, or

☒ United States application or PCT international application number 13/666680

filed on November 1, 2012.

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

WARNING:

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LEGAL NAME OF INVENTOR

Inventor: Kemal UGUR Date (Optional) : Nov-02-2012

Signature:

Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form. Use an additional PTO/AIA/01 form for each additional inventor.

PTO/SB/81 (01-06)
Approved for use through 12/31/2008. OMB 0651-0035
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

POWER OF ATTORNEY and CORRESPONDENCE ADDRESS INDICATION FORM

Application Number	13/666680
Filing Date	November 1 2012
First Named Inventor	Mehmet Oguz BICI
Title	METHOD FOR CODING AND AN
Art Unit	TBD
Examiner Name	TBD
Attorney Docket Number	NC77198US-NP

I hereby revoke all previous powers of attorney given in the above-identified application.

I hereby appoint:

☑ Practitioners associated with the Customer Number: 73658

OR

☐ Practitioner(s) named below:

Name	Registration Number

as my/our attorney(s) or agent(s) to prosecute the application identified above, and to transact all business in the United States Patent and Trademark Office connected therewith.

Please recognize or change the correspondence address for the above-identified application to:

☑ The address associated with the above-mentioned Customer Number:

OR

☐ The address associated with Customer Number:

OR

☐ Firm or Individual Name					
Address					
City		State		Zip	
Country					
Telephone		Email			

I am the:

☐ Applicant/Inventor.

☑ Assignee of record of the entire interest. See 37 CFR 3.71.
Statement under 37 CFR 3.73(b) is enclosed. (Form PTO/SB/96)

SIGNATURE of Applicant or Assignee of Record

Signature	/Thomas J. Arria/	Date	January 2, 2013
Name	Thomas J. Arria	Telephone	781-219-8760
Title and Company	Senior IPR Specialist, Nokia Corporation		

NOTE: Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required. Submit multiple forms if more than one signature is required, see below*.

☑ *Total of one forms are submitted.

NOKIA

LIMITED POWER OF ATTORNEY

that we, the undersigned, under the authority granted to each of us to sign jointly on behalf of

NOKIA CORPORATION
Keilalahdentie 4
02150 Espoo
Finland

hereby authorize the following person

Thomas Arria
Nokia Corporation
15 Wayside Road
01803 Burlington
U.S.A.

Nokia Corporation
P.O.Box 226,
FI-00045 NOKIA GROUP, Finland
(Keilalahdentie 4, 02150 ESPOO)

Tel. +358 7180 08000
Fax +358 7180 38226

Business Identity Code
0112038-9, Helsinki

in his capacity as Senior IP Specialist, Patenting, to sign alone in the name of Nokia Corporation all the documents that relate to the filing, prosecution and registration of patent applications, as well as post-grant operations relating to patents granted based on such patent applications. Such documents may include without limitation case-specific Powers of Attorney, Assignment Deeds for assigning the ownership of an invention to Nokia, Novelty Declarations and Inventorship Declarations.

The rights granted under this Power of Attorney may not be transferred further, other than as specified above.

The authority granted by this Power of Attorney shall expire six (6) months from the date of execution.

Notwithstanding the foregoing, the authority granted by this Power of Attorney shall expire when the authorized person's employment with Nokia ends.

This Power of Attorney is duly signed on this day of January 1, 2013.

NOKIA CORPORATION

By:	By:
Name: Harri Honkasalo	Name: Paul Melin
Title: Director,	Title: Vice President,
Legal and Intellectual Property	Intellectual Property

PTO/SB/96 (01-08)
Approved for use through 03/31/2008. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

STATEMENT UNDER 37 CFR 3.73(b)

Applicant/Patent Owner: Mehmet Oguz BICI

Application No./Patent No.: 13/666680 Filed/Issue Date: November 1 2012

Entitled: METHOD FOR CODING AND AN APPARATUS

Nokia Corporation, a Corporation
(Name of Assignee) (Type of Assignee, e.g., corporation, partnership, university, government agency, etc.)

states that it is:

1. ☑ the assignee of the entire right, title, and interest; or
2. ☐ an assignee of less than the entire right, title and interest
   (The extent (by percentage) of its ownership interest is________ %)

in the patent application/patent identified above by virtue of either:

A. ☑ An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel ___________, Frame __________, or for which a copy thereof is attached.

OR

B. ☐ A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:

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☐ Additional documents in the chain of title are listed on a supplemental sheet.

☑ As required by 37 CFR 3.73(b)(1)(i), the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.

[NOTE: A separate copy (*i.e.,* a true copy of the original assignment document(s)) must be submitted to Assignment Division in accordance with 37 CFR Part 3, to record the assignment in the records of the USPTO. See MPEP 302.08]

The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.

/Thomas J. Arria/	January 2, 2013
Signature	Date
Thomas J. Arria	781-219-8760
Printed or Typed Name	Telephone Number
Senior IPR Specialist, Nokia Corporation	
Title	

Docket No.: NC77198US-NP

ASSIGNMENT

Title of Invention	METHOD FOR CODING AND AN APPARATUS

This Assignment is directed to (check all that apply):

☒ U.S. Provisional No. 61/555703 filed on November 4, 2011

☒ U.S. Application No. 13/666680 filed on November 1, 2012

☐ which is a 371 National Stage of ____________ filed on ____________

As the below named inventor(s), I/we have invented certain improvements in the patent application for which I/we have filed an application for Letters Patent of the United States of America as identified above;

WHEREAS, I/we authorize the attorney of record to update this document to include Patent Office information as deemed necessary (i.e., filing date, serial number, etc.);

WHEREAS, NOKIA CORPORATION, a corporation organized under the laws of Finland, having its principal office in Espoo, Finland (hereinafter referred to as "ASSIGNEE"), is desirous of acquiring the entire right, title and interest in and under the said invention and the said application, and in and to any and all Letters Patent which shall be granted therefore in the United States of America and in any and all foreign countries;

NOW, THEREFORE, for good and valuable consideration, the receipt and sufficiency of which is hereby acknowledged, I/we have sold and do hereby sell, assign, transfer and convey unto said ASSIGNEE, its successors, assigns and legal representatives, the entire right, title and interest in and to said invention and application, and in all divisionals, reissues, substitutions, continuations, continuation-in-part and, in any and all Letters Patents of the United States of America and all foreign countries or reissues, reexaminations, or extensions thereof which may be granted therefore or thereon, for the full end of the term for which said Letters Patent may be granted, together with the right to claim the priority of said application in all foreign countries in accordance with the International Convention, the same to be held and enjoyed by said ASSIGNEE, its successors and assigns, as fully and entirely as the same would have been held and enjoyed by me if this assignment and sale had not been made.

I/WE ALSO HEREBY authorize and request the Commissioner of Patents and Trademarks to issue all patents for said invention, or patents resulting therefrom to the said ASSIGNEE of my/our entire right, title and interest.

I/WE FURTHER HEREBY sell and assign to said ASSIGNEE, its successors, assigns and legal representatives the full and exclusive rights, title and interest to the invention disclosed in said application throughout the world, including, without limitation, the right to file applications and obtain patents, utility models, industrial models and designs for said invention in its own name throughout the world including all rights of priority, all rights to publish cautionary notices reserving ownership of said invention and all rights to register said invention in appropriate registries. I/we further agree to execute any and all powers of attorney, applications, assignments, declarations, affidavits, and any other papers in connection therewith necessary to perfect such rights, title and interest in ASSIGNEE, its successors, assigns and legal representatives.

I/WE HEREBY covenant that I/we have not and I/we will not execute any agreement in conflict herewith.

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ASSIGNMENT

I/WE HEREBY further covenant, and agree to bind my/our heirs, legal representatives, and assigns, promptly to communicate to said ASSIGNEE or its representatives any facts known to me relating to said invention, to testify in any interference or legal proceedings involving said invention, to execute any additional papers which may be requested to confirm the right of the assignee, its representatives, successors, or assigns to secure patent or similar protection for the said invention in all countries and to vest in the assignee complete title to the said invention and Letters Patent, without further compensation, but at the expense of said ASSIGNEE, its successors, assigns, and other legal representatives.

IN WITNESS WHEREOF, I/we have hereunto set my/our hand and seal on the date indicated below.

Inventor: Mehmet Oguz BICI Date: NOV-05-2012

Signature: MOBici Residence: Tampere, Finland

Witness Signature: Payman Aflaki

Printed Name: PAYMAN AFLAKI Date: 5, 11, 2012

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ASSIGNMENT

IN WITNESS WHEREOF, I/we have hereunto set my/our hand and seal on the date indicated below.

Inventor: Jani LAINEMA

Date: NOV-02-2012

Signature:

Residence: Tampere, Finland

Witness Signature:

Printed Name: PAYMAN AFLAKI

Date: 2/11/2012

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ASSIGNMENT

IN WITNESS WHEREOF, I/we have hereunto set my/our hand and seal on the date indicated below.

Inventor: Kemal UGUR

Date: Nov - 02 - 2012

Signature:

Residence: Tampere, Finland

Witness Signature:

Printed Name: PAYMAN AFLAKI

Date: 2/11/2012

Electronic Patent Application Fee Transmittal

Application Number:	13666680
Filing Date:	01-Nov-2012
Title of Invention:	METHOD FOR CODING AND AN APPARATUS
First Named Inventor/Applicant Name:	Mehmet Oguz BICI
Filer:	Thomas Joseph Arria/thao pham
Attorney Docket Number:	NC77198US-NP

Filed as Large Entity

Utility under 35 USC 111(a) Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Late filing fee for oath or declaration	1051	1	130	130
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
		Total in USD ($)		**130**

(12) 특허협력조약에 의하여 공개된 국제출원

(19) 세계지식재산권기구
국제사무국

(43) 국제공개일
2011 년 5 월 26 일 (26.05.2011)

PCT

(10) 국제공개번호
WO 2011/062392 A2

(51) 국제특허분류:
H04N 7/32 (2006.01) *H04N 7/24* (2011.01)

(21) 국제출원번호: PCT/KR2010/007839

(22) 국제출원일: 2010 년 11 월 8 일 (08.11.2010)

(25) 출원언어: 한국어

(26) 공개언어: 한국어

(30) 우선권정보:
10-2009-0111302 2009 년 11 월 18 일 (18.11.2009) KR

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(81) 지정국 (별도의 표시가 없는 한, 가능한 모든 종류의 국내 권리의 보호를 위하여): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) 지정국 (별도의 표시가 없는 한, 가능한 모든 종류의 역내 권리의 보호를 위하여): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), 유라시아 (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), 유럽 (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

공개:

— 국제조사보고서 없이 공개하며 보고서 접수 후 이를 별도 공개함 (규칙 48.2(g))

(54) Title: METHOD AND APPARATUS FOR ENCODING/DECODING A MOTION VECTOR BY SELECTING A SET OF PREDICTED CANDIDATE MOTION VECTORS, AND METHOD AND APPARATUS FOR IMAGE ENCODING/DECODING USING THE SAME

(54) 발명의 명칭 : 후보 예측 움직임 벡터 집합 선택을 이용한 움직임 벡터 부호화/복호화 방법 및 장치와 그를 이용한 영상 부호화/복호화 방법 및 장치

(57) Abstract: The present invention relates to a method and apparatus for encoding/decoding a motion vector by selecting a set of predicted candidate motion vectors, and a method and apparatus for image encoding/decoding using the same. The method for encoding a motion vector according to the present invention comprises: selecting one set of predicted candidate motion vectors among plural sets of predicted candidate motion vectors by using information about motions of neighboring blocks of a current block; selecting one of the predicted candidate motion vectors in the selected set of predicted candidate motion vectors as a predicted motion vector; encoding a differential vector which represents the difference between the current motion vector as a motion vector of the current block and the predicted motion vector being selected; and encoding a predicted motion vector index that represents the predicted motion vector being selected. According to the present invention, as a motion vector is encoded by selecting an efficient set of predicted candidate motion vectors, the magnitude of a differential vector to be encoded can be reduced without necessarily encoding additional information to indicate which set of predicted candidate motion vectors has been selected. In result, the compression efficiency of a motion vector and further the compression efficiency of an image can be improved.

(57) 요약서: 본 발명은 후보 예측 움직임 벡터 집합 선택을 이용한 움직임 벡터 부호화/복호화 방법 및 장치와 영상 부호화/복호화 방법 및 장치에 관한 것이다. 본 발명은 현재 블록의 주변 블록의 움직임 정보를 이용하여 복수 개의 후보 예측 움직임 벡터 집합 중에서 하나의 후보 예측 움직임 벡터 집합을 선택하고, 선택되는 후보 예측 움직임 벡터 집합 내의 후보 예측 움직임 벡터 중에서 하나의 후보 예측 움직임 벡터를 예측 움직임 벡터로서 선택하며, 현재 블록의 움직임 벡터인 현재 움직임 벡터와 선택되는 예측 움직임 벡터의 차이인 차분 벡터를 부호화하며, 선택되는 예측 움직임 벡터를 나타내는 예측 움직임 벡터 인덱스를 부호화하는 단계를 포함하는 것을 특징으로 하는 움직임 벡터 부호화 방법을 제공한다. 본 발명에 의하면, 효율적인 후보 예측 움직임 벡터 집합을 선택하여 움직임 벡터를 부호화함에 따라 부호화할 차분 벡터의 크기를 줄이면서도 어떠한 후보 예측 움직임 벡터 집합이 선택되었는지를 나타내기 위한 부가 정보를 부호화하지 않아도 되므로, 움직임 벡터의 압축 효율을 향상시켜 결과적으로 영상의 압축 효율을 향상시킬 수 있다.

WO 2011/062392 A2

명세서

발명의 명칭: 후보 예측 움직임 벡터 집합 선택을 이용한 움직임 벡터 부호화/복호화 방법 및 장치와 그를 이용한 영상 부호화/복호화 방법 및 장치

기술분야

[1] 본 발명은 후보 예측 움직임 벡터 집합 선택을 이용한 움직임 벡터 부호화/복호화 방법 및 장치와 그를 이용한 영상 부호화/복호화 방법 및 장치에 관한 것이다. 더욱 상세하게는, 영상을 예측 부호화하는 데 이용되는 움직임 벡터를 효율적으로 압축하여 영상의 압축 효율을 향상시키기 위한 방법 및 장치에 관한 것이다.

배경기술

[2] H.264/AVC와 같은 통상적인 영상 압축 기술에서는 블록 기반으로 움직임을 추정하여 얻어지는 움직임 벡터를 예측 부호화하기 위해서, 부호화하고자 하는 블록의 주변 블록의 움직임 벡터들의 중앙값(Median)을 이용하여 예측 움직임 벡터를 결정하고, 부호화하고자 하는 움직임 벡터와 예측 움직임 벡터의 차분을 가변 길이 부호화하여 움직임 벡터를 압축한다.

[3] 최근 ITU-T VCEG(Video Coding Expert Group)에서는 KTA(Key Technical Area)라는 이름으로 기존의 H.264/AVC 기반으로 더 높은 성능을 갖는 코덱을 연구해왔는데, 그 중 MVComp(Competition-based Motion Vector Coding)라는 기법을 통하여 기존의 H.264/AVC의 움직임 벡터 부호화 기법을 개선하였다.

[4] MVComp는 여러 개의 후보 예측 움직임 벡터를 두고, 현재 움직임 벡터와 예측 후에 얻어지는 움직임 벡터와의 차분 값이 최소가 되는 후보 예측 움직임 벡터를 선택하여 복호화기에 선정된 후보 예측 움직임 벡터에 대한 정보를 전송해주는 방법으로, 기존의 H.264/AVC에 비해서 5% 정도의 부호화 압축 효율을 개선하였다. 하지만, 이 기법은 후보 예측 움직임 벡터의 개수가 늘어날수록 복호화기에 전송해야 할 인덱싱 부가 정보(Indexing Side Information)의 양이 증가하는 문제점이 있다.

[5] 이에, 여러 개의 후보 예측 움직임 벡터 중에 현재 움직임 벡터와 가장 유사할 것과 같은 하나의 움직임 벡터를 부호화기에서 선택하여, 선택된 움직임 벡터가 최적의 움직임 벡터인지 아닌지만을 구별하기 위한 부가 정보를 보내는 기술 등이 제안되었다. 하지만, 제안된 방법은 현재 프레임의 비트를 에러 없이 전달 받았음에도 불구하고, 이전 프레임에서 발생한 에러 때문에 현재 프레임 및 다음 인트라 프레임 전까지의 프레임을 복원할 수 없게 되는 복호화기 충돌 문제(Decoder Crash Problem)와 복호화기에 많은 연산량 증가를 가져오는 한계를 가지는 문제점이 있다.

[6] 이에, 현재 부호화할 블록 주위의 움직임 벡터를 이용하여 현재 블록의 움직임

벡터를 결정하는 기법들이 제안되었다. 이 기법은 주변 블록의 움직임 벡터를 이용하여 인덱싱 부가 정보를 효율적으로 전송하고 후보 예측 움직임 벡터의 선택을 이전 프레임의 정보와 분리시켜 복호화기 충돌 문제를 해결하였지만, 한정된 개수의 후보 예측 움직임 벡터를 사용하기 때문에 압축 성능에 있어서 제한적이라는 한계를 가지는 문제점이 있다.

발명의 상세한 설명

기술적 과제

[7] 전술한 문제점을 해결하기 위해 본 발명은, 부호화할 움직임 벡터와 더욱 유사한 예측 움직임 벡터를 이용하여 움직임 벡터를 부호화하면서도 그로 인해 발생하는 비트량을 줄여 움직임 벡터를 효율적으로 압축하고 그에 따라 영상의 압축 효율을 향상시키는 데 주된 목적이 있다.

과제 해결 수단

[8] 전술한 목적을 달성하기 위해 본 발명은, 움직임 벡터를 부호화하는 장치에 있어서, 현재 블록의 주변 블록의 움직임 정보를 이용하여 복수 개의 후보 예측 움직임 벡터 집합 중에서 하나의 후보 예측 움직임 벡터 집합을 선택하는 후보 예측 움직임 벡터 집합 선택기; 선택되는 후보 예측 움직임 벡터 집합 내의 후보 예측 움직임 벡터 중에서 하나의 후보 예측 움직임 벡터를 예측 움직임 벡터로서 선택하는 예측 움직임 벡터 선택기; 현재 블록의 움직임 벡터인 현재 움직임 벡터와 선택되는 예측 움직임 벡터의 차이인 차분 벡터를 부호화하는 차분 벡터 부호화기; 및 선택되는 예측 움직임 벡터를 나타내는 예측 움직임 벡터 인덱스를 부호화하는 예측 움직임 벡터 부호화기를 포함하는 것을 특징으로 하는 움직임 벡터 부호화 장치를 제공한다.

[9] 또한, 본 발명의 다른 목적에 의하면, 영상을 부호화하는 장치에 있어서, 현재 블록의 현재 움직임 벡터를 결정하고, 결정되는 현재 움직임 벡터를 이용하여 현재 블록을 예측 부호화하는 영상 부호화기; 및 복수 개의 후보 예측 움직임 벡터 집합 중 현재 블록의 주변 블록의 움직임 정보를 기초로 선택되는 후보 예측 움직임 벡터 집합에서 예측 움직임 벡터를 선택하고, 현재 움직임 벡터와 선택되는 예측 움직임 벡터의 차이인 차분 벡터 및 선택되는 예측 움직임 벡터를 나타내는 예측 움직임 벡터 인덱스를 부호화하는 움직임 벡터 부호화기를 포함하는 것을 특징으로 하는 영상 부호화 장치를 제공한다.

[10] 또한, 본 발명의 또 다른 목적에 의하면, 움직임 벡터를 복호화하는 장치에 있어서, 현재 블록의 주변 블록의 움직임 정보를 이용하여 복수 개의 후보 예측 움직임 벡터 집합 중에서 하나의 후보 예측 움직임 벡터 집합을 선택하는 후보 예측 움직임 벡터 집합 선택기; 움직임 벡터 데이터로부터 추출되는 인덱스 데이터를 복호화하여 예측 움직임 벡터 인덱스를 복원하고, 선택되는 후보 예측 움직임 벡터 집합에서 복원되는 예측 움직임 벡터 인덱스에 의해 식별되는 후보 예측 움직임 벡터를 예측 움직임 벡터로서 복원하는 예측 움직임 벡터 복원기;

및 움직임 벡터 데이터로부터 추출되는 차분 벡터 데이터를 복호화하여 차분 벡터를 복원하고, 복원되는 차분 벡터와 복원되는 예측 움직임 벡터를 가산하여 현재 블록의 현재 움직임 벡터를 복원하는 현재 움직임 벡터 복원기를 포함하는 것을 특징으로 하는 움직임 벡터 복호화 장치를 제공한다.

[11] 또한, 본 발명의 또 다른 목적에 의하면, 영상을 복호화하는 장치에 있어서, 비트스트림으로부터 추출되는 움직임 벡터 데이터를 복호화하여 차분 벡터와 예측 움직임 벡터 인덱스를 복원하고, 현재 블록의 주변 블록의 움직임 정보를 이용하여 복수 개의 후보 예측 움직임 벡터 집합 중에서 하나의 후보 예측 움직임 벡터 집합을 선택하며, 선택되는 후보 예측 움직임 벡터 집합에서 복원되는 예측 움직임 벡터 인덱스에 의해 식별되는 후보 예측 움직임 벡터를 예측 움직임 벡터로서 선택하며, 복원되는 차분 벡터와 선택되는 예측 움직임 벡터를 가산하여 현재 블록의 현재 움직임 벡터를 복원하는 움직임 벡터 복호화기; 및 비트스트림으로부터 추출되는 영상 데이터를 복원되는 현재 움직임 벡터를 이용하여 예측 복호화하여 현재 블록을 복원하는 영상 복호화기를 포함하는 것을 특징으로 하는 영상 복호화 장치를 제공한다.

[12] 또한, 본 발명의 또 다른 목적에 의하면, 움직임 벡터를 부호화하는 방법에 있어서, 현재 블록의 주변 블록의 움직임 정보를 이용하여 복수 개의 후보 예측 움직임 벡터 집합 중에서 하나의 후보 예측 움직임 벡터 집합을 선택하는 단계; 선택되는 후보 예측 움직임 벡터 집합 내의 후보 예측 움직임 벡터 중에서 하나의 후보 예측 움직임 벡터를 예측 움직임 벡터로서 선택하는 단계; 현재 블록의 움직임 벡터인 현재 움직임 벡터와 선택되는 예측 움직임 벡터의 차이인 차분 벡터를 부호화하는 단계; 및 선택되는 예측 움직임 벡터를 나타내는 예측 움직임 벡터 인덱스를 부호화하는 단계를 포함하는 것을 특징으로 하는 움직임 벡터 부호화 방법을 제공한다.

[13] 또한, 본 발명의 또 다른 목적에 의하면, 영상을 부호화하는 방법에 있어서, 현재 블록의 현재 움직임 벡터를 결정하는 단계; 결정되는 현재 움직임 벡터를 이용하여 현재 블록을 예측 부호화하는 단계; 복수 개의 후보 예측 움직임 벡터 집합 중 현재 블록의 주변 블록의 움직임 정보를 기초로 선택되는 후보 예측 움직임 벡터 집합에서 예측 움직임 벡터를 선택하는 단계; 및 현재 움직임 벡터와 선택되는 예측 움직임 벡터의 차이인 차분 벡터와 선택되는 예측 움직임 벡터를 나타내는 예측 움직임 벡터 인덱스를 부호화하는 단계를 포함하는 것을 특징으로 하는 영상 부호화 방법을 제공한다.

[14] 또한, 본 발명의 또 다른 목적에 의하면, 움직임 벡터를 복호화하는 방법에 있어서, 움직임 벡터 데이터로부터 추출되는 차분 벡터 데이터와 인덱스 데이터를 복호화하여 차분 벡터와 예측 움직임 벡터 인덱스를 복원하는 단계; 현재 블록의 주변 블록의 움직임 정보를 이용하여 복수 개의 후보 예측 움직임 벡터 집합 중에서 하나의 후보 예측 움직임 벡터 집합을 선택하는 단계; 선택되는 후보 예측 움직임 벡터 집합에서 복원되는 예측 움직임 벡터 인덱스에

의해 식별되는 후보 예측 움직임 벡터를 예측 움직임 벡터로서 복원하는 단계; 및 복원되는 차분 벡터와 복원되는 예측 움직임 벡터를 가산하여 현재 블록의 현재 움직임 벡터를 복원하는 단계를 포함하는 것을 특징으로 하는 움직임 벡터 복호화 방법을 제공한다.

[15] 또한, 본 발명의 또 다른 목적에 의하면, 영상을 복호화하는 방법에 있어서, 비트스트림으로부터 추출되는 움직임 벡터 데이터를 복호화하여 차분 벡터와 예측 움직임 벡터 인덱스를 복원하는 단계; 현재 블록의 주변 블록의 움직임 정보를 이용하여 복수 개의 후보 예측 움직임 벡터 집합 중에서 하나의 후보 예측 움직임 벡터 집합을 선택하는 단계; 선택되는 후보 예측 움직임 벡터 집합에서 복원되는 예측 움직임 벡터 인덱스에 의해 식별되는 후보 예측 움직임 벡터를 예측 움직임 벡터로서 선택하는 단계; 복원되는 차분 벡터와 선택되는 예측 움직임 벡터를 가산하여 현재 블록의 현재 움직임 벡터를 복원하는 단계; 및 비트스트림으로부터 추출되는 영상 데이터를 복원되는 현재 움직임 벡터를 이용하여 예측 복호화하여 현재 블록을 복원하는 단계를 포함하는 것을 특징으로 하는 영상 복호화 방법을 제공한다.

발명의 효과

[16] 이상에서 설명한 바와 같이 본 발명에 의하면, 효율적인 후보 예측 움직임 벡터 집합을 선택하여 움직임 벡터를 부호화함에 따라 부호화할 차분 벡터의 크기를 줄이면서도 어떠한 후보 예측 움직임 벡터 집합이 선택되었는지를 나타내기 위한 부가 정보를 부호화하지 않아도 되므로, 움직임 벡터의 압축 효율을 향상시켜 결과적으로 영상의 압축 효율을 향상시킬 수 있다.

도면의 간단한 설명

[17] 도 1은 본 발명의 일 실시예에 따른 영상 부호화 장치를 간략하게 나타낸 블록 구성도,

[18] 도 2는 본 발명의 일 실시예에 따른 움직임 벡터 부호화 장치를 간략하게 나타낸 블록 구성도,

[19] 도 3은 본 발명의 일 실시예에 따른 주변 블록의 움직임 정보를 나타낸 예시도,

[20] 도 4는 본 발명의 일 실시예에 따라 후보 예측 움직임 벡터 집합을 선택하는 방법을 구현한 예를 나타낸 예시도,

[21] 도 5는 본 발명의 일 실시예에 따른 움직임 벡터 부호화 방법을 설명하기 위한 순서도,

[22] 도 6은 본 발명의 일 실시예에 따른 영상 부호화 방법을 설명하기 위한 순서도,

[23] 도 7은 본 발명의 일 실시예에 따른 영상 복호화 장치를 간략하게 나타낸 블록 구성도,

[24] 도 8은 본 발명의 일 실시예에 따른 움직임 벡터 복호화 장치를 간략하게 나타낸 블록 구성도,

[25] 도 9는 본 발명의 일 실시예에 따른 움직임 벡터 복호화 방법을 설명하기 위한

순시도,

[26] 도 10은 본 발명의 일 실시예에 따른 영상 복호화 방법을 설명하기 위한 순서도이다.

발명의 실시를 위한 형태

[27] 이하, 본 발명의 일부 실시예들을 예시적인 도면을 통해 상세하게 설명한다. 각 도면의 구성요소들에 참조부호를 부가함에 있어서, 동일한 구성요소들에 대해서는 비록 다른 도면상에 표시되더라도 가능한 한 동일한 부호를 가지도록 하고 있음에 유의해야 한다. 또한, 본 발명을 설명함에 있어, 관련된 공지 구성 또는 기능에 대한 구체적인 설명이 본 발명의 요지를 흐릴 수 있다고 판단되는 경우에는 그 상세한 설명은 생략한다.

[28] 또한, 본 발명의 구성 요소를 설명하는 데 있어서, 제 1, 제 2, A, B, (a), (b) 등의 용어를 사용할 수 있다. 이러한 용어는 그 구성 요소를 다른 구성 요소와 구별하기 위한 것일 뿐, 그 용어에 의해 해당 구성 요소의 본질이나 차례 또는 순서 등이 한정되지 않는다. 어떤 구성 요소가 다른 구성요소에 "연결", "결합" 또는 "접속"된다고 기재된 경우, 그 구성 요소는 그 다른 구성요소에 직접적으로 연결되거나 접속될 수 있지만, 각 구성 요소 사이에 또 다른 구성 요소가 "연결", "결합" 또는 "접속"될 수도 있다고 이해되어야 할 것이다.

[29] 이하에서 후술할 움직임 벡터 부호화 장치(Motion Vector Encoding Apparatus), 움직임 벡터 복호화 장치(Motion Vector Decoding Apparatus), 영상 부호화 장치(Video Encoding Apparatus), 영상 복호화 장치(Video Decoding Apparatus)는 개인용 컴퓨터(PC: Personal Computer), 노트북 컴퓨터, 개인 휴대 단말기(PDA: Personal Digital Assistant), 휴대형 멀티미디어 플레이어(PMP: Portable Multimedia Player), 플레이스테이션 포터블(PSP: PlayStation Portable), 이동통신 단말기(Mobile Communication Terminal) 등과 같은 사용자 단말기이거나 응용 서버와 서비스 서버 등 서버 단말기일 수 있으며, 각종 기기 또는 유무선 통신망과 통신을 수행하기 위한 통신 모뎀 등의 통신 장치, 움직임 벡터를 부호화거나 복호화거나 영상을 부호화하거나 복호화하기 위한 각종 프로그램과 데이터를 저장하기 위한 메모리, 프로그램을 실행하여 연산 및 제어하기 위한 마이크로프로세서 등을 구비하는 다양한 장치를 의미한다.

[30] 또한, 움직임 벡터 부호화 장치 또는 영상 부호화 장치에 의해 비트스트림으로 부호화된 움직임 벡터 또는 영상은 실시간 또는 비실시간으로 인터넷, 근거리 무선 통신망, 무선랜망, 와이브로망, 이동통신망 등의 유무선 통신망 등을 통하거나 케이블, 범용 직렬 버스(USB: Universal Serial Bus) 등과 같은 다양한 통신 인터페이스를 통해 움직임 벡터 복호화 장치 또는 영상 복호화 장치로 전송되어 움직임 벡터 복호화 장치에서 복호화되어 움직임 벡터로서 복원되거나 영상 복호화 장치에서 복호화되어 영상으로 복원되고 재생될 수 있다.

[31] 통상적으로 동영상은 일련의 픽처(Picture)로 구성되어 있으며, 각 픽처들은 블록(Block)과 같은 소정의 영역으로 분할된다. 영상의 영역이 블록으로 분할되는 경우에는 분할된 블록은 부호화 방법에 따라 크게 인트라 블록(Intra Block), 인터 블록(Inter Block)으로 분류된다. 인트라 블록은 인트라 예측 부호화(Intra Prediction Coding) 방식을 사용하여 부호화되는 블록을 뜻하는데, 인트라 예측 부호화란 현재 부호화를 수행하는 현재 픽처 내에서 이전에 부호화되고 복호화되어 복원된 블록들의 화소를 이용하여 현재 부호화하고자 하는 블록인 현재 블록의 화소를 예측함으로써 예측 블록을 생성하고 현재 블록의 화소와의 차분값을 부호화하는 방식이다. 인터 블록은 인터 예측 부호화(Inter Prediction Coding)를 사용하여 부호화되는 블록을 뜻하는데, 인터 예측 부호화란 하나 이상의 과거 픽처 또는 미래 픽처를 참조하여 현재 픽처 내의 현재 블록을 예측함으로써 예측 블록을 생성하고 현재 블록과의 차분값을 부호화하는 방식이다. 여기서, 현재 픽처를 부호화하거나 복호화하는데 참조되는 픽처를 참조 픽처(Reference Picture)라고 한다.

[32] 도 1은 본 발명의 일 실시예에 따른 영상 부호화 장치를 간략하게 나타낸 블록 구성도이다.

[33] 본 발명의 일 실시예에 따른 영상 부호화 장치(100)는 영상을 부호화하는 장치로서, 움직임 벡터 부호화기(Motion Vector Encoder, 110)와 영상 부호화기(Video Encoder, 120)를 포함하여 구성될 수 있다.

[34] 움직임 벡터 부호화기(110)는 복수 개의 후보 예측 움직임 벡터 집합(Candidate Predicted Motion Vector Set) 중 현재 블록의 주변 블록(Neighbor Block)의 움직임 정보(Motion Information)를 기초로 선택되는 후보 예측 움직임 벡터 집합에서 예측 움직임 벡터(Predicted Motion Vector)를 선택하고, 현재 움직임 벡터(Current Motion Vector)와 선택되는 예측 움직임 벡터의 차이인 차분 벡터(Differential Motion Vector) 및 선택되는 예측 움직임 벡터를 나타내는 예측 움직임 벡터 인덱스(Predicted Motion Vector Index)를 부호화한다. 차분 벡터는 부호화되어 차분 벡터 데이터로서 생성되고 예측 움직임 벡터 인덱스는 부호화되어 인덱스 데이터로서 생성된다. 따라서, 움직임 벡터 부호화기(110)는 차분 벡터 데이터와 그룹 인덱스 데이터를 포함하는 움직임 벡터 데이터를 생성한다.

[35] 여기서, 움직임 벡터 부호화기(110)는 차분 벡터를 생성하는 데 있어서, 영상 부호화기(120)에서 현재 블록을 예측 부호화하기 위해 결정된 현재 움직임 벡터를 이용한다. 움직임 벡터 부호화기(110)에 대해서는 후술하는 과정에서 도 2를 통해 상세히 설명한다.

[36] 영상 부호화기(120)는 현재 블록의 움직임 벡터인 현재 움직임 벡터를 결정하고 현재 움직임 벡터를 이용하여 현재 블록을 예측 부호화한다. 이와 같이 현재 블록이 예측 부호화되어 영상 데이터가 생성된다.

[37] 이를 위해, 영상 부호화기(120)는 예측기(Predictor), 감산기(Subtracter), 변환기 및 양자화기(Transformer and Quantizer), 부호화기(Encoder)를 포함하여 구성될

수 있으며, 역 양자화기 및 역 변환기(Inverse Transformer and Inverse Quantizer), 가산기(Adder), 디블로킹 필터(Deblocking Filter), 메모리(Memory) 등을 추가로 포함할 수 있다. 여기서, 예측기는 현재 블록의 움직임을 추정하여 현재 움직임 벡터를 결정하고 현재 움직임 벡터를 이용하여 현재 블록의 움직임을 보상하여 예측 블록(Predicted Block)을 생성하며, 감산기는 현재 블록과 예측 블록을 감산하여 잔여 블록(Residual Block)을 생성하며, 변환기 및 양자화기는 잔여 블록을 변환 및 양자화하여 양자화된 변환 계수(Quantized Transform Coefficient)를 생성하며, 부호화기는 양자화된 변환 계수를 부호화하여 영상 데이터를 생성한다. 또한, 역 양자화기 및 역 변환기는 양자화된 변환 계수를 역 양자화 및 역 변환하여 잔여 블록을 복원하고 가산기는 예측 블록과 복원되는 잔여 블록을 복원하여 현재 블록을 복원하며, 복원된 현재 블록은 디블로킹 필터(Deblocking Filter)에 의해 디블로킹 필터링되어 메모리에 픽처 단위로 누적되어 참조 픽처로서 저장되고 다음 블록 또는 다음 픽처를 예측하는 데 활용된다.

[38] 도 2는 본 발명의 일 실시예에 따른 움직임 벡터 부호화 장치를 간략하게 나타낸 블록 구성도이다.

[39] 본 발명의 일 실시예에 따른 움직임 벡터 부호화 장치는 도 1을 통해 전술한 영상 부호화 장치(100)에서는 움직임 벡터 부호화기(110)로 구현될 수 있다. 이하에서는 설명의 편의를 위해, 본 발명의 일 실시예에 따른 움직임 벡터 부호화 장치를 움직임 벡터 부호화기(110)라 칭한다.

[40] 움직임 벡터 부호화기(110)는 후보 예측 움직임 벡터 집합 선택기(Candidate Predicted Motion Vector Set Selector, 210), 예측 움직임 벡터 선택기(Predicted Motion Vector Selector, 220), 차분 벡터 부호화기(Differential Motion Vector Encoder, 230) 및 예측 움직임 벡터 부호화기(Predicted Motion Vector Encoder, 240)를 포함하여 구성될 수 있다.

[41] 후보 예측 움직임 벡터 집합 선택기(210)는 현재 블록의 주변 블록의 움직임 정보를 이용하여 복수 개의 후보 예측 움직인 벡터 집합 중에서 하나의 후보 예측 움직임 벡터 집합을 선택한다.

[42] 본 발명의 일 실시예에서, 현재 블록의 주변 블록이란 현재 블록이 포함된 현재 픽처에서 현재 블록이 부호화되기 전에 이미 부호화되고 복호화되어 기 복원된 블록 중 현재 블록의 주변에 위치한 블록을 말한다. 주변 블록은 현재 블록과 인접한 인접 블록이 될 수도 있지만 반드시 인접한 블록만으로 한정되지는 않는다. 주변 블록의 움직임 정보란 기 부호화되고 복호화되어 복원된 주변 블록에 대해 움직임 벡터와 관련하여 획득된 정보들을 말하며, 주변 블록의 움직임 벡터와 예측 움직임 벡터 등이 될 수 있다.

[43] 도 3은 본 발명의 일 실시예에 따른 주변 블록의 움직임 정보를 나타낸 예시도이다.

[44] 3A는 현재 블록의 주변 블록과 주변 블록의 움직임 벡터를 예시적으로

나타내었다. 현재 블록의 주변에 위치한 블록들 중에서 현재 블록의 왼쪽에 인접한 블록을 블록 A, 위쪽에 인접한 블록을 블록 B, 위쪽 오른쪽에 인접한 블록을 블록 C라고 가정하면, 블록 A, 블록 B 및 블록 C가 현재 블록의 주변 블록이 될 수 있다. 이때, 블록 A, 블록 B 및 블록 C는 모두 현재 블록이 부호화되기 전에 이미 부호화되고 복호화되어 복원된 블록들이다. 3A에서는 블록 A, 블록 B 및 블록 C만이 현재 블록의 주변 블록인 것으로 도시하였지만, 이에 한정되지 않고 현재 블록의 위쪽 왼쪽에 위치한 블록 등과 같이 다른 블록들도 주변 블록으로 이용될 수 있다.

[45] 3A에서, MV_a, MV_b, MV_c는 블록 A, 블록 B 및 블록 C 각각의 움직임 벡터를 나타낸다. 블록 A, 블록 B 및 블록 C의 움직임 벡터는 각 블록을 부호화할 때 이미 결정되어 영상 부호화 장치(100) 또는 움직임 벡터 부호화기(110)의 버퍼 또는 메모리 등에 저장되어 있으므로, 영상 부호화 장치(100), 움직임 벡터 부호화기(110) 또는 후보 예측 움직임 벡터 집합 선택기(210)가 현재 블록을 부호화하거나 현재 블록의 움직임 벡터를 부호화할 때 언제든지 획득하여 이용할 수 있는 정보이다.

[46] 3B는 주변 블록의 예측 움직임 벡터를 예시적으로 나타내었다. 3B에서, PMV_a, PMV_b, PMV_c는 블록 A, 블록 B 및 블록 C 각각의 예측 움직임 벡터를 나타낸다. 블록 A, 블록 B 및 블록 C의 예측 움직임 벡터도 각 블록을 부호화할 때 이미 결정되어 영상 부호화 장치(100) 또는 움직임 벡터 부호화기(110)의 버퍼 또는 메모리 등에 저장되어 있으므로, 영상 부호화 장치(100), 움직임 벡터 부호화기(110) 또는 후보 예측 움직임 벡터 집합 선택기(210)가 현재 블록을 부호화하거나 현재 블록의 움직임 벡터를 부호화할 때 언제든지 획득하여 이용할 수 있는 정보이다.

[47] 따라서, 3A와 3B에 나타낸 예의 경우, 주변 블록의 움직임 정보는 3C에 나타낸 바와 같이 $MV_a, MV_b, MV_c, PMV_a, PMV_b, PMV_c$가 될 수 있다.

[48] 후보 예측 움직임 벡터 집합 선택기(210)는, 도 3에 도시한 바와 같이, 주변 블록의 움직임 벡터와 예측 움직임 벡터를 주변 블록의 움직임 정보로서 이용하여 복수 개의 후보 예측 움직임 벡터 집합 중에서 하나의 후보 예측 움직임 벡터 집합을 선택할 수 있다.

[49] 일 예로, 후보 예측 움직임 벡터 집합 선택기(210)는 주변 블록의 움직임 정보를 이용하여 카메라의 움직임 여부를 판단하고 판단되는 카메라의 움직임 여부를 기초로 복수 개의 후보 예측 움직임 벡터 집합 중에서 하나의 후보 예측 움직임 벡터 집합을 선택할 수 있다. 이를 위해, 후보 예측 움직임 벡터 집합 선택기(210)는 주변 블록들 중에서 움직임 벡터가 제로 벡터(Zero Vector)인 주변 블록의 개수가 기 설정된 개수 이상인지 여부를 판단하여 카메라의 움직임 여부를 판단할 수 있다. 즉, 후보 예측 움직임 벡터 집합 선택기(210)는 움직임 벡터가 제로 벡터인 주변 블록의 개수가 기 설정된 개수 이상인 경우에는 카메라의 움직임이 없는 것으로 판단하고, 움직임 벡터가 제로 벡터인 주변

블록의 개수가 기 설정된 개수 미만인 경우에는 카메라의 움직임이 있는 것으로 판단할 수 있다.

[50] 도 3에 도시한 예에서, 주변 블록들의 움직임 벡터 MV_a, MV_b, MV_c가 각각 (0, 0), (0, 0), (0, 1)이고, 카메라의 움직임 여부를 판단하기 위한 개수로 2 개가 설정되었으며, 복수 개의 후보 예측 움직임 벡터 집합으로서 $\{MV_a, MV_{H.264}\}$, $\{MV_a, MV_{extspa}\}$ 두 개의 후보 예측 움직임 벡터 집합이 설정되었다고 가정하면, 움직임 벡터가 제로 벡터인 주변 블록의 개수가 2로서 기 설정된 개수인 2 이상이므로, 카메라의 움직임이 없는 것으로 판단되어 $MV_{H.264}$가 포함된 $\{MV_a, MV_{H.264}\}$가 후보 예측 움직임 벡터 집합으로서 선택될 수 있다. 이때, 주변 블록들의 움직인 벡터 MV_a, MV_b, MV_c가 각각 (0, 0), (1, 0), (0, 1)이라고 가정하면, 움직임 벡터가 제로 벡터인 주변 블록의 개수가 1로서 기 설정된 개수인 2 미만이므로, 카메라의 움직임이 있는 것으로 판단되어 MV_{extspa}가 포함된 $\{MV_a, MV_{extspa}\}$가 후보 예측 움직임 벡터 집합으로서 선택될 수 있다.

[51] 이때, 카메라의 움직임이 없는 것으로 판단되면 $MV_{H.264}$가 포함된 집합을 후보 예측 움직임 벡터 집합으로서 선택하고 카메라의 움직임이 있는 것으로 판단되면 MV_{extspa}가 포함된 집합을 후보 예측 움직임 벡터 집합으로서 선택하는 것은 예시적인 것일 뿐, 반드시 $MV_{H.264}$ 또는 MV_{extspa}가 포함된 집합을 선택해야 하는 것은 아니며, 어떠한 후보 예측 움직임 벡터가 포함된 집합을 선택해야 하는 지는 실험을 통해 경험적으로 결정될 수 있다. 즉, 카메라의 움직임 여부에 따라 선택되어 후보 예측 움직임 벡터 집합에 포함될 후보 예측 움직임 벡터는 실험을 통해 경험적으로 결정될 수 있으며, 이와 같이 경험적으로 결정되는 데이터는 영상 부호화 장치(110)와 영상 복호화 장치에 미리 설정하여 저장될 수 있다.

[52] 다른 예로, 후보 예측 움직임 벡터 집합 선택기(210)는 주변 블록의 움직임 정보를 이용하여 주변 블록의 객체 움직임(Object Motion)을 판단하고, 판단되는 주변 블록의 객체 움직임을 기초로 복수 개의 후보 예측 움직임 벡터 집합 중에서 하나의 후보 예측 움직임 벡터 집합을 선택할 수 있다. 이를 위해, 후보 예측 움직임 벡터 집합 선택기(210)는 주변 블록의 예측 움직임 벡터를 이용하여 주변 블록의 객체 움직임을 판단할 수 있다. 즉, 후보 예측 움직임 벡터 집합 선택기(210)는 주변 블록의 객체 움직임을 판단하기 위해 주변 블록의 움직임 정보로서 주변 블록의 예측 움직임 벡터를 분석하고, 분석된 주변 블록의 예측 움직임 벡터의 분포에 따라 이용 가능한 후보 예측 움직임 벡터들 중 하나 이상의 후보 예측 움직임 벡터를 선택하고, 복수 개의 후보 예측 움직임 벡터 집합 중에서 선택된 하나 이상의 후보 예측 움직임 벡터를 포함하는 후보 예측 움직임 벡터 집합을 하나의 후보 예측 움직임 벡터 집합으로서 선택할 수 있다.

[53] 도 3에 도시한 예에서, 설정된 복수 개의 후보 예측 움직임 벡터 집합으로서 $\{MV_a, MV_{H.264}\}$, $\{MV_b, MV_{H.264}\}$, $\{MV_c, MV_{H.264}\}$ 세 개의 후보 예측 움직임 벡터 집합이 설정되었다고 가정하면, 주변 블록들의 예측 움직임 벡터 PMV_a, PMV_b,

PMV_c는 각각 MV_a, MV_a, MV_c인데, 이 경우 현재 블록의 예측 움직임 벡터는 MV_a가 될 확률이 MV_a나 MV_c가 될 확률보다 높다는 가정 하에서, MV_a, MV_a, MV_c, $MV_{H.264}$, MV_{extspa} 등과 같은 이용 가능한 후보 예측 움직임 벡터들 중에서 MV_b를 선택하여, 선택된 MV_b를 포함하는 $\{MV_b, MV_{H.264}\}$가 후보 예측 움직임 벡터 집합으로서 선택될 수 있다. 이때, 주변 블록들의 예측 움직임 벡터 PMV_a, PMV_b, PMV_c가 각각 MV_a, MV_a, MV_c일 때, 현재 블록의 예측 움직임 벡터는 MV_b가 될 확률이 MV_a나 MV_c가 될 확률보다 높다는 것은 예시적인 것일 뿐, 이는 실험을 통해 경험적으로 결정될 수 있나. 즉, 주변 블록의 예측 움직임 벡터의 분포에 따라 선택되어 후보 예측 움직임 벡터 집합에 포함될 후보 예측 움직임 벡터는 실험을 통해 경험적으로 결정될 수 있으며, 이와 같이 경험적으로 결정되는 데이터는 영상 부호화 장치(110)와 영상 복호화 장치에 미리 설정하여 저장될 수 있다.

[54] 또 다른 예로, 도 4에 도시한 바와 같이, 선술한 카메라의 움직임 여부와 주변 블록의 객체 움직임 모두를 기초로 복수 개의 후보 예측 움직임 벡터 집합 중에서 하나의 후보 예측 움직임 벡터 집합을 선택할 수 있다.

[55] 도 4는 본 발명의 일 실시예에 따라 후보 예측 움직임 벡터 집합을 선택하는 방법을 구현한 예를 나타낸 예시도이다.

[56] 복수 개의 후보 예측 움직임 벡터 집합들이 $\{MV_a, MV_{H.264}\}$, $\{MV_b, MV_{H.264}\}$, $\{MV_c, MV_{H.264}\}$, $\{MV_a, MV_{extspa}\}$, $\{MV_b, MV_{extspa}\}$, $\{MV_c, MV_{extspa}\}$로 설정된 경우(S410), 후보 예측 움직임 벡터 집합 선택기(210)는 주변 블록의 움직임 정보를 분석하여(S420), 주변 블록의 객체 움직임을 기초로 전술한 예에서와 같이 이용 가능한 후보 예측 움직임 벡터 중에서 MV_a를 선택하며(S430), 카메라 움직임이 없는지 여부를 판단하여(S410), 카메라 움직임이 없는 경우에는 $MV_{H.264}$를 선택하여(S450), $\{MV_a, MV_{H.264}\}$를 후보 예측 움직임 벡터 집합으로서 선택하며(S460), 카메라 움직임이 있는 경우에는 MV_{extspa}를 선택하여(S470), $\{MV_a, MV_{extspa}\}$를 후보 예측 움직임 벡터 집합으로서 선택할 수 있다(S480).

[57] 도 3 및 도 4를 통해서는 복수 개의 후보 예측 움직임 벡터 집합이 2 개, 3 개, 6 개인 경우에 대해서 예를 들었지만, 후보 예측 움직임 벡터 집합은 2 개 이상이라면 제한 없이 설정될 수 있다. 또한, 도 3 및 도 4를 통해서는 각 후보 예측 움직임 벡터 집합 내에 두 개의 후보 예측 움직임 벡터가 포함되는 것으로 예를 들었지만, 반드시 두 개에 한정되지 않고 두 개 이상 복수 개의 후보 예측 움직임 벡터가 포함될 수 있다.

[58] 다시 도 2를 참조하면, 예측 움직임 벡터 선택기(220)는 선택되는 후보 예측 움직임 벡터 집합 내의 후보 예측 움직임 벡터 중에서 하나의 후보 예측 움직임 벡터를 예측 움직임 벡터로서 선택한다. 이를 위해, 예측 움직임 벡터 선택기(220)는 후보 예측 움직임 벡터 집합 선택기(210)에 의해 선택되는 후보 예측 움직임 벡터 집합 내에 포함되는 후보 예측 움직임 벡터들 중에서 율-왜곡 측면에서 최적이 되는 후보 예측 움직임 벡터를 예측 움직임 벡터로서 선택할 수

있다. 여기서, 율-왜곡 측면에서 최적이 되는 후보 예측 움직임 벡터란 해당 후보 예측 움직임 벡터들 각각을 이용하여 현재 움직임 벡터를 부호화하고 현재 블록을 부호화하여 생성되는 비트스트림의 율-왜곡 비용이 가장 작은 후보 예측 움직임 벡터를 말한다.

[59] 예를 들어, 예측 움직임 벡터 선택기(220)에 의해 선택되는 후보 예측 움직임 벡터 집합이 $\{MV_a, MV_{H.264}\}$라고 가정하면, 수학식 1을 이용하여 예측 움직임 벡터가 선택될 수 있다.

[60] [수학식 1]

[61] $$BMVI = \arg\min_{l}\left[\sum_{i}\sum_{j}\left|x_{i,j}-\hat{x}_{i,j}\right| + \lambda\cdot\{R(MV_c - MV_l) + R(l)\}\right]$$

[62] 수학식 1에서, BMVI(Best Motion Vector Index)는 예측 움직임 벡터 선택기(220)에 의해 선택되는 예측 움직임 벡터를 식별하기 위한 예측 움직임 벡터 인덱스를 나타내며, $x_{i,y}$는 현재 화소의 좌표 (i, j)에 대한 화소값을 나타내며, $\hat{x}_{i,j}$는 참조 화소의 좌표 (i, j)에 대한 화소값을 나타내며, $R(MV\text{-}MVl)$과 $R(l)$은 각각 현재 블록의 움직임 벡터와 예측 움직임 벡터와의 차이를 부호화하는 데 소요되는 비트량과 예측 움직임 벡터 인덱스를 부호화하는 데 소요되는 비트량이 계산된 값을 나타낸다.

[63] 차분 벡터 부호화기(230)는 현재 블록의 움직임 벡터인 현재 움직임 벡터와 선택되는 예측 움직임 벡터의 차이인 차분 벡터를 부호화한다. 즉, 차분 벡터 부호화기(230)는 현재 움직임 벡터와 예측 움직임 벡터 선택기(220)에 의해 선택되는 예측 움직임 벡터를 감산하여 차분 벡터를 생성하고 차분 벡터를 부호화하여 차분 벡터 데이터를 생성한다. 예를 들어, 예측 움직임 벡터 선택기(220)에 의해 선택되는 예측 움직임 벡터가 MV_a라고 가정하면, 차분 벡터는 수학식 2와 같이 계산될 수 있다. 수학식 2에서, DMV는 차분 벡터를 나타내고, MV는 현재 움직임 벡터를 나타낸다.

[64] [수학식 2]

[65] $$DMV = MV_c - MV_a$$

[66] 다만, 차분 벡터 부호화기(230)는 차분 벡터를 별도로 부호화하지 않고 예측 움직임 벡터 선택기(220)가 율-왜곡 비용을 구하기 위해 차분 벡터를 구하고 부호화한 경우 예측 움직임 벡터 선택기(220)에 의해 부호화된 차분 벡터 데이터를 출력할 수 있다. 차분 벡터를 부호화하는 기법으로서는 고정 길이 부호화(Fixed Length Coding), 가변 길이 부호화(Variable Length Coding), 산술 부호화(Arithmetic Coding) 등과 같은 엔트로피 부호화(Entropy Coding) 기법이 이용될 수 있다.

[67] 예측 움직임 벡터 부호화기(240)는 예측 움직임 벡터 선택기(220)에 의해 선택되는 예측 움직임 벡터를 나타내는 예측 움직임 벡터 인덱스를 부호화한다. 예측 움직임 벡터 인덱스를 부호화하는 기법으로서는 차분 벡터를 부호화할

때와 마찬가지로 고정 길이 부호화, 가변 길이 부호화, 산술 부호화 등과 같은 엔트로피 부호화 기법이 이용될 수 있다.

[68] 예를 들어, 후보 예측 움직임 벡터 집합 선택기(210)에 의해 선택되는 후보 예측 움직임 벡터 집합이 $\{MV_a, MV_{H.264}\}$라고 가정하면, MV_a의 예측 움직임 벡터 인덱스는 '0'이고 $MV_{H.264}$의 예측 움직임 벡터 인덱스는 '1'로 설정될 수 있다. 따라서, 이 경우, 후보 예측 움직임 벡터 집합 내에 두 개의 후보 예측 움직임 벡터만이 존재하므로 예측 움직임 벡터 인덱스가 부호화되어 생성되는 인덱스 데이터는 '0' 또는 '1'의 값을 가지는 1 비트로 생성될 수 있다. 여기서, 영상 복호화 장치 또는 움직임 벡터 복호화 장치에서 예측 움직임 벡터 인덱스를 올바르게 복원하기 위해서는 후보 예측 움직임 벡터 집합별로 각 집합 내에 포함되는 후보 예측 움직임 벡터에 대한 예측 움직임 벡터 인덱스가 영상 부호화 장치(100)와 영상 복호화 장치 또는 움직임 벡터 부호화 장치(110)와 움직임 벡터 복호화 장치에 미리 동일하게 설정되어 저장되어야 한다.

[69] 도 5는 본 발명의 일 실시예에 따른 움직임 벡터 부호화 방법을 설명하기 위한 순서도이다.

[70] 본 발명의 일 실시예에 따른 움직임 벡터 부호화 방법에 따르면, 움직임 벡터 부호화기(110)는 현재 블록의 주변 블록의 움직임 정보를 이용하여 복수 개의 후보 예측 움직임 벡터 집합 중에서 하나의 후보 예측 움직임 벡터 집합을 선택하고(S510), 선택되는 후보 예측 움직임 벡터 집합 내의 후보 예측 움직임 벡터 중에서 하나의 후보 예측 움직임 벡터를 예측 움직임 벡터로서 선택하며(S520), 현재 블록의 움직임 벡터인 현재 움직임 벡터와 선택되는 예측 움직임 벡터의 차이인 차분 벡터를 부호화하며(S530), 선택되는 예측 움직임 벡터를 나타내는 예측 움직임 벡터 인덱스를 부호화한다(S540).

[71] 단계 S510에서, 움직임 벡터 부호화기(110)는 주변 블록의 움직임 정보를 이용하여 카메라의 움직임 여부를 판단하고 판단되는 카메라의 움직임 여부를 기초로 하나의 후보 예측 움직임 벡터 집합을 선택할 수 있다.

[72] 또한, 단계 S510에서, 움직임 벡터 부호화기(110)는 주변 블록의 움직임 정보를 이용하여 주변 블록의 객체 움직임을 판단하고, 판단되는 주변 블록의 객체 움직임을 기초로 하나의 후보 예측 움직임 벡터 집합을 선택할 수 있다. 이를 위해, 움직임 벡터 부호화기(110)는 주변 블록의 예측 움직임 벡터를 이용하여 주변 블록의 객체 움직임을 판단할 수 있다.

[73] 또한, 단계 S510에서, 움직임 벡터 부호화기(110)는 단계 S510에서, 주변 블록의 움직임 정보를 이용하여 주변 블록의 객체 움직임을 판단하고 판단되는 객체 움직임을 기초로 후보 예측 움직임 벡터를 선택하며, 주변 블록의 움직임 정보를 이용하여 카메라의 움직임 여부를 판단하고 판단되는 카메라의 움직임 여부를 기초로 후보 예측 움직임 벡터를 선택하며, 복수 개의 후보 예측 움직임 벡터 집합 중에서 객체 움직임을 기초로 선택되는 후보 예측 움직임 벡터 및 카메라의 움직임 여부를 기초로 선택되는 후보 예측 움직임 벡터를 포함하는

후보 예측 움직임 벡터 집합을 하나의 후보 예측 움직임 벡터 집합으로서 선택할 수 있다.

[74] 도 6은 본 발명의 일 실시예에 따른 영상 부호화 방법을 설명하기 위한 순서도이다.

[75] 본 발명의 일 실시예에 따른 영상 부호화 방법에 따르면, 영상 부호화 장치(100)는 현재 블록의 현재 움직임 벡터를 결정하고(S610), 결정되는 현재 움직임 벡터를 이용하여 현재 블록을 예측 부호화하며(S620), 복수 개의 후보 예측 움직임 벡터 집합 중 현재 블록의 주변 블록의 움직임 정보를 기초로 선택되는 후보 예측 움직임 벡터 집합에서 예측 움직임 벡터를 선택하며(S630), 현재 움직임 벡터와 선택되는 예측 움직임 벡터의 차이인 차분 벡터와 선택되는 예측 움직임 벡터를 나타내는 예측 움직임 벡터 인덱스를 부호화한다(S640).

[76] 도 7은 본 발명의 일 실시예에 따른 영상 복호화 장치를 간략하게 나타낸 블록 구성도이다.

[77] 본 발명의 일 실시예에 따른 영상 복호화 장치(700)는 움직임 벡터 복호화기(Motion Vector Decoder, 710) 및 영상 복호화기(Video Decoder, 720)를 포함하여 구성될 수 있다.

[78] 움직임 벡터 복호화기(710)는 비트스트림으로부터 추출되는 움직임 벡터 데이터를 복호화하여 차분 벡터와 예측 움직임 벡터 인덱스를 복원하고, 현재 블록의 주변 블록의 움직임 정보를 이용하여 복수 개의 후보 예측 움직임 벡터 집합 중에서 하나의 후보 예측 움직임 벡터 집합을 선택하며, 선택되는 후보 예측 움직임 벡터 집합에서 복원되는 예측 움직임 벡터 인덱스에 의해 식별되는 후보 예측 움직임 벡터를 예측 움직임 벡터로서 선택하며, 복원되는 차분 벡터와 선택되는 예측 움직임 벡터를 가산하여 현재 블록의 현재 움직임 벡터를 복원한다. 움직임 벡터 복호화기(710)에 대해서는 후술하는 과정에서 도 8을 통해 상세히 설명한다.

[79] 영상 복호화기(720)는 비트스트림으로부터 추출되는 영상 데이터를 복원되는 현재 움직임 벡터를 이용하여 예측 복호화하여 현재 블록을 복원한다. 이를 위해, 영상 복호화기(720)는 복호화기(Decoder), 역 양자화기 및 역 변환기, 예측기, 가산기, 디블로킹 필터, 메모리 등을 포함하여 구성될 수 있다. 여기서, 복호화기는 비트스트림으로부터 추출되는 영상 데이터를 복호화하여 양자화된 변환 계수를 복원하고, 역 양자화기 및 역 변환기는 복원되는 양자화된 변환 계수를 역 양자화 및 역 변환하여 잔여 블록을 복원하며, 예측기는 움직임 벡터 복호화기(710)에 의해 복원되는 현재 블록의 현재 움직임 벡터를 이용하여 현재 블록의 움직임을 보상함으로써 예측 블록을 생성하며, 가산기는 복원되는 잔여 블록과 예측 블록을 가산하여 현재 블록을 복원할 수 있다. 복원되는 현재 블록은 디블로킹 필터에 의해 디블로킹 필터링되고 픽처 단위로 누적되어 복원 영상으로서 출력되거나 메모리에 저장되어 예측기가 다음 블록 또는 다음 픽처를 예측하는데 활용된다.

[80] 도 8은 본 발명의 일 실시예에 따른 움직임 벡터 복호화 장치를 간략하게 나타낸 블록 구성도이다.

[81] 본 발명의 일 실시예에 따른 움직임 벡터 복호화 장치는 도 7을 통해 전술한 영상 복호화 장치(700)에서는 움직임 벡터 복호화기(710)로 구현될 수 있다. 이하에서는 설명의 편의를 위해, 본 발명의 일 실시예에 따른 움직임 벡터 복호화 장치를 움직임 벡터 복호화기(710)라 칭한다.

[82] 움직임 벡터 복호화기(710)는 후보 예측 움직임 벡터 집합 선택기(810), 예측 움직임 벡터 복원기(Predicted Motion Vector Reconstructer, 820) 및 현재 움직임 벡터 복원기(Current Motion Vector Reconstructer, 830)를 포함하여 구성될 수 있다.

[83] 후보 예측 움직임 벡터 집합 선택기(810)는 현재 블록의 주변 블록의 움직임 정보를 이용하여 복수 개의 후보 예측 움직임 벡터 집합 중에서 하나의 후보 예측 움직임 벡터 집합을 선택한다. 여기서, 후보 예측 움직임 벡터 집합 선택기(810)는 도 2를 통해 전술한 후보 예측 움직임 벡터 집합 선택기(210)와 동일 또는 유사하므로 상세한 설명은 생략한다.

[84] 예측 움직임 벡터 복원기(820)는 움직임 벡터 데이터로부터 추출되는 인덱스 데이터를 복호화하여 예측 움직임 벡터 인덱스를 복원하고, 선택되는 후보 예측 움직임 벡터 집합에서 복원되는 예측 움직임 벡터 인덱스에 의해 식별되는 후보 예측 움직임 벡터를 예측 움직임 벡터로서 복원한다. 즉, 예측 움직임 벡터 복원기(820)는 움직임 벡터 데이터로부터 인덱스 데이터를 추출하고 복호화하여 예측 움직임 벡터 인덱스를 복원하고, 후보 예측 움직임 벡터 집합 선택기(810)에 의해 선택되는 후보 예측 움직임 벡터 집합 내의 후보 예측 움직임 벡터들 중에서 복원되는 예측 움직임 벡터 인덱스에 의해 식별되는 후보 예측 움직임 벡터를 예측 움직임 벡터로서 복원한다.

[85] 예를 들어, 후보 예측 움직임 벡터 집합 선택기(810)에 의해 선택되는 후보 예측 움직임 벡터 집합이 $\{MV_a, MV_{H.264}\}$이고, MV_a의 예측 움직임 벡터 인덱스는 '0'이고 $MV_{H.264}$의 예측 움직임 벡터 인덱스는 '1'로 설정되어 있으며, 움직임 벡터 데이터로부터 추출되는 인덱스 데이터가 '0'의 비트라고 가정하면, 복원되는 예측 움직임 벡터 인덱스에 의해 식별되는 후보 예측 움직임 벡터는 MV_a가 되어, MV_a가 예측 움직임 벡터로서 복원될 수 있다. 여기서, 후보 예측 움직임 벡터 집합별로 각 집합 내에 포함되는 후보 예측 움직임 벡터에 대한 예측 움직임 벡터 인덱스는 영상 부호화 장치(100)와 영상 복호화 장치(700) 또는 움직임 벡터 부호화기(110)와 움직임 벡터 복호화기(710)에 미리 동일하게 설정되어 저장되어야 한다.

[86] 현재 움직임 벡터 복원기(830)는 움직임 벡터 데이터로부터 추출되는 차분 벡터 데이터를 복호화하여 차분 벡터를 복원하고, 복원되는 차분 벡터와 복원되는 예측 움직임 벡터를 가산하여 현재 블록의 현재 움직임 벡터를 복원한다. 즉, 현재 움직임 벡터 복원기(830)는 움직임 벡터 데이터로부터 차분

벡터 데이터를 추출하고 복호화하여 차분 벡터를 복원하고, 복원되는 차분 벡터와 예측 움직임 벡터 복원기(820)에 의해 복원되는 예측 움직임 벡터를 가산하여 현재 움직임 벡터를 복원한다.

[87] 도 9는 본 발명의 일 실시예에 따른 움직임 벡터 복호화 방법을 설명하기 위한 순서도이다.

[88] 본 발명의 일 실시예에 따른 움직임 벡터 복호화 방법에 따르면, 움직임 벡터 복호화기(710)는 움직임 벡터 데이터로부터 추출되는 차분 벡터 데이터와 인덱스 데이터를 복호화하여 차분 벡터와 예측 움직임 벡터 인덱스를 복원하고(S910), 현재 블록의 주변 블록의 움직임 정보를 이용하여 복수 개의 후보 예측 움직임 벡터 집합 중에서 하나의 후보 예측 움직임 벡터 집합을 선택하며(S920), 선택되는 후보 예측 움직임 벡터 집합에서 복원되는 예측 움직임 벡터 인덱스에 의해 식별되는 후보 예측 움직임 벡터를 예측 움직임 벡터로서 복원하며(S930), 복원되는 차분 벡터와 복원되는 예측 움직임 벡터를 가산하여 현재 블록의 현재 움직임 벡터를 복원한다(S940).

[89] 단계 S920에서, 움직임 벡터 복호화기(710)는 주변 블록의 움직임 정보를 이용하여 카메라의 움직임 여부를 판단하고 판단되는 카메라의 움직임 여부를 기초로 하나의 후보 예측 움직임 벡터 집합을 선택할 수 있다.

[90] 또한, 단계 S920에서, 움직임 벡터 복호화기(710)는 주변 블록의 움직임 정보를 이용하여 주변 블록의 객체 움직임을 판단하고, 판단되는 주변 블록의 객체 움직임을 기초로 하나의 후보 예측 움직임 벡터 집합을 선택할 수 있다. 이를 위해, 움직임 벡터 복호화기(710)는 주변 블록의 예측 움직임 벡터를 이용하여 주변 블록의 객체 움직임을 판단할 수 있다.

[91] 또한, 단계 S920에서, 움직임 벡터 복호화기(710)는 주변 블록의 움직임 정보를 이용하여 주변 블록의 객체 움직임을 판단하고 판단되는 객체 움직임을 기초로 후보 예측 움직임 벡터를 선택하며, 주변 블록의 움직임 정보를 이용하여 카메라의 움직임 여부를 판단하고 판단되는 카메라의 움직임 여부를 기초로 후보 예측 움직임 벡터를 선택하며, 복수 개의 후보 예측 움직임 벡터 집합 중에서 객체 움직임을 기초로 선택되는 후보 예측 움직임 벡터 및 카메라의 움직임 여부를 기초로 선택되는 후보 예측 움직임 벡터를 포함하는 후보 예측 움직임 벡터 집합을 하나의 후보 예측 움직임 벡터 집합으로서 선택할 수 있다.

[92] 도 10은 본 발명의 일 실시예에 따른 영상 복호화 방법을 설명하기 위한 순서도이다.

[93] 본 발명의 일 실시예에 따른 영상 복호화 방법에 따르면, 영상 복호화 장치(700)는 비트스트림으로부터 추출되는 움직임 벡터 데이터를 복호화하여 차분 벡터와 예측 움직임 벡터 인덱스를 복원하고(S1010), 현재 블록의 주변 블록의 움직임 정보를 이용하여 복수 개의 후보 예측 움직임 벡터 집합 중에서 하나의 후보 예측 움직임 벡터 집합을 선택하며(S1020), 선택되는 후보 예측 움직임 벡터 집합에서 복원되는 예측 움직임 벡터 인덱스에 의해 식별되는 후보

예측 움직임 벡터를 예측 움직임 벡터로서 선택하며(S1030), 복원되는 차분 벡터와 선택되는 예측 움직임 벡터를 가산하여 현재 블록의 현재 움직임 벡터를 복원하며(S1040), 비트스트림으로부터 추출되는 영상 데이터를 복원되는 현재 움직임 벡터를 이용하여 예측 복호화하여 현재 블록을 복원할 수 있다.

[94] 한편, 이상에서는 영상과 움직임 벡터가 블록 단위로 예측 부호화되고 복화화되는 것으로 예를 들어 설명했지만, 영상과 움직임 벡터가 반드시 블록 단위로 예측 부호화되고 복호화되어야 하는 것은 아니다. 예를 들어, 블록 단위가 아닌, 슬라이스, 픽처, 시퀀스 단위와 같은 소정의 부호화 단위로 예측 부호화될 수도 있고 블록의 형태가 아닌 비정형의 다양한 영역의 형태로 예측 부호화될 수도 있다.

[95] 이상에서 전술한 바와 같이, 본 발명의 일 실시예에 따르면, 이미 부호화되고 복호화되어 복원된 주변 블록의 움직임 정보를 이용하여 블록 단위, 슬라이스 단위, 픽처 단위, 시퀀스 단위 등 소정의 부호화 단위마다 적응적으로 해당 부호화 단위에 적합한 후보 예측 움직임 벡터 집합을 선택함으로써, 부호화하고자 하는 움직임 벡터와 더욱 유사한 예측 움직임 벡터를 선택하여 차분 벡터의 크기를 줄이면서도 선택한 후보 예측 움직임 벡터 집합에 대한 정보를 부호화할 필요가 없으므로, 움직임 벡터를 부호화하는 데 소요되는 비트량을 줄일 수 있으며 그에 따라 영상의 압축 효율을 향상시킬 수 있다.

[96] 이상에서, 본 발명의 실시예를 구성하는 모든 구성 요소들이 하나로 결합하거나 결합하여 동작하는 것으로 설명되었다고 해서, 본 발명이 반드시 이러한 실시예에 한정되는 것은 아니다. 즉, 본 발명의 목적 범위 안에서라면, 그 모든 구성 요소들이 하나 이상으로 선택적으로 결합하여 동작할 수도 있다. 또한, 그 모든 구성 요소들이 각각 하나의 독립적인 하드웨어로 구현될 수 있지만, 각 구성 요소들의 그 일부 또는 전부가 선택적으로 조합되어 하나 또는 복수 개의 하드웨어에서 조합된 일부 또는 전부의 기능을 수행하는 프로그램 모듈을 갖는 컴퓨터 프로그램으로서 구현될 수도 있다. 그 컴퓨터 프로그램을 구성하는 코드들 및 코드 세그먼트들은 본 발명의 기술 분야의 당업자에 의해 용이하게 추론될 수 있을 것이다. 이러한 컴퓨터 프로그램은 컴퓨터가 읽을 수 있는 저장매체(Computer Readable Media)에 저장되어 컴퓨터에 의하여 읽혀지고 실행됨으로써, 본 발명의 실시예를 구현할 수 있다. 컴퓨터 프로그램의 저장매체로서는 자기 기록매체, 광 기록매체, 캐리어 웨이브 매체 등이 포함될 수 있다.

[97] 또한, 이상에서 기재된 "포함하다", "구성하다" 또는 "가지다" 등의 용어는, 특별히 반대되는 기재가 없는 한, 해당 구성 요소가 내재할 수 있음을 의미하는 것이므로, 다른 구성 요소를 제외하는 것이 아니라 다른 구성 요소를 더 포함할 수 있는 것으로 해석되어야 한다. 기술적이거나 과학적인 용어를 포함한 모든 용어들은, 다르게 정의되지 않는 한, 본 발명이 속하는 기술 분야에서 통상의 지식을 가진 자에 의해 일반적으로 이해되는 것과 동일한 의미가 있다. 사전에

정의된 용어와 같이 일반적으로 사용되는 용어들은 관련 기술의 문맥상의 의미와 일치하는 것으로 해석되어야 하며, 본 발명에서 명백하게 정의하지 않는 한, 이상적이거나 과도하게 형식적인 의미로 해석되지 않는다.

[98] 이상의 설명은 본 발명의 기술 사상을 예시적으로 설명한 것에 불과한 것으로서, 본 발명이 속하는 기술 분야에서 통상의 지식을 가진 자라면 본 발명의 본질적인 특성에서 벗어나지 않는 범위에서 다양한 수정 및 변형이 가능할 것이다. 따라서, 본 발명에 개시된 실시예들은 본 발명의 기술 사상을 한정하기 위한 것이 아니라 설명하기 위한 것이고, 이러한 실시예에 의하여 본 발명의 기술 사상의 범위가 한정되는 것은 아니다. 본 발명의 보호 범위는 아래의 청구범위에 의하여 해석되어야 하며, 그와 동등한 범위 내에 있는 모든 기술 사상은 본 발명의 권리범위에 포함되는 것으로 해석되어야 할 것이다.

산업상 이용가능성

[99] 이상에서 설명한 바와 같이 본 발명은 영상을 부호화하고 복호화하는 영상 압축 처리 분야에 적용되어, 효율적인 후보 예측 움직임 벡터 집합을 선택하여 움직임 벡터를 부호화함에 따라 부호화할 차분 벡터의 크기를 줄이면서도 어떠한 후보 예측 움직임 벡터 집합이 선택되었는지를 나타내기 위한 부가 정보를 부호화하지 않아도 되므로, 움직임 벡터의 압축 효율을 향상시켜 결과적으로 영상의 압축 효율을 향상시킬 수 있는 효과를 발생하는 매우 유용한 발명이다.

[100]

[101] CROSS-REFERENCE TO RELATED APPLICATION

[102] 본 특허출원은 2009년 11월 18일 한국에 출원한 특허출원번호 제 10-2009-0111302 호에 대해 미국 특허법 119(a)조(35 U.S.C § 119(a))에 따라 우선권을 주장하면, 그 모든 내용은 참고문헌으로 본 특허출원에 병합된다. 아울러, 본 특허출원은 미국 이외에 국가에 대해서도 위와 동일한 동일한 이유로 우선권을 주장하면 그 모든 내용은 참고문헌으로 본 특허출원에 병합된다.

청구범위

[청구항 1] 움직임 벡터를 부호화하는 장치에 있어서,

현재 블록의 주변 블록의 움직임 정보를 이용하여 복수 개의 후보 예측 움직임 벡터 집합 중에서 하나의 후보 예측 움직임 벡터 집합을 선택하는 후보 예측 움직임 벡터 집합 선택기;

상기 선택되는 후보 예측 움직임 벡터 집합 내의 후보 예측 움직임 벡터 중에서 하나의 후보 예측 움직임 벡터를 예측 움직임 벡터로서 선택하는 예측 움직임 벡터 선택기;

상기 현재 블록의 움직임 벡터인 현재 움직임 벡터와 상기 선택되는 예측 움직임 벡터의 차이인 차분 벡터를 부호화하는 차분 벡터 부호화기; 및

상기 선택되는 예측 움직임 벡터를 나타내는 예측 움직임 벡터 인덱스를 부호화하는 예측 움직임 벡터 부호화기

를 포함하는 것을 특징으로 하는 움직임 벡터 부호화 장치.

[청구항 2] 영상을 부호화하는 장치에 있어서,

현재 블록의 현재 움직임 벡터를 결정하고, 상기 결정되는 현재 움직임 벡터를 이용하여 상기 현재 블록을 예측 부호화하는 영상 부호화기; 및

복수 개의 후보 예측 움직임 벡터 집합 중 상기 현재 블록의 주변 블록의 움직임 정보를 기초로 선택되는 후보 예측 움직임 벡터 집합에서 예측 움직임 벡터를 선택하고, 현재 움직임 벡터와 상기 선택되는 예측 움직임 벡터의 차이인 차분 벡터 및 상기 선택되는 예측 움직임 벡터를 나타내는 예측 움직임 벡터 인덱스를 부호화하는 움직임 벡터 부호화기

를 포함하는 것을 특징으로 하는 영상 부호화 장치.

[청구항 3] 움직임 벡터를 복호화하는 장치에 있어서,

현재 블록의 주변 블록의 움직임 정보를 이용하여 복수 개의 후보 예측 움직임 벡터 집합 중에서 하나의 후보 예측 움직임 벡터 집합을 선택하는 후보 예측 움직임 벡터 집합 선택기;

움직임 벡터 데이터로부터 추출되는 인덱스 데이터를 복호화하여 예측 움직임 벡터 인덱스를 복원하고, 상기 선택되는 후보 예측 움직임 벡터 집합에서 상기 복원되는 예측 움직임 벡터 인덱스에 의해 식별되는 후보 예측 움직임 벡터를 예측 움직임 벡터로서 복원하는 예측 움직임 벡터 복원기; 및

상기 움직임 벡터 데이터로부터 추출되는 차분 벡터 데이터를 복호화하여 차분 벡터를 복원하고, 상기 복원되는 차분 벡터와 상기 복원되는 예측 움직임 벡터를 가산하여 상기 현재 블록의

현재 움직임 벡터를 복원하는 현재 움직임 벡터 복원기
를 포함하는 것을 특징으로 하는 움직임 벡터 복호화 장치.

[청구항 4] 영상을 복호화하는 장치에 있어서,
비트스트림으로부터 추출되는 움직임 벡터 데이터를 복호화하여 차분 벡터와 예측 움직임 벡터 인덱스를 복원하고, 현재 블록의 주변 블록의 움직임 정보를 이용하여 복수 개의 후보 예측 움직임 벡터 집합 중에서 하나의 후보 예측 움직임 벡터 집합을 선택하며, 상기 선택되는 후보 예측 움직임 벡터 집합에서 상기 복원되는 예측 움직임 벡터 인덱스에 의해 식별되는 후보 예측 움직임 벡터를 예측 움직임 벡터로서 선택하며, 상기 복원되는 차분 벡터와 상기 선택되는 예측 움직임 벡터를 가산하여 상기 현재 블록의 현재 움직임 벡터를 복원하는 움직임 벡터 복호화기; 및
상기 비트스트림으로부터 추출되는 영상 데이터를 상기 복원되는 현재 움직임 벡터를 이용하여 예측 복호화하여 상기 현재 블록을 복원하는 영상 복호화기
를 포함하는 것을 특징으로 하는 영상 복호화 장치.

[청구항 5] 움직임 벡터를 부호화하는 방법에 있어서,
현재 블록의 주변 블록의 움직임 정보를 이용하여 복수 개의 후보 예측 움직임 벡터 집합 중에서 하나의 후보 예측 움직임 벡터 집합을 선택하는 단계;
상기 선택되는 후보 예측 움직임 벡터 집합 내의 후보 예측 움직임 벡터 중에서 하나의 후보 예측 움직임 벡터를 예측 움직임 벡터로서 선택하는 단계;
상기 현재 블록의 움직임 벡터인 현재 움직임 벡터와 상기 선택되는 예측 움직임 벡터의 차이인 차분 벡터를 부호화하는 단계; 및
상기 선택되는 예측 움직임 벡터를 나타내는 예측 움직임 벡터 인덱스를 부호화하는 단계
를 포함하는 것을 특징으로 하는 움직임 벡터 부호화 방법.

[청구항 6] 제 5 항에 있어서,
상기 하나의 후보 예측 움직임 벡터 집합을 선택하는 단계는, 상기 주변 블록의 움직임 정보를 이용하여 카메라의 움직임 여부를 판단하고 상기 판단되는 카메라의 움직임 여부를 기초로 상기 하나의 후보 예측 움직임 벡터 집합을 선택하는 것을 특징으로 하는 움직임 벡터 부호화 방법.

[청구항 7] 제 5 항에 있어서,
상기 하나의 후보 예측 움직임 벡터 집합을 선택하는 단계는, 상기 주변 블록의 움직임 정보를 이용하여 상기 주변 블록의 객체

움직임을 판단하고, 상기 판단되는 주변 블록의 객체 움직임을 기초로 상기 하나의 후보 예측 움직임 벡터 집합을 선택하는 것을 특징으로 하는 움직임 벡터 부호화 방법.

[청구항 8] 제 7 항에 있어서,
상기 하나의 후보 예측 움직임 벡터 집합을 선택하는 단계는,
상기 주변 블록의 예측 움직임 벡터를 이용하여 상기 주변 블록의 객체 움직임을 판단하는 것을 특징으로 하는 움직임 벡터 부호화 방법.

[청구항 9] 제 5 항에 있어서,
상기 하나의 후보 예측 움직임 벡터 집합을 선택하는 단계는,
상기 주변 블록의 움직임 정보를 이용하여 상기 주변 블록의 객체 움직임을 판단하고 상기 판단되는 객체 움직임을 기초로 후보 예측 움직임 벡터를 선택하는 단계;
상기 주변 블록의 움직임 정보를 이용하여 카메라의 움직임 여부를 판단하고 상기 판단되는 카메라의 움직임 여부를 기초로 후보 예측 움직임 벡터를 선택하는 단계; 및
상기 복수 개의 후보 예측 움직임 벡터 집합 중에서 상기 객체 움직임을 기초로 선택되는 후보 예측 움직임 벡터 및 상기 카메라의 움직임 여부를 기초로 선택되는 후보 예측 움직임 벡터를 포함하는 후보 예측 움직임 벡터 집합을 상기 하나의 후보 예측 움직임 벡터 집합으로서 선택하는 단계
를 포함하는 것을 특징으로 하는 움직임 벡터 부호화 방법.

[청구항 10] 영상을 부호화하는 방법에 있어서,
현재 블록의 현재 움직임 벡터를 결정하는 단계;
상기 결정되는 현재 움직임 벡터를 이용하여 상기 현재 블록을 예측 부호화하는 단계;
복수 개의 후보 예측 움직임 벡터 집합 중 상기 현재 블록의 주변 블록의 움직임 정보를 기초로 선택되는 후보 예측 움직임 벡터 집합에서 예측 움직임 벡터를 선택하는 단계; 및
상기 현재 움직임 벡터와 상기 선택되는 예측 움직임 벡터의 차이인 차분 벡터와 상기 선택되는 예측 움직임 벡터를 나타내는 예측 움직임 벡터 인덱스를 부호화하는 단계
를 포함하는 것을 특징으로 하는 영상 부호화 방법.

[청구항 11] 움직임 벡터를 복호화하는 방법에 있어서,
움직임 벡터 데이터로부터 추출되는 차분 벡터 데이터와 인덱스 데이터를 복호화하여 차분 벡터와 예측 움직임 벡터 인덱스를 복원하는 단계;
현재 블록의 주변 블록의 움직임 정보를 이용하여 복수 개의 후보

예측 움직임 벡터 집합 중에서 하나의 후보 예측 움직임 벡터 집합을 선택하는 단계;
상기 선택되는 후보 예측 움직임 벡터 집합에서 상기 복원되는 예측 움직임 벡터 인덱스에 의해 식별되는 후보 예측 움직임 벡터를 예측 움직임 벡터로서 복원하는 단계; 및
상기 복원되는 차분 벡터와 상기 복원되는 예측 움직임 벡터를 가산하여 상기 현재 블록의 현재 움직임 벡터를 복원하는 단계
를 포함하는 것을 특징으로 하는 움직임 벡터 복호화 방법.

[청구항 12] 제 11 항에 있어서,
상기 하나의 후보 예측 움직임 벡터 집합을 선택하는 단계는,
상기 주변 블록의 움직임 정보를 이용하여 카메라의 움직임 여부를 판단하고 상기 판단되는 카메라의 움직임 여부를 기초로 상기 하나의 후보 예측 움직임 벡터 집합을 선택하는 것을 특징으로 하는 움직임 벡터 복호화 방법.

[청구항 13] 제 11 항에 있어서,
상기 하나의 후보 예측 움직임 벡터 집합을 선택하는 단계는,
상기 주변 블록의 움직임 정보를 이용하여 상기 주변 블록의 객체 움직임을 판단하고, 상기 판단되는 주변 블록의 객체 움직임을 기초로 상기 하나의 후보 예측 움직임 벡터 집합을 선택하는 것을 특징으로 하는 움직임 벡터 복호화 방법.

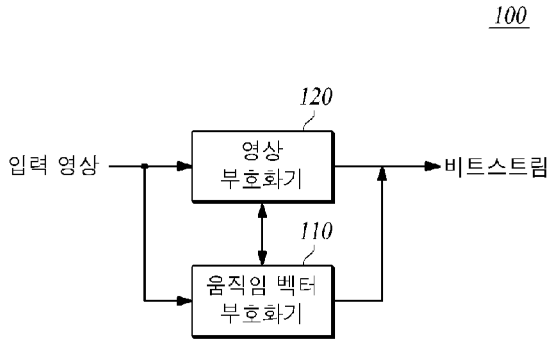
[청구항 14] 제 13 항에 있어서,
상기 하나의 후보 예측 움직임 벡터 집합을 선택하는 단계는,
상기 주변 블록의 예측 움직임 벡터를 이용하여 상기 주변 블록의 객체 움직임을 판단하는 것을 특징으로 하는 움직임 벡터 복호화 방법.

[청구항 15] 제 11 항에 있어서,
상기 하나의 후보 예측 움직임 벡터 집합을 선택하는 단계는,
상기 주변 블록의 움직임 정보를 이용하여 상기 주변 블록의 객체 움직임을 판단하고 상기 판단되는 객체 움직임을 기초로 후보 예측 움직임 벡터를 선택하는 단계;
상기 주변 블록의 움직임 정보를 이용하여 카메라의 움직임 여부를 판단하고 상기 판단되는 카메라의 움직임 여부를 기초로 후보 예측 움직임 벡터를 선택하는 단계; 및
상기 복수 개의 후보 예측 움직임 벡터 집합 중에서 상기 객체 움직임을 기초로 선택되는 후보 예측 움직임 벡터 및 상기 카메라의 움직임 여부를 기초로 선택되는 후보 예측 움직임 벡터를 포함하는 후보 예측 움직임 벡터 집합을 상기 하나의 후보 예측 움직임 벡터 집합으로서 선택하는 단계

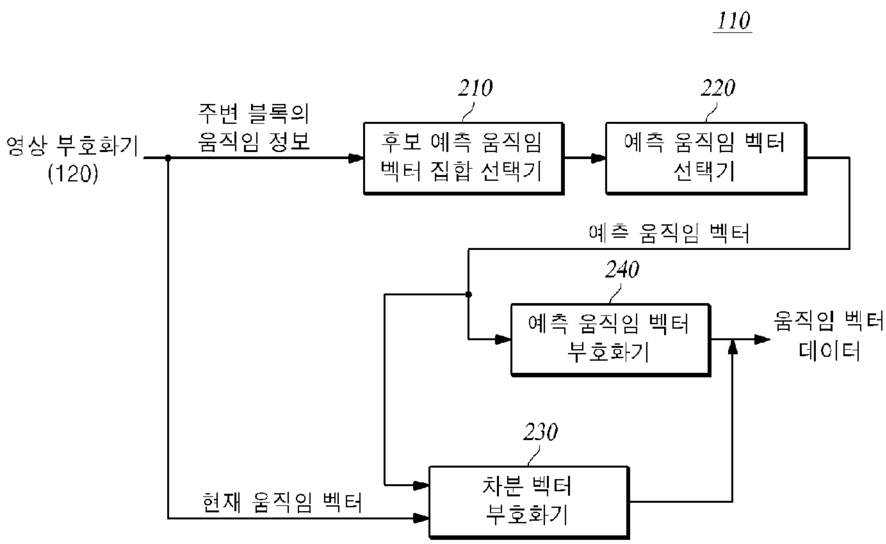
를 포함하는 것을 특징으로 하는 움직임 벡터 복호화 방법.

[청구항 16] 영상을 복호화하는 방법에 있어서,
비트스트림으로부터 추출되는 움직임 벡터 데이터를 복호화하여 차분 벡터와 예측 움직임 벡터 인덱스를 복원하는 단계;
현재 블록의 주변 블록의 움직임 정보를 이용하여 복수 개의 후보 예측 움직임 벡터 집합 중에서 하나의 후보 예측 움직임 벡터 집합을 선택하는 단계;
상기 선택되는 후보 예측 움직임 벡터 집합에서 상기 복원되는 예측 움직임 벡터 인덱스에 의해 식별되는 후보 예측 움직임 벡터를 예측 움직임 벡터로서 선택하는 단계;
상기 복원되는 차분 벡터와 상기 선택되는 예측 움직임 벡터를 가산하여 상기 현재 블록의 현재 움직임 벡터를 복원하는 단계; 및
상기 비트스트림으로부터 추출되는 영상 데이터를 상기 복원되는 현재 움직임 벡터를 이용하여 예측 복호화하여 상기 현재 블록을 복원하는 단계
를 포함하는 것을 특징으로 하는 영상 복호화 방법.

[Fig. 1]

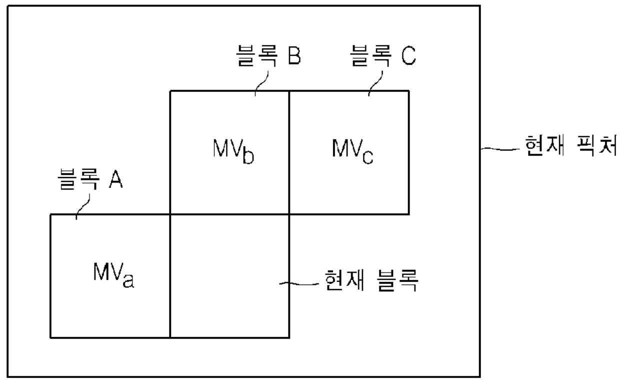

100
120
입력 영상
영상
부호화기
비트스트림
110
움직임 벡터
부호화기

[Fig. 2]

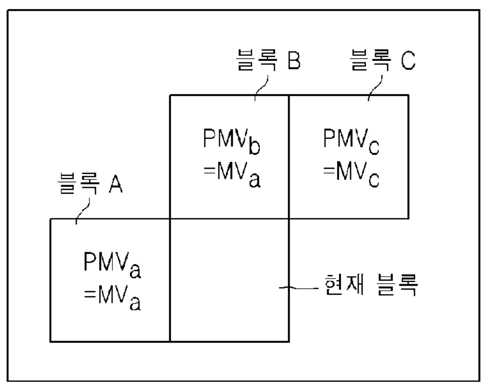

110
210
220
영상 부호화기
(120)
주변 블록의
움직임 정보
후보 예측 움직임
벡터 집합 선택기
예측 움직임 벡터
선택기
예측 움직임 벡터
240
예측 움직임 벡터
부호화기
움직임 벡터
데이터
230
차분 벡터
부호화기
현재 움직임 벡터

[Fig. 3]

3A



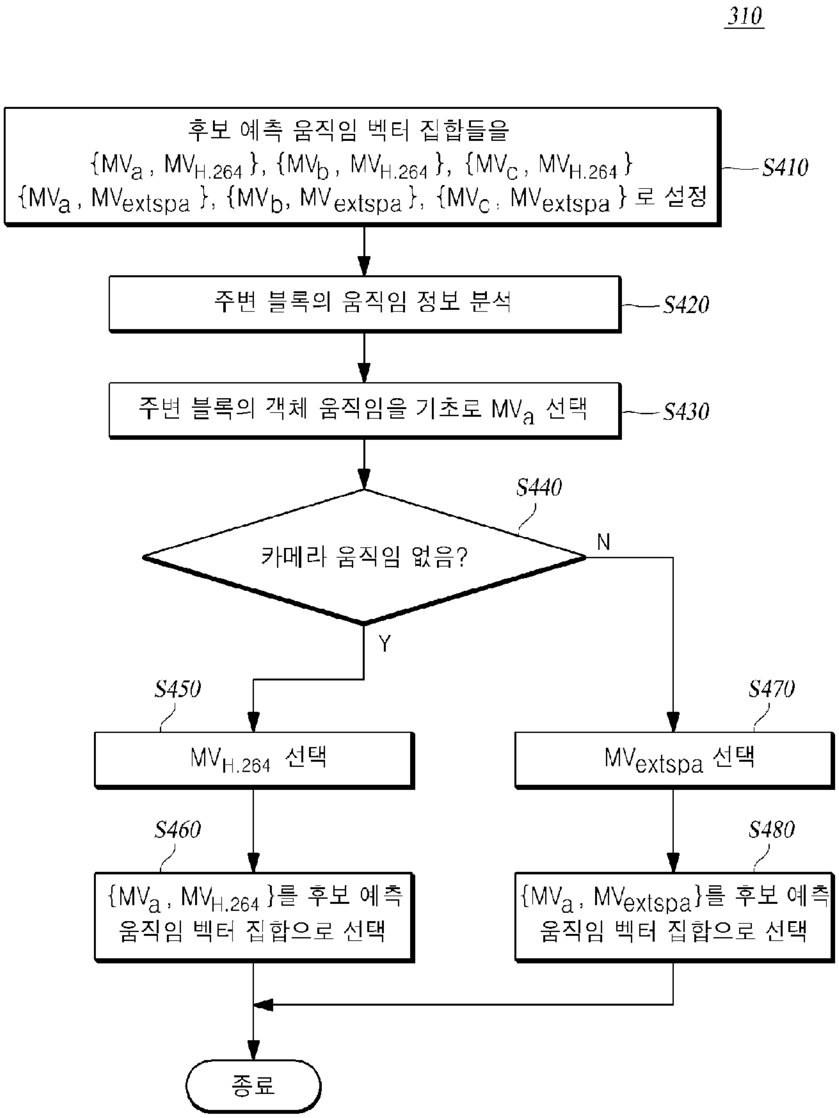
3B



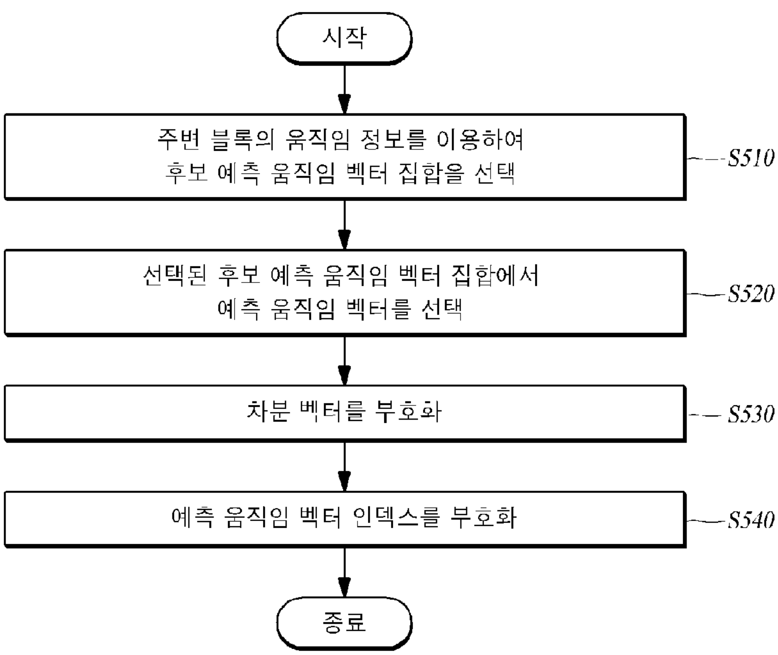
3C

주변 블록의 움직임 정보 = $\{MV_a , MV_b , MV_c , PMV_a , PMV_b , PMV_c\}$

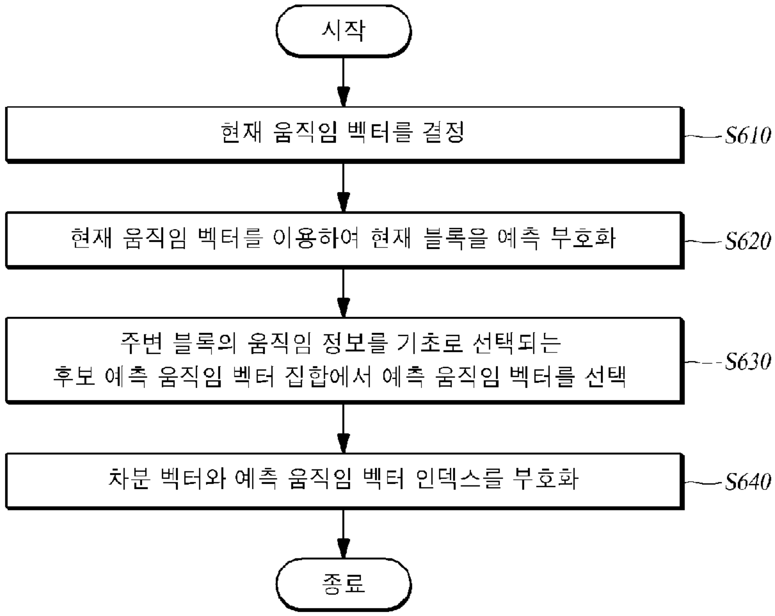
[Fig. 4]


310
후보 예측 움직임 벡터 집합들을
$\{MV_a, MV_{H.264}\}$, $\{MV_b, MV_{H.264}\}$, $\{MV_c, MV_{H.264}\}$
$\{MV_a, MV_{extspa}\}$, $\{MV_b, MV_{extspa}\}$, $\{MV_c, MV_{extspa}\}$ 로 설정
S410
주변 블록의 움직임 정보 분석
S420
주변 블록의 객체 움직임을 기초로 MV_a 선택
S430
S440
카메라 움직임 없음?
N
Y
S450
$MV_{H.264}$ 선택
S470
MV_{extspa} 선택
S460
$\{MV_a, MV_{H.264}\}$를 후보 예측 움직임 벡터 집합으로 선택
S480
$\{MV_a, MV_{extspa}\}$를 후보 예측 움직임 벡터 집합으로 선택
종료

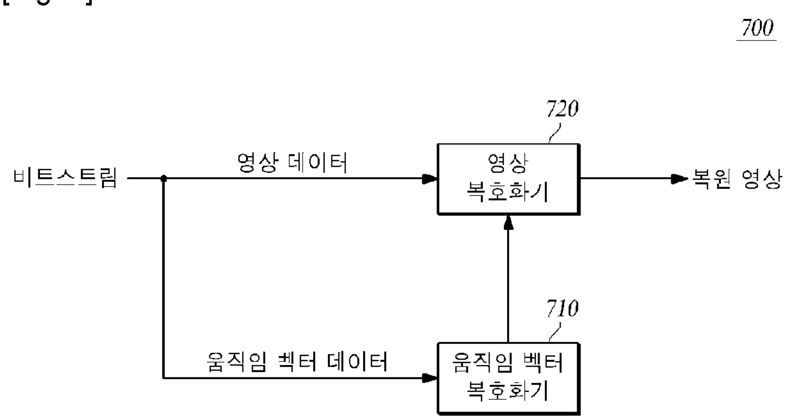
[Fig. 5]


시작
주변 블록의 움직임 정보를 이용하여 후보 예측 움직임 벡터 집합을 선택
S510
선택된 후보 예측 움직임 벡터 집합에서 예측 움직임 벡터를 선택
S520
차분 벡터를 부호화
S530
예측 움직임 벡터 인덱스를 부호화
S540
종료

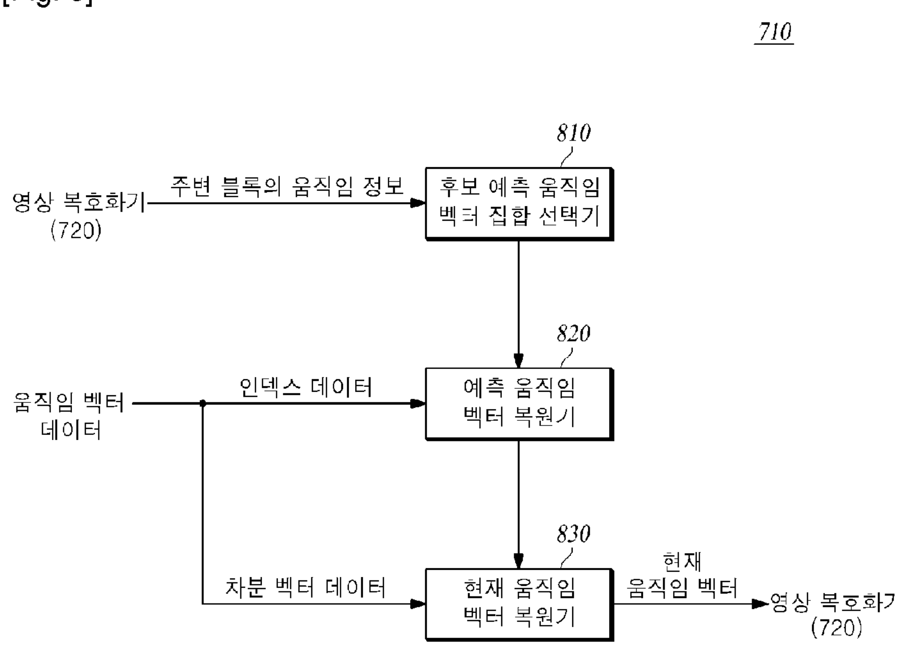
[Fig. 6]



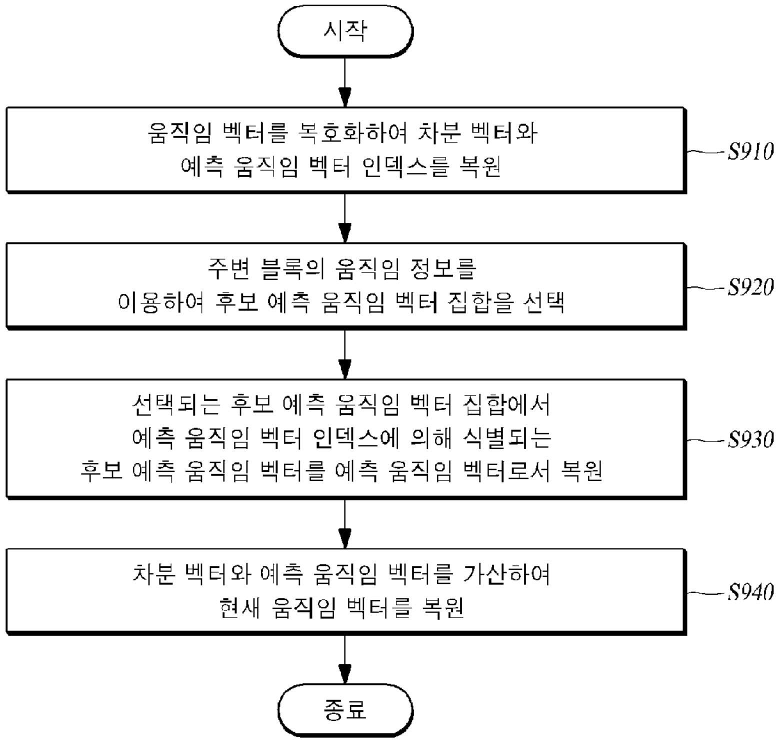
[Fig. 7]



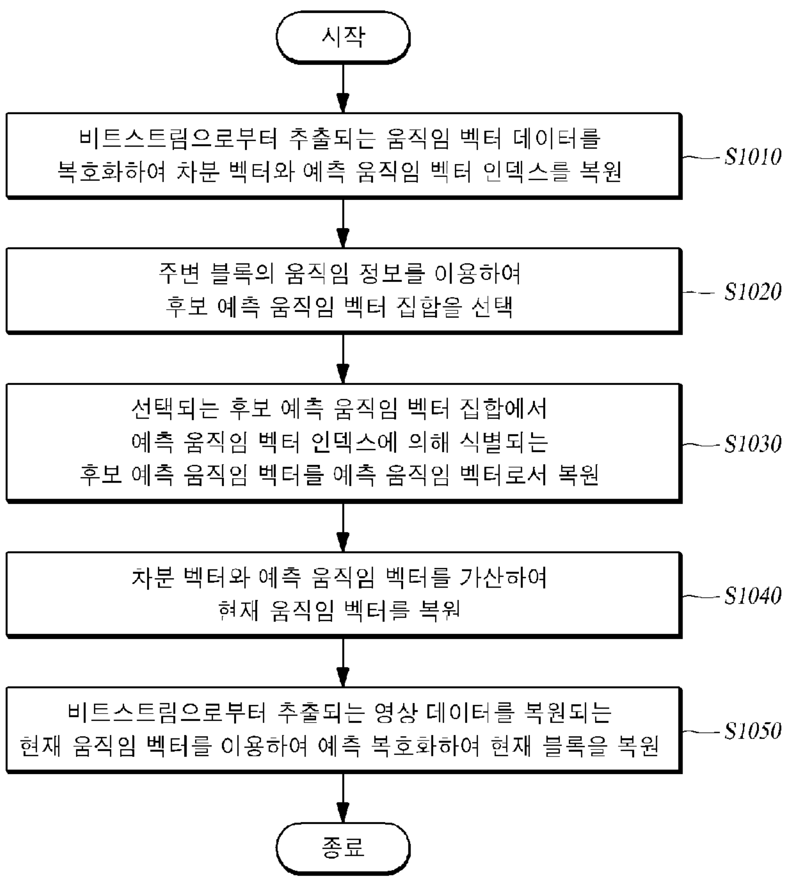
[Fig. 8]



[Fig. 9]


시작
움직임 벡터를 복호화하여 차분 벡터와
예측 움직임 벡터 인덱스를 복원
S910
주변 블록의 움직임 정보를
이용하여 후보 예측 움직임 벡터 집합을 선택
S920
선택되는 후보 예측 움직임 벡터 집합에서
예측 움직임 벡터 인덱스에 의해 식별되는
후보 예측 움직임 벡터를 예측 움직임 벡터로서 복원
S930
차분 벡터와 예측 움직임 벡터를 가산하여
현재 움직임 벡터를 복원
S940
종료

[Fig. 10]


시작
비트스트림으로부터 추출되는 움직임 벡터 데이터를
복호화하여 차분 벡터와 예측 움직임 벡터 인덱스를 복원
S1010
주변 블록의 움직임 정보를 이용하여
후보 예측 움직임 벡터 집합을 선택
S1020
선택되는 후보 예측 움직임 벡터 집합에서
예측 움직임 벡터 인덱스에 의해 식별되는
후보 예측 움직임 벡터를 예측 움직임 벡터로서 복원
S1030
차분 벡터와 예측 움직임 벡터를 가산하여
현재 움직임 벡터를 복원
S1040
비트스트림으로부터 추출되는 영상 데이터를 복원되는
현재 움직임 벡터를 이용하여 예측 복호화하여 현재 블록을 복원
S1050
종료

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**		
	Application Number	13666680
	Filing Date	2012-11-01
	First Named Inventor	Mehmet Oguz BICI
	Art Unit	2631
	Examiner Name	TBD
	Attorney Docket Number	NC77198US-NP

U.S.PATENTS

Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					

If you wish to add additional U.S. Patent citation information please click the Add button. Add

U.S.PATENT APPLICATION PUBLICATIONS

Remove

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20120307905	A1	2012-12-06	Sunyeon et al.	
	2	20110170602	A1	2011-07-14	Tammy et al.	

If you wish to add additional U.S. Published Application citation information please click the Add button. Add

FOREIGN PATENT DOCUMENTS

Remove

Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1	2011062392	WO	A2	2011-05-26	SK Telecom Co. Ltd. et al.		☐

If you wish to add additional Foreign Patent Document citation information please click the Add button Add

NON-PATENT LITERATURE DOCUMENTS

Remove

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**		
	Application Number	13666680
	Filing Date	2012-11-01
	First Named Inventor	Mehmet Oguz BICI
	Art Unit	2631
	Examiner Name	TBD
	Attorney Docket Number	NC77198US-NP

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T5
	1	International Search Report and Written Opinion received for corresponding Patent Cooperation Treaty Application No. PCT/FI2012/051070, dated March 27, 2013, 12 pages.	☐
	2	Oudin, S. et al.; "Block Merging for Quadtree-Based Video Coding", IEEE Int. Conf. on Multimedia and Expo, July 11-15, 2011, 6 pages.	☐
	3	Sullivan, G. J.; "Overview of the High Efficiency Video Coding (HEVC) Standard", IEEE Trans. on Circuits and Systems for Video Technology, Vol. 22, No. 12, December 2012, pp. 1649-1668.	☐

If you wish to add additional non-patent literature document citation information please click the Add button Add

EXAMINER SIGNATURE

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	13666680
	Filing Date	2012-11-01
	First Named Inventor	Mehmet Oguz BICI
	Art Unit	2631
	Examiner Name	TBD
	Attorney Docket Number	NC77198US-NP

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☐ Fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ None

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Thomas J. Arria/	Date (YYYY-MM-DD)	2013-04-22
Name/Print	Thomas J. Arria	Registration Number	60223

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these record s.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Acknowledgement Receipt

EFS ID:	15579218
Application Number:	13666680
International Application Number:	
Confirmation Number:	4782
Title of Invention:	METHOD FOR CODING AND AN APPARATUS
First Named Inventor/Applicant Name:	Mehmet Oguz BICI
Customer Number:	73658
Filer:	Thomas Joseph Arria/thao pham
Filer Authorized By:	Thomas Joseph Arria
Attorney Docket Number:	NC77198US-NP
Receipt Date:	22-APR-2013
Filing Date:	01-NOV-2012
Time Stamp:	15:55:51
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	77198_IDS.pdf	612036 589f3026006778cb6803b0090f6d1baa211799ae	no	4

Warnings:

Information:

2	Non Patent Literature	77198_ISR_WO.pdf	1918766 092c169f17cdb2416782db54eb72d5f1d2cefb53	no	12
Warnings:					
Information:					
3	Non Patent Literature	OUDIN.PDF	468422 315377bd759752c6fa371689a7c187886a4997a1	no	6
Warnings:					
Information:					
4	Non Patent Literature	SULLIVAN.PDF	1726067 7cc3203335537fbc186f548ac62e2b9ff5ee72f8	no	20
Warnings:					
Information:					
5	Foreign Reference	WO2011062392A2.pdf	3674943 751e69a655a915ff41fd86d434c8b5b122fa388a	no	28
Warnings:					
Information:					
			Total Files Size (in bytes):	8400234	

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

<u>New Applications Under 35 U.S.C. 111</u>
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

<u>National Stage of an International Application under 35 U.S.C. 371</u>
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

<u>New International Application Filed with the USPTO as a Receiving Office</u>
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PATENT COOPERATION TREATY

From the INTERNATIONAL SEARCHING AUTHORITY

To: Nokia Corporation IPR Department Jussi Jaatinen Keilalahdentie 4 FI- 02150 Espoo FINLAND	**PCT** NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL SEARCH REPORT AND THE WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY, OR THE DECLARATION (PCT Rule 44.1)
	Date of mailing *(day/month/year)* 27 March 2013 (27.03.2013)
Applicant's or agent's file reference NC77198WO	**FOR FURTHER ACTION** See paragraphs 1 and 4 below
International application No. PCT/FI2012/051070	International filing date *(day/month/year)* 02 November 2012 (02.11.2012)
Applicant NOKIA CORPORATION	

1. ☒ The applicant is hereby notified that the international search report and the written opinion of the International Searching Authority have been established and are transmitted herewith.

   Filing of amendments and statement under Article 19:
   The applicant is entitled, if he so wishes, to amend the claims of the international application (see Rule 46):

   When? The time limit for filing such amendments is normally two months from the date of transmittal of the international search report.

   Where? Directly to the International Bureau of WIPO, 34 chemin des Colombettes
   1211 Geneva 20, Switzerland, Facsimile No.: +41 22 338 82 70

   For more detailed instructions, see *PCT Applicant's Guide,* International Phase, paragraphs 9.004 – 9.011.

2. ☐ The applicant is hereby notified that no international search report will be established and that the declaration under Article 17(2)(a) to that effect and the written opinion of the International Searching Authority are transmitted herewith.

3. ☐ **With regard to any protest** against payment of (an) additional fee(s) under Rule 40.2, the applicant is notified that:

   ☐ the protest together with the decision thereon has been transmitted to the International Bureau together with the applicant's request to forward the texts of both the protest and the decision thereon to the designated Offices.

   ☐ no decision has been made yet on the protest; the applicant will be notified as soon as a decision is made.

4. **Reminders**

   The applicant may submit comments on an informal basis on the written opinion of the International Searching Authority to the International Bureau. The International Bureau will send a copy of such comments to all designated Offices unless an international preliminary examination report has been or is to be established. Following the expiration of 30 months from the priority date, these comments will also be made available to the public.

   Shortly after the expiration of **18 months** from the priority date, the international application will be published by the International Bureau. If the applicant wishes to avoid or postpone publication, a notice of withdrawal of the international application, or of the priority claim, must reach the International Bureau before the completion of the technical preparations for international publication (Rules 90*bis*.1 and 90*bis*.3).

   Within **19 months** from the priority date, but only in respect of some designated Offices, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase **until 30 months** from the priority date (in some Offices even later); otherwise, the applicant must, **within 20 months** from the priority date, perform the prescribed acts for entry into the national phase before those designated Offices.

   In respect of other designated Offices, the time limit of **30 months** (or later) will apply even if no demand is filed within 19 months.

   For details about the applicable time limits, Office by Office, see www.wipo.int/pct/en/texts/time_limits.html and the *PCT Applicant's Guide*, National Chapters.

Name and mailing address of the ISA/FI National Board of Patents and Registration of Finland P.O. Box 1160, FI-00101 HELSINKI, Finland Facsimile No. +358 9 6939 5328	Authorized officer Timo Laakso Telephone No. +358 9 6939 500

Form PCT/ISA/220 (July 2010)

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference NC77198WO	FOR FURTHER ACTION	see Form PCT/ISA/220 as well as, where applicable, item 5 below.
International application No. PCT/FI2012/051070	International filing date *(day/month/year)* 02 November 2012 (02.11.2012)	(Earliest) Priority Date *(day/month/year)* 04 November 2011 (04.11.2011)
Applicant NOKIA CORPORATION		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 4 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**
   a. With regard to the **language**, the international search was carried out on the basis of:
      ☒ the international application in the language in which it was filed.
      ☐ a translation of the international application into ______ which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).
   b. ☐ This international search report has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43.6*bis*(a)).
   c. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, see Box No. I.
2. ☐ **Certain claims were found unsearchable** (see Box No. II).
3. ☐ **Unity of invention is lacking** (see Box No. III).
4. With regard to the **title**,
   ☐ the text is approved as submitted by the applicant.
   ☒ the text has been established by this Authority to read as follows:
   METHOD FOR VIDEO CODING AND APPARATUS
5. With regard to the **abstract**,
   ☒ the text is approved as submitted by the applicant.
   ☐ the text has been established, according to Rule 38.2, by this Authority as it appears in Box No. IV. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.
6. With regard to the **drawings**,
   a. the figure of the **drawings** to be published with the abstract is Figure No. 6b
      ☐ as suggested by the applicant.
      ☒ as selected by this Authority, because the applicant failed to suggest a figure.
      ☐ as selected by this Authority, because this figure better characterizes the invention.
   b. ☐ none of the figures is to be published with the abstract.

Form PCT/ISA/210 (first sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI2012/051070

A. CLASSIFICATION OF SUBJECT MATTER

See extra sheet

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: G06T, H04N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

FI, SE, NO, DK

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI, Google Scholar, IEEE Xplore

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2011062392 A2 (SK TELECOM CO LTD et al.) 26 May 2011 (26.05.2011) abstract, claim 1 & US 2012307905 A1 (KIM SUNYEON et al) 6 December 2012 (06.12.2012)	1-20
A	US 2011170602 A1 (LEE TAMMY et al.) 14 July 2011 (14.07.2011) the whole document	1-20
A	OUDIN, S. et al.: "Block merging for quadtree-based video coding", IEEE Int. Conf. on Multimedia and Expo, 11-15 July 2011, 6p the whole document	1-20
T	SULLIVAN, G. J.: "Overview of the High Efficiency Video Coding (HEVC) Standard", IEEE Trans. on Circuits and Systems for Video technology, vol. 22, no. 12, Dec. 2012, pp. 1649-1668 the whole document	1-20

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
26 March 2013 (26.03.2013)	27 March 2013 (27.03.2013)

Name and mailing address of the ISA/FI	Authorized officer
National Board of Patents and Registration of Finland P.O. Box 1160, FI-00101 HELSINKI, Finland Facsimile No. +358 9 6939 5328	Timo Laakso Telephone No. +358 9 6939 500

Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/FI2012/051070

Patent document cited in search report	Publication date	Patent family members(s)	Publication date
WO 2011062392 A2	26/05/2011	US 2012307905 A1	06/12/2012
		CN 102714720 A	03/10/2012
		KR 20110054592 A	25/05/2011
US 2011170602 A1	14/07/2011	US 2013044815 A1	21/02/2013
		MX 2012008229 A	17/08/2012
		EP 2524507 A2	21/11/2012
		CN 102792697 A	21/11/2012
		US 2012155542 A1	21/06/2012
		SG 182491 A1	30/08/2012
		WO 2011087321 A2	21/07/2011
		CA 2787006 A1	21/07/2011
		AU 2011205896 A1	30/08/2012
		KR 20110083365 A	20/07/2011

International application No.
PCT/FI2012/051070

CLASSIFICATION OF SUBJECT MATTER

Int.Cl.
H04N 7/26 (2006.01)
H04N 7/50 (2006.01)
H04N 7/34 (2006.01)
G06T 9/00 (2006.01)

Form PCT/ISA/210 (extra sheet)

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To:
Nokia Corporation
IPR Department Jussi Jaatinen
Keilalahdentie 4
FI- 02150 Espoo
FINLAND

PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43*bis*.1)

Date of mailing *(day/month/year)* 27 March 2013 (27.03.2013)		
Applicant's or agent's file reference NC77198WO	**FOR FURTHER ACTION** See paragraph 2 below	
International application No. PCT/FI2012/051070	International filing date *(day/month/year)* 02 November 2012 (02.11.2012)	Priority date *(day/month/year)* 04 November 2011 (04.11.2011)
International Patent Classification (IPC) or both national classification and IPC See supplemental box		
Applicant NOKIA CORPORATION		

1. This opinion contains indications relating to the following items:

- [x] Box No. I Basis of the opinion
- [ ] Box No. II Priority
- [ ] Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- [ ] Box No. IV Lack of unity of invention
- [x] Box No. V Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step and industrial applicability; citations and explanations supporting such statement
- [ ] Box No. VI Certain documents cited
- [x] Box No. VII Certain defects in the international application
- [ ] Box No. VIII Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1*bis*(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

Name and mailing address of the ISA/FI	Date of completion of this opinion	Authorized officer
National Board of Patents and Registration of Finland P.O. Box 1160, FI-00101 HELSINKI, Finland Facsimile No. +358 9 6939 5328	26 March 2013 (26.03.2013)	Timo Laakso Telephone No. +358 9 6939 500

Form PCT/ISA/237 (cover sheet) (July 2011)

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/FI2012/051070

Box No. I Basis of this opinion

1. With regard to the **language**, this opinion has been established on the basis of:

☒ the international application in the language in which it was filed.

☐ a translation of the international application into ____________ which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).

2. ☐ This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43*bis*.1(a))

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of a sequence listing filed or furnished:

a. (means)

☐ on paper
☐ in electronic form

b. (time)

☐ in the international application as filed
☐ together with the international application in electronic form
☐ subsequently to this Authority for the purposes of search

4. ☐ In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

5. Additional comments:

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/FI2012/051070

Box No. V **Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Statement

Novelty (N)	Claims	1-20	YES
	Claims		NO
Inventive step (IS)	Claims	1-20	YES
	Claims		NO
Industrial applicability (IA)	Claims	1-20	YES
	Claims		NO

2. Citations and explanations:

2.1 Documents cited in the International Search Report

D1: WO 2011062392 A2 (SK TELECOM CO LTD et al.) 26 May 2011 (26.05.2011)
D2: US 2011170602 A1 (LEE TAMMY et al.) 14 July 2011 (14.07.2011)
D3: OUDIN, S. et al.: "Block merging for quadtree-based video coding", IEEE Int. Conf. on Multimedia and Expo, 11-15 July 2011, 6p.
D4: SULLIVAN, G. J.: "Overview of the High Efficiency Video Coding (HEVC) Standard", IEEE Trans. on Circuits and Systems for Video technology, vol. 22, no. 12, Dec. 2012, pp. 1649-1668.

It is assumed that the contents of WO2011062392 correspond to those of US2012307905 which belongs to the same patent family.

2.2 Claimed invention

As described in claim 1, the invention relates to a method for video coding, comprising:

(F1) receiving a block of pixels including a prediction unit;
(F2) determining a set of spatial motion vector prediction candidates for the block of pixels; the spatial motion vector prediction candidates being provided with motion information;
(F3) selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit;
(F4) determining a subset of spatial motion vector predictions based on the location of the block associated with the first spatial motion vector prediction candidate;
(F5) comparing motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates;
(F6) if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other, excluding the first spatial motion vector prediction candidate from the merge list.

(F1)...(F6) denote the technical features of the invention. Independent claims 9 and 15-20 define another method, two apparatuses, two storage mediums and two apparatuses with the corresponding technical features.

In addition, dependent claims 2-8 and 10-14 specify preferred embodiments of the invention.

The objective of the invention is to provide an improved arrangement for video coding for mobile communications systems.

Continued to next page

Supplemental Box

Continuation of: Box V (1 / 2)

2.3 Novelty under PCT Article 33(2)

D1 (abstract, claim 1) discloses a method of encoding a motion vector that includes: selecting one of a plurality of predicted candidate motion vector sets by using motion information of neighboring blocks of a current block; selecting one of predicted candidate motion vectors within a selected predicted candidate motion vector set, as a predicted motion vector; encoding a differential motion vector representing a difference between a current motion vector or motion vector of the current block and a selected predicted motion vector; and encoding a predicted motion vector index indicating the selected predicted motion vector. As a motion vector is encoded after selecting an efficient predicted candidate motion vector set, the size of a differential vector to be encoded can be reduced without necessarily encoding additional information to indicate which set of predicted candidate motion vectors has been selected, resulting in improved compression efficiency of motion vectors and in turn the improved video compression efficiency.

D2 introduces methods and apparatuses for encoding and decoding a motion vector. The method of encoding a motion vector includes: selecting a mode from among a first mode in which information indicating a motion vector predictor of at least one motion vector predictor is encoded and a second mode in which information indicating generation of a motion vector predictor based on pixels included in a previously encoded area adjacent to a current block is encoded; determining a motion vector predictor of the current block according to the selected mode and encoding information about the motion vector predictor of the current block; and encoding a difference vector between a motion vector of the current block and the motion vector predictor of the current block.

D3 presents an approach for block merging that removes redundancies by using a single parameter for a whole motion-compensated region of contiguous blocks. The proposed technique provides improvement over the specified H.264/AVC video coding standard and is included in the novel High Efficiency Video Coding (HEVC) standard.

D4 is a tutorial overview article of the novel HEVC video coding standard.

Documents D1-D3 represent the most relevant prior art. D4 is a later document not in conflict with the application that is cited to understand the theory underlying the invention.

2.3.1 Independent claims

Document D1 is regarded as the prior art closest to the subject matter of independent claim 1.

Document D1 (abstract, claim 1) discloses a methods for encoding a motion vector by selecting a set of predicted candidate motion vectors by using motion information of neighboring blocks of a current block. The subject matter of claim 1 differs from this in that merging of spatial motion vectors is not considered in D1 as in feature (F6) of claim 1. The subject matter of claim 1 is therefore novel. The same applies to independent claims 9 and 15-20 with the corresponding technical features.

2.3.2 Dependent claims

Because independent claims 1 and 9 are novel, also dependent claims 2-8 and 10-14 are novel.

Continued to next page

Supplemental Box

Continuation of: Box V (2 / 2)

2.4 Inventive step under PCT Article 33(3)

2.4.1 Independent claims

The solution presented in claim 1 is neither described in nor made obvious by the available prior art. Thus, claim 1 involves an inventive step. The same applies to independent claims 9 and 15-20 with the corresponding technical features.

2.4.2 Dependent claims

Because independent claims 1 and 9 involve an inventive step, also dependent claims 2-8 and 10-14 involve an inventive step.

2.5 Industrial applicability under PCT Article 33(4)

Claims 1-20 meet the requirement of industrial applicability because the claimed subject matter can be made or used in industry.

Box No. VII Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

Contrary to the requirements of PCT Rule 5.1(a)(ii), no relevant prior art is indicated in the description, nor are the documents reflecting such art identified therein.

Claims are not drafted in a two-part form in accordance with PCT Rule 6.3(b), which in the present case would be appropriate, with those features known from the prior art placed in the preamble (PCT Rule 6.3(b)(i)) and the remaining features included in the characterising part (PCT Rule 6.3(b)(ii)).

The features of the claims are not provided with reference signs placed in parentheses (PCT Rule 6.2(b)).

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/FI2012/051070

Supplemental Box

In case **the space in any of the preceding boxes is not sufficient.**

Continuation of: International Patent Classification (IPC)

Int.Cl.
H04N 7/26 (2006.01)
H04N 7/50 (2006.01)
H04N 7/34 (2006.01)
G06T 9/00 (2006.01)

Form PCT/ISA/237 (Supplemental box) (July 2011)

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
13/666,680	11/01/2012	Mehmet Oguz BICI	NC77198US-NP

CONFIRMATION NO. 4782

PUBLICATION NOTICE

OC000000061096343

73658
Nokia, Inc.
Attn: Intellectual Property Rights Docketing
200 South Mathilda Ave
Sunnyvale, CA 94086

Title:METHOD FOR CODING AND AN APPARATUS

Publication No.US-2013-0114723-A1
Publication Date:05/09/2013

NOTICE OF PUBLICATION OF APPLICATION

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

The publication may be accessed through the USPTO's publically available Searchable Databases via the Internet at www.uspto.gov. The direct link to access the publication is currently http://www.uspto.gov/patft/.

The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO's Office of Public Records. The Office of Public Records can be reached by telephone at (703) 308-9726 or (800) 972-6382, by facsimile at (703) 305-8759, by mail addressed to the United States Patent and Trademark Office, Office of Public Records, Alexandria, VA 22313-1450 or via the Internet.

In addition, information on the status of the application, including the mailing date of Office actions and the dates of receipt of correspondence filed in the Office, may also be accessed via the Internet through the Patent Electronic Business Center at www.uspto.gov using the public side of the Patent Application Information and Retrieval (PAIR) system. The direct link to access this status information is currently http://pair.uspto.gov/. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

Further assistance in electronically accessing the publication, or about PAIR, is available by calling the Patent Electronic Business Center at 1-866-217-9197.

Office of Data Managment, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

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United States Patent and Trademark Office
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Alexandria, Virginia 22313-1450
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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
13/666,680	11/01/2012	2631	2640	NC77198US-NP	20	8

CONFIRMATION NO. 4782

UPDATED FILING RECEIPT

OC000000062918875

73658
Nokia, Inc.
Attn: Intellectual Property Rights Docketing
200 South Mathilda Ave
Sunnyvale, CA 94086

Date Mailed: 08/05/2013

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Inventor(s)

Mehmet Oguz BICI, Tampere, TURKEY;
Jani LAINEMA, Tampere, FINLAND;
Kemal UGUR, Tampere, FINLAND;

Applicant(s)

Mehmet Oguz BICI, Tampere, TURKEY;
Jani LAINEMA, Tampere, FINLAND;
Kemal UGUR, Tampere, FINLAND;

Non-Applicant Assignee(s)

NOKIA CORPORATION, Espoo, FINLAND

Power of Attorney: None

Domestic Priority data as claimed by applicant

This appln claims benefit of 61/555,703 11/04/2011

Foreign Applications for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.) - None.
Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.

If Required, Foreign Filing License Granted: 11/20/2012
The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 13/666,680**
Projected Publication Date: Not Applicable
Non-Publication Request: No

Early Publication Request: No
Title

METHOD FOR CODING AND AN APPARATUS

Preliminary Class

375

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications:

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at http://www.uspto.gov/web/offices/pac/doc/general/index.html.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, http://www.stopfakes.gov. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

LICENSE FOR FOREIGN FILING UNDER

Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

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The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign AssetsControl, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

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Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
13/666,680	11/01/2012	Mehmet Oguz BICI	NC77198US-NP

CONFIRMATION NO. 4782

73658
Nokia, Inc.
Attn: Intellectual Property Rights Docketing
200 South Mathilda Ave
Sunnyvale, CA 94086

IMPROPER CFR REQUEST

OC000000062918776

Date Mailed: 08/05/2013

RESPONSE TO REQUEST FOR CORRECTED FILING RECEIPT

Power of Attorney, Claims, Fees, System Limitations, and Miscellaneous

In response to your request for a corrected Filing Receipt, the Office is unable to comply with your request because:

- Any request to correct or update the name of the applicant must include an application data sheet (ADS) in compliance with 37 CFR 1.76 specifying the correct or updated name of the applicant in the applicant information section. Any request to change the applicant after an original applicant has been specified under 37 CFR 1.46(b) must include a new ADS in compliance with 37 CFR 1.76 specifying the applicant in the applicant information section and comply with 37 CFR 3.71 and 3.73. See 37 CFR 1.46(c).

/zretta/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
13/666,680	11/01/2012	Mehmet Oguz BICI	NC77198US-NP

CONFIRMATION NO. 4782

IMPROPER CPOA LETTER

73658
Nokia, Inc.
Attn: Intellectual Property Rights Docketing
200 South Mathilda Ave
Sunnyvale, CA 94086

OC000000062918749

Date Mailed: 08/05/2013

NOTICE REGARDING POWER OF ATTORNEY

This is in response to the power of attorney filed 01/02/2013. The power of attorney in this application is not accepted for the reason(s) listed below:

- The power of attorney has not been accepted because the party who is giving power of attorney has not been identified. Power of attorney may only be signed by the applicant for patent (37 CFR 1.42) or the patent owner. A patent owner who was not the applicant must appoint any power of attorney in compliance with 37 CFR 3.71 and 3.73. See 37 CFR 1.32(b)(4).

/zretta/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 13/666,680

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED		(Column 2) NUMBER EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY FEE($)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A		N/A	N/A			N/A	280
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A		N/A	N/A			N/A	600
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A		N/A	N/A			N/A	720
TOTAL CLAIMS (37 CFR 1.16(i))	20	minus 20 =	*			OR	x 80 =	0.00
INDEPENDENT CLAIMS (37 CFR 1.16(h))	8	minus 3 =	* 5				x 420 =	2100
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).							0.00
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))								0.00
* If the difference in column 1 is less than zero, enter "0" in column 2.				TOTAL			TOTAL	3700

APPLICATION AS AMENDED - PART II

AMENDMENT A		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

AMENDMENT B		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE($)	ADDITIONAL FEE($)	OR	RATE($)	ADDITIONAL FEE($)
	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.

PLUS Search Results for S/N 13666680, Searched Tue May 26 15:06:59 EDT 2015

The Patent Linguistics Utility System (PLUS) is a USPTO automated search system for U.S. Patents from 1971 to the present PLUS is a query-by-example search system which produces a list of patents that are most closely related linguistically to the application searched. This search was prepared by the staff of the Scientific and Technical Information Center, SIRA.

5719627 99
5815602 99
4989089 99
5428403 99
5781249 99
5838391 99
4851906 98
4989087 98
5235419 98
5371549 98
5414469 98
5457481 98
5506622 98
5521642 98
5532746 98
5546129 98
5557341 98
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5862261 98
5903672 98
5991447 98
6005980 98
6020925 98
6023298 98
6026195 98
6057884 98
6091777 98
6154519 98
6205177 98

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**		
	Application Number	13666680
	Filing Date	2012-11-01
	First Named Inventor	Mehmet Oguz BICI
	Art Unit	2631
	Examiner Name	TBD
	Attorney Docket Number	NC77198US-NP

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	1	20120307905	A1	2012-12-06	Sunyeon et al.	
	2	20110170602	A1	2011-07-14	Tammy et al.	

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	1	2011062392	WO	A2	2011-05-26	SK Telecom Co. Ltd. et al.		☐

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**	Application Number		13666680
	Filing Date		2012-11-01
	First Named Inventor	Mehmet Oguz BICI	
	Art Unit		2631
	Examiner Name	TBD	
	Attorney Docket Number		NC77198US-NP

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
	1	International Search Report and Written Opinion received for corresponding Patent Cooperation Treaty Application No. PCT/FI2012/051070, dated March 27, 2013, 12 pages.	☐
	2	Oudin, S. et al.; "Block Merging for Quadtree-Based Video Coding", IEEE Int. Conf. on Multimedia and Expo, July 11-15, 2011, 6 pages.	☐
	3	Sullivan, G. J.; "Overview of the High Efficiency Video Coding (HEVC) Standard", IEEE Trans. on Circuits and Systems for Video Technology, Vol. 22, No. 12, December 2012, pp. 1649-1668.	☐

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EXAMINER SIGNATURE

Examiner Signature	/CLIFFORD HILAIRE/	Date Considered	06/24/2015

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**	Application Number	13666680
	Filing Date	2012-11-01
	First Named Inventor	Mehmet Oguz BICI
	Art Unit	2631
	Examiner Name	TBD
	Attorney Docket Number	NC77198US-NP

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☐ Fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ None

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Thomas J. Arria/	Date (YYYY-MM-DD)	2013-04-22
Name/Print	Thomas J. Arria	Registration Number	60223

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Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these record s.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

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Notice of References Cited	Application/Control No. 13/666,680	Applicant(s)/Patent Under Reexamination BICI ET AL.	
	Examiner CLIFFORD HILAIRE	Art Unit 2488	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
	A	US-			
	B	US-			
	C	US-			
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	Han, Woo-Jin, et al. "Improved video compression efficiency through flexible unit representation and corresponding extension of coding tools." Circuits and Systems for Video Technology, IEEE Transactions on 20.12 (2010): 1709-1720.
	V	Tai, Shen-Chuan, et al. "A multi-pass true motion estimation scheme with motion vector propagation for frame rate up-conversion applications." Journal of display technology 4.2 (2008): 188-197.
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

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CONFIRMATION NO. 4782

SERIAL NUMBER	FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
13/666,680	11/01/2012 RULE	375	2488	NC77198US-NP

APPLICANTS

INVENTORS

Mehmet Oguz BICI, Tampere, TURKEY;
Jani LAINEMA, Tampere, FINLAND;
Kemal UGUR, Tampere, FINLAND;

** **CONTINUING DATA** *************************

This appln claims benefit of 61/555,703 11/04/2011

** **FOREIGN APPLICATIONS** *************************

** **IF REQUIRED, FOREIGN FILING LICENSE GRANTED** **

11/20/2012

		STATE OR COUNTRY	SHEETS DRAWINGS	TOTAL CLAIMS	INDEPENDENT CLAIMS
Foreign Priority claimed ☐ Yes ☑ No 35 USC 119(a-d) conditions met ☐ Yes ☑ No Verified and Acknowledged /CLIFFORD HILAIRE/ Examiner's Signature	☐ Met after Allowance Initials	TURKEY	13	20	8

ADDRESS

Nokia USA Inc.
Attn: Intellectual Property Rights Docketing
200 South Mathilda Ave
Sunnyvale, CA 94086
UNITED STATES

TITLE

METHOD FOR CODING AND AN APPARATUS

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2640	FEES: Authority has been given in Paper No.____________ to charge/credit DEPOSIT ACCOUNT No.____________ for following:	☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other ________________ ☐ Credit

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/666,680	11/01/2012	Mehmet Oguz BICI	NC77198US-NP	4782

73658 7590 07/06/2015
Nokia USA Inc.
Attn: Intellectual Property Rights Docketing
200 South Mathilda Ave
Sunnyvale, CA 94086

EXAMINER	
HILAIRE, CLIFFORD	

ART UNIT	PAPER NUMBER
2488	

NOTIFICATION DATE	DELIVERY MODE
07/06/2015	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

thao.pham@nokia.com
sandy.fong-hou@nokia.com
jacqueline.linebarger@nokia.com

PTOL-90A (Rev. 04/07)

Office Action Summary	**Application No.** 13/666,680	**Applicant(s)** BICI ET AL.	
	Examiner CLIFFORD HILAIRE	**Art Unit** 2488	**AIA (First Inventor to File) Status** No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *11/01/2012*.
☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

5)☒ Claim(s) *1-20* is/are pending in the application.
5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6)☐ Claim(s) _____ is/are allowed.

7)☒ Claim(s) *1-20* is/are rejected.

8)☐ Claim(s) _____ is/are objected to.

9)☐ Claim(s) _____ are subject to restriction and/or election requirement.

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a)☐ All b)☐ Some** c)☐ None of the:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☒ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b)
Paper No(s)/Mail Date *04/22/2013*.

3) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ .

4) ☐ Other: _____.

DETAILED ACTION

Notice of Pre-AIA or AIA Status

1. The present application is being examined under the pre-AIA first to invent provisions.

Claim Rejections - 35 USC § 112

The following is a quotation of 35 U.S.C. 112(b):

(b) CONCLUSION.—The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the inventor or a joint inventor regards as the invention.

The following is a quotation of 35 U.S.C. 112 (pre-AIA), second paragraph:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claims 1, 6, 9, 13, 15, 16, 17, 18, 19 and 20 are rejected under 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA), second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventor or a joint inventor, or for pre-AIA the applicant regards as the invention.

3. Claim 6 and 13 recite the limitation "*the maximum number*" in the first limitation of both claims. There is insufficient antecedent basis for this limitation in the claim.

4. Claim 1, 9, 15, 16, 17, 18, 19 and 20 recite the limitation "*the determined subset of spatial motion vector prediction candidates*" in the next to last limitation of each claims *(i.e. "comparing motion information…" for claims 1,9,15,17,18; "compare motion*

information…" for claim 16 and "means for comparing motion information…" for claims 19 and 20). There is insufficient antecedent basis for this limitation in the claim. For examining purposes, it will be assumed the limitation "*the determined subset of spatial motion vector prediction candidates*" is obtain from the limitation above it *(i.e. "determining a subset of spatial motion vector* ***prediction candidates"*** *instead of "determining a subset of spatial motion vector* ***predictions")***.

Claim Rejections - 35 USC § 101

35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

35 U.S.C. 101 requires that a claimed invention must fall within one of the four eligible categories of invention (i.e. process, machine, manufacture, or composition of matter) *and* must not be directed to subject matter encompassing a judicially recognized exception as interpreted by the courts. MPEP 2106. The four eligible categories of invention include: (1) process which is an act, or a series of acts or steps, (2) machine which is an concrete thing, consisting of parts, or of certain devices and combination of devices, (3) manufacture which is an article produced from raw or prepared materials by giving to these materials new forms, qualities, properties, or combinations, whether by hand labor or by machinery, and (4) composition of matter which is all compositions of two or more substances and all composite articles, whether they be the results of

chemical union, or of mechanical mixture, or whether they be gases, fluids, powders or solids. MPEP 2106(I).

5. Claims 17 and 18 are rejected under 35 U.S.C. 101 as not falling within one of the four statutory categories of invention because the broadest reasonable interpretation of the instant claims in light of the specification encompasses transitory signals. But, transitory signals are not within one of the four statutory categories (i.e. non-statutory subject matter). *See* MPEP 2106(I). However, claims directed toward a non-transitory computer readable medium may qualify as a manufacture and make the claim patent-eligible subject matter. MPEP 2106(I). Therefore, amending the claims to recite a "*non-transitory computer-readable medium*" would resolve this issue.

Claim Rejections - 35 USC § 103

The following is a quotation of pre-AIA 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. Claims 1, 2, 3, 4, 5, 6, 7, 9 10, 11, 12, 14, 15, 16, 17. 18, 19 and 20 rejected under pre-AIA 35 U.S.C. 103 (a) as being unpatentable over Woo-Jin Han et al.

["Improved Video Compression Efficiency Through Flexible Unit Representation and Corresponding Extension of Coding Tools"] in view of Shen-Chuan Tai et al.*["A Multi-Pass True Motion Estimation Scheme With Motion Vector Propagation for Frame Rate Up-Conversion Applications"].*

Regarding claim 1, Han teaches

1. A method comprising *(i.e. a novel video compression scheme based on a highly flexible hierarchy of unit representation which includes three block concepts: coding unit (CU), prediction unit (PU), and transform unit (TU) - Abstract)*:

receiving a block of pixels including a prediction unit *(i.e. Fig. 1 shows all proposed building blocks of the decoder. All the coding tools are extended to support the proposed flexible architecture. Intra prediction is extended to support an arbitrary number of angles rather than the conventional 9-modes defined in H.264/AVC. Fast integer transforms larger than 8 × 8 are developed to support large TU sizes. Edge definition for the deblocking filter is modified according to the CU, PU, and TU concepts. Partition information in quadtreebased adaptive loop filter (QALF) [13] is replaced with CU splitting information- page 1710, ¶ 3)*;

However, Han does not teach explicitly:

determining a set of spatial motion vector prediction candidates for the block of pixels;

the spatial motion vector prediction candidates being provided with motion information;

selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit;

determining a subset of spatial motion vector predictions based on the location of the block associated with the first spatial motion vector prediction candidate;

comparing motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates;

if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other, excluding the first spatial motion vector prediction candidate from the merge list.

In the same field of endeavor, Tai teaches:

determining a set *(i.e. $CS^i(\vec{X},t)$)* of spatial motion vector prediction candidates for the block of pixels *(i.e. The MV search in block in the ith pass is performed in accordance with (1). As shown, the search is confined to the vectors defined in the candidate vector set $CS^i(\vec{X},t)$), i.e., a full search is not performed- Page 189, Col 2, ¶ 3)*;

the spatial motion vector prediction candidates being provided with motion information *(i.e. The basic principle of the multi-pass ME strategy proposed in* *this study is to utilize the motion information relating to neighboring blocks generated in the previous pass to gradually refine the accuracy of the MV in the current block- Page 189, Col 2, ¶ 3)*;

selecting a first spatial motion vector prediction *(i.e.* $CS^i(\vec{X},t) = \{\vec{V}|\vec{V} = \overrightarrow{PMV}^i(\vec{X}) + \vec{U}, \vec{U} \in US^i\}$*- equation 2)* candidate *(i.e.*$\overrightarrow{PMV}^i(\vec{X})$*, predictive motion vectors (PMVs)- Page 190, Col 1, ¶ 2)* from the set of spatial motion vector prediction candidates *(i.e.* $\overrightarrow{PMV}^i(\vec{X})$*, is the PMV of block and is chosen from the MVs of the neighboring blocks and is a set of update vectors- Page 190, Col 1, ¶ 2)* as a potential spatial motion vector prediction candidate to be included in a merge list for the *(i.e. current block)* prediction unit *(i.e. Although the MVs of all eight neighboring blocks can theoretically be used as PMV predictors for the current block- Page 190, Col 1, ¶ 3)*;

determining a subset *(i.e.* $CS^i(\vec{X},t) = \{\vec{V}|\vec{V} = \overrightarrow{PMV}^i(\vec{X}) + \vec{U}, \vec{U} \in US^i\}$*- Equation 2)* of spatial motion vector predictions based on the location of the block associated with the first spatial motion vector prediction candidate *(i.e. by selecting one of the* $\overrightarrow{PMV}$ *from MVs of neighboring blocks, a subset of* $CS^i(\vec{X},t)$ *is defined for different linear combination of that PMV and* $\vec{U} \in US^i$*)*;

comparing motion information of the first spatial motion vector prediction candidate *(i.e.* $\overrightarrow{MV}^i(\vec{X},t) = arg_{\vec{V}\in CS^i(\vec{X},t)} \min\left(e(\vec{V},\vec{X},t)\right), 1 \le i \le 12;$ *equation 1)* with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates *(i.e. Each pass* *in the proposed ME scheme is performed using one of the PMV predictor patterns (see Fig. 3) and then one MVin the selected PMV pattern which has minimal distortion is selected as the final PMV of this pass- Page 190; Col 1, ¶ 5)*; if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other *(i.e. all MV's with non-minimal distortion as inferred above)*, excluding the first spatial motion vector prediction candidate from the merge list *(i.e. all MV's with non-minimal distortion as inferred above will not be a final PMV for that pass)*.

It would have been obvious to one with ordinary skill in the art at the time of invention, to modify the teachings of Han with the teachings of Tai to use the geometric relationship proposed in [2] describing the correlation between the current block position and the motion edge to reduce the number of PMV predictors to be evaluated *(Tai- Page 190, Col 1, ¶ 4)*.

Regarding claim 2, Han and Tai teach all the limitatrions of claim 1. Han further teaches:

comprising selecting spatial motion vector prediction candidates from the set of spatial motion vector prediction candidates as the potential spatial motion vector prediction candidate in a predetermined order *(i.e. comprising selecting spatial motion vector prediction candidates from the set of spatial motion vector prediction candidates as the potential spatial motion vector prediction candidate in a predetermined order- page 1712, Col 2, ¶ 4)*.

Regarding claim 3, Han and Tai teach all the limitations of claim 1.

However, Han does not teach:

comprising comparing motion information of the potential spatial motion vector prediction candidate with motion information of at most one other spatial motion vector prediction candidate of the set of spatial motion vector prediction candidates.

In the same field of endeavor, Tai teaches:

comprising comparing motion information of the potential spatial motion vector prediction candidate *(i.e.* $\overrightarrow{MV}^i(\overrightarrow{X}, t) = arg_{\vec{V} \in CS^i(\vec{X},t)} \min\left(e(\vec{V}, \vec{X}, t)\right), 1 \leq i \leq 12;$ *equation 1)*with motion information of at most one other spatial motion vector prediction candidate of the set of spatial motion vector prediction candidates *(i.e. Each pass in the proposed ME scheme is performed using one of the PMV predictor patterns (see Fig. 3) and then one MVin the selected PMV pattern which has minimal distortion is selected as the final PMV of this pass- Page 190; Col 1, ¶ 5).*

Regarding claim 4, Han and Tai teach all the limitations of claim 1. Han further teaches:

comprising examining whether the received block of pixels is divided into a first prediction unit and a second prediction unit *(i.e. tu size flag is equal to one)*; and if so, excluding the potential spatial motion vector prediction candidate from the merge list *(i.e. the transform may be applied to the residue generated by multiple PU partitions with different motion vectors or prediction methods)* if the prediction unit is the second prediction unit *(i.e. When the tu size flag is equal to zero, the TU size is set equal to that of the CU which it belongs to. When tu size flag is equal to one, the TU size is set as N × N for symmetric PU splitting's and N/2 × N/2 for asymmetric PU splitting's, respectively. This ensures that the transform which is not applied across motion boundaries can be tested in the rate-distortion optimization process for asymmetric PU partitions. It should be noted that the transform may be applied to the residue generated by multiple PU partitions with different motion vectors or prediction methods- Page 1711, ¶ 4-5)*

Regarding claim 5, Han and Tai teach all the limitations of claim 1. Han further teaches:

further comprising determining a maximum number *(i.e. N)* of spatial motion vector prediction candidates to be included in a merge *(i.e. A')* list *(i.e. Fig. 3 shows the spatially adjacent motion vectors which can be considered the candidate for the prediction. Let* $A = \{\mathbf{a}_0, \mathbf{a}_1, \ldots, \mathbf{a}_N\}$, $A' \subset A$, *and* $I_{A'}$ *denote the set of motion vectors above the current PU, the set of the available motion vectors in A, and the set which includes the indices of the elements in A' respectively- page 1712, col 2, ¶ 3)*; and

limiting the number *(i.e.* $A' \subset A$*)* of spatial motion vector prediction candidates in the merge list smaller or equal to the maximum number *(i.e. The set of the* *available motion vectors, A', is derived from A by verifying whether the corresponding reference index is the same as that of the current PU partition- page 1712, col 2, ¶ 3).*

Regarding claim 7, Han and Tai teach all the limitations of claim 1. Han further teaches:

further comprising including a temporal motion prediction candidate into the merge list *(i.e. This paper proposes the AMVP method, which is adapted to the proposed flexible unit representation. It allows the selection of the best predictor from the set which consists of three spatially adjacent motion vectors, their median, and a temporal motion vector- Page 1712, Col 2, ¶ 2).*

Regarding claim 8, Han and Tai teach all the limitations of claim 1. Han further teaches:

comprising selecting one motion vector prediction candidate *(i.e. the best predictor is selected)* from the merge list to represent a motion vector prediction for the block of pixels*(i.e. the best predictor is selected from a given set through rate-distortion optimization- Page 1712, Col 2, ¶ 1).*

Regarding claim 9, Han teaches

1. A method comprising *(i.e. a novel video compression scheme based on a highly flexible hierarchy of unit representation which includes three block*

concepts: coding unit (CU), prediction unit (PU), and transform unit (TU)-Abstract):

receiving a encoded block of pixels including a prediction unit *(i.e. Fig. 1 shows all proposed building blocks of the decoder. All the coding tools are extended to support the proposed flexible architecture. Intra prediction is extended to support an arbitrary number of angles rather than the conventional 9-modes defined in H.264/AVC. Fast integer transforms larger than 8 × 8 are developed to support large TU sizes. Edge definition for the deblocking filter is modified according to the CU, PU, and TU concepts. Partition information in quadtreebased adaptive loop filter (QALF) [13] is replaced with CU splitting information- page 1710, ¶ 3)*;

However, Lin does not teach explicitly:

determining a set of spatial motion vector prediction candidates for the encoded block of pixels;

the spatial motion vector prediction candidates being provided with motion information;

selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit;

determining a subset of spatial motion vector predictions based on the location of the block associated with the first spatial motion vector prediction candidate;

comparing motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates;

if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other, excluding the first spatial motion vector prediction candidate from the merge list.

In the same field of endeavor, Tai teaches:

determining a set *(i.e.* $CS^i(\vec{X},t)$*)* of spatial motion vector prediction candidates for the encoded block of pixels *(i.e. The MV search in block in the ith pass is performed in accordance with (1). As shown, the search is confined to the vectors defined in the candidate vector set* $CS^i(\vec{X},t)$*), i.e., a full search is not performed- Page 189, Col 2, ¶ 3)*;

the spatial motion vector prediction candidates being provided with motion information *(i.e. The basic principle of the multi-pass ME strategy proposed in this study is to utilize the motion information relating to neighboring blocks generated in the previous pass to gradually refine the accuracy of the MV in the current block- Page 189, Col 2, ¶ 3)*;

selecting a first spatial motion vector prediction *(i.e.* $CS^i(\vec{X},t) = \{\vec{V}|\vec{V} = \overrightarrow{PMV}^i(\vec{X}) + \vec{U}, \vec{U} \in US^i\}$*- equation 2)* candidate *(i.e.*$\overrightarrow{PMV}^i(\vec{X})$*, predictive motion vectors (PMVs)- Page 190, Col 1, ¶ 2)* from the set of spatial motion vector prediction candidates *(i.e.* $\overrightarrow{PMV}^i(\vec{X})$*, is the PMV of block and is chosen from the MVs of the neighboring blocks and is a set of update vectors- Page 190, Col 1, ¶ 2)* as a potential spatial motion vector prediction candidate to be included in a merge list for the *(i.e. current block)* prediction unit *(i.e. Although the MVs of all eight neighboring blocks can theoretically be used as PMV predictors for the current block- Page 190, Col 1, ¶ 3)*;

determining a subset *(i.e.* $CS^i(\vec{X},t) = \{\vec{V}|\vec{V} = \overrightarrow{PMV}^i(\vec{X}) + \vec{U}, \vec{U} \in US^i\}$*- equation 2)* of spatial motion vector predictions based on the location of the block associated with the first spatial motion vector prediction candidate *(i.e. by selecting one of the* $\overrightarrow{PMV}$ *from MVs of neighboring blocks, a subset of* $CS^i(\vec{X},t)$ *is defined for different linear combination of that PMV and* $\vec{U} \in US^i$*)*;

comparing motion information of the first spatial motion vector prediction candidate *(i.e.* $\overrightarrow{MV}^i(\vec{X},t) = arg_{\vec{V}\in CS^i(\vec{X},t)} \min\left(e(\vec{V},\vec{X},t)\right), 1 \le i \le 12;$ *equation 1)* with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates *(i.e. Each pass in the proposed ME scheme is performed using one of the PMV predictor patterns (see Fig. 3) and then one MVin the selected PMV pattern which has minimal distortion is selected as the final PMV of this pass- Page 190; Col 1, ¶ 5)*;

if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other *(i.e. all MV's with non-minimal distortion as inferred above)*, excluding the first spatial motion vector prediction candidate from the merge list *(i.e. all MV's with non-minimal distortion as inferred above will not be a final PMV for that pass)*.

Regarding claim 10, Han and Tai teach all the limitations of claim 9.

However, Han does not teach:

comprising comparing motion information of the potential spatial motion vector prediction candidate with motion information of at most one other spatial motion vector prediction candidate of the set of spatial motion vector prediction candidates.

In the same field of endeavor, Tai teaches:

comprising comparing motion information of the potential spatial motion vector prediction candidate *(i.e.* $\overrightarrow{MV}^i(\vec{X},t) = arg_{\vec{V}\in CS^i(\vec{X},t)} \min\left(e(\vec{V},\vec{X},t)\right), 1 \leq i \leq 12$*; equation 1)*with motion information of at most one other spatial motion vector prediction candidate of the set of spatial motion vector prediction candidates *(i.e. Each pass in the proposed ME scheme is performed using one of the PMV predictor patterns (see Fig. 3) and then one MVin the selected PMV pattern which has minimal distortion is selected as the final PMV of this pass- Page 190; Col 1, ¶ 5).*

Regarding claim 11, Han and Tai teach all the limitations of claim 9. Han further teaches:

comprising examining whether the received encoded block of pixels is divided into a first prediction unit and a second prediction unit *(i.e. tu size flag is equal to one)*; and if so, excluding the potential spatial motion vector prediction candidate from the merge list *(i.e. the transform may be applied to the residue generated by multiple PU partitions with different motion vectors or prediction methods)* if the prediction unit is the second prediction unit *(i.e. When the tu size flag is equal to zero, the TU size is set equal to that of the CU which it belongs to. When tu size flag is equal to one, the TU size is set as N × N for symmetric PU splitting's and N/2 × N/2 for asymmetric PU splitting's, respectively. This ensures that the transform which is not applied across motion boundaries can be tested in the rate-distortion optimization process for asymmetric PU partitions. It should be noted that the transform may be applied to the residue generated by multiple PU partitions with different motion vectors or prediction methods- Page 1711, ¶ 4-5)*

Regarding claim 12, Han and Tai teach all the limitations of claim 9. Han further teaches:

further comprising determining a maximum number *(i.e. N)* of spatial motion vector prediction candidates to be included in a merge *(i.e. A')* list *(i.e. Fig. 3 shows the spatially adjacent motion vectors which can be considered the candidate for the prediction. Let* $A = \{\mathbf{a}_0, \mathbf{a}_1, \ldots, \mathbf{a}_N\}$, $A' \subset A$, *and* $I_{A'}$ *denote the set of motion vectors above the current PU, the set of the available motion vectors in A, and the set which includes the indices of the elements in A' respectively- page 1712, col 2, ¶ 3)*; and

limiting the number *(i.e.* $A' \subset A$*)* of spatial motion vector prediction candidates in the merge list smaller or equal to the maximum number *(i.e. The set of the available motion vectors, A', is derived from A by verifying whether the* *corresponding reference index is the same as that of the current PU partition- page 1712, col 2, ¶ 3).*

Regarding claim 14, Han and Tai teach all the limitations of claim 9. Han further teaches:

comprising selecting one motion vector prediction candidate *(i.e. the best predictor is selected)* from the merge list to represent a motion vector prediction for the received encoded block of pixels*(i.e. the best predictor is selected from a given set through rate-distortion optimization- Page 1712, Col 2, ¶ 1).*

Regarding claim 15 and 19, apparatus claim 15 and 19 is drawn to the apparatus using/performing the same method as claimed in claim 1. Therefore apparatus claim 15 and 19 corresponds to method claim 1, and is rejected for the same reasons of obviousness as used above.

Regarding claim 16 and 20, apparatus claim 16 and 20 is drawn to the apparatus using/performing the same method as claimed in claim 9. Therefore apparatus claim 16 and 20 corresponds to method claim 9, and is rejected for the same reasons of obviousness as used above.

Regarding claim 17, computer-readable medium storing instructions claim 17 corresponds to the same method as claimed in claim 1, and therefore is also rejected for the same reasons of obviousness as listed above.

Regarding claim 18, computer-readable medium storing instructions claim 50 corresponds to the same method as claimed in claim 9, and therefore is also rejected for the same reasons of obviousness as listed above.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to CLIFFORD HILAIRE whose telephone number is (571)272-8397. The examiner can normally be reached on Monday-Friday- 0800-1700, EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Sath V. Perungavoor can be reached on (571)272-7455. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/C. H./
Examiner, Art Unit 2488

/SATH V PERUNGAVOOR/
Supervisory Patent Examiner, Art Unit 2488

Index of Claims	Application/Control No. 13666680	Applicant(s)/Patent Under Reexamination BICI ET AL.
	Examiner CLIFFORD HILAIRE	Art Unit 2488

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	06/26/2015								
	1	✓								
	2	✓								
	3	✓								
	4	✓								
	5	✓								
	6	✓								
	7	✓								
	8	✓								
	9	✓								
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	15	✓								
	16	✓								
	17	✓								
	18	✓								
	19	✓								
	20	✓								

Search Notes	**Application/Control No.** 13666680	**Applicant(s)/Patent Under Reexamination** BICI ET AL.
	Examiner CLIFFORD HILAIRE	**Art Unit** 2488

CPC- SEARCHED

Symbol	Date	Examiner
H04N19/52; H04N19/513; H04N19/176; H04N19/61; H04N19/51; H04N19/597; H04N19/56; H04N19/139; H04N19/573; H04N19/521; H04N19/103; H04N19/30	6/25/2015	CH

CPC COMBINATION SETS - SEARCHED

Symbol	Date	Examiner

US CLASSIFICATION SEARCHED

Class	Subclass	Date	Examiner
375	240	6/25/2015	CH

SEARCH NOTES

Search Notes	Date	Examiner
See Attached EAST Search History Document	6/25/2015	CH
IEEEXplore Search	6/25/2015	CH

INTERFERENCE SEARCH

US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner

/CLIFFORD HILAIRE/ Examiner.Art Unit 2488	

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S3	9	((Mehmet) near2 (BICI)).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/24 17:00
S4	85	((Jani) near2 (LAINEMA)).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/24 17:00
S5	59	((Kemal) near2 (UGUR)).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/24 17:00
S6	4	("20110170602" | "20120307905").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/06/25 09:41
S7	2	("20110170602" | "20120307905").PN.	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/25 09:41
S8	9	((Mehmet) near2 (BICI)).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/25 09:43
S9	85	((Jani) near2 (LAINEMA)).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/25 09:43
S10	59	((Kemal) near2 (UGUR)).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/25 09:43
S11	104	S8 S9 S10	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/25 09:43
S12	45	S11 and merg$4	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/25 09:43
S13	12	S11 and merg$4 near list$4	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/25 09:44
S14	45	S11 and merg$4	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/25 09:44
S15	18	S11 and merg$4 same candidate	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/25 10:10
S16	67	S11 and candidate	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/25 10:11
S17	63	S11 and candidate with motion	US-PGPUB; USPAT;	OR	ON	2015/06/25 10:13

			USOCR			
S18	55	S11 and candidate with motion with vector	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/25 10:13
S19	45	S11 and candidate with motion with vector same block	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/25 10:14
S20	28	S11 and (candidate and list and vector)	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/25 10:15
S21	5805	S11 and (candidate and list and vector)".clm"	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/25 10:15
S22	4	S11 and (candidate and list and vector).clm.	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/25 10:15
S23	1	"20130114723".pn.	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/25 10:52
S24	1	"20130114723".pn. and (candidate with vector with motion) same (merg$4 set list subset)	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/25 10:53
S25	1812	(candidate with vector with motion) same (merg$4 set list subset)	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/25 10:55
S26	27634	((H04N19/52 OR H04N19/513 OR H04N19/176 OR H04N19/61 OR H04N19/51 OR H04N19/597 OR H04N19/56 OR H04N19/139 OR H04N19/573 OR H04N19/521 OR H04N19/103 OR H04N19/30).CPC.)	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/25 10:57
S27	1	"20130034162".pn.	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/25 11:08
S28	1	"20130034162".pn. and (candidate with motion with vector)	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/25 11:16
S29	1	"20130034162".pn. and (candidate with motion with vector) same block	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/25 11:17
S30	1	"20130034162".pn. and (candidate)	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/25 11:18
S31	1	"20130034162".pn. and (candidate) and (list set subset)	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/25 11:19
S32	1	"20130034162".pn. and (candidate same block) and (list set subset)	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/25 11:19
S33	1274	(candidate with vector with motion) same (merg$4 set list subset) and (motion vector) with search$4	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/25 11:32
S34	1064	(candidate with vector with motion) same (merg$4 set list subset) and (motion vector) near4 search$4	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/25 11:32
S35	888	(candidate with vector with motion) with (merg$4 set list subset) and (motion	US-PGPUB; USPAT;	OR	ON	2015/06/25 11:32

		vector) near4 search$4	USOCR			
S36	618	(candidate with vector with motion) near4 (merg$4 set list subset) and (motion vector) near4 search$4	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/25 11:33
S37	112	(candidate with vector with motion) near4 (merg$4 set list subset) same (motion vector) near4 search$4	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/25 11:33
S38	92	(candidate with vector with motion) near4 (merg$4 set list subset) same (motion vector) near4 search$4 and "375".clas.	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/25 11:33
S39	150592	(candidate with vector with motion) near4 (merg$4 set list subset) same (motion vector) near4 search$4 same block "375".clas.	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/25 11:33
S40	51	(candidate with vector with motion) near4 (merg$4 set list subset) same (motion vector) near4 search$4 same block and "375".clas.	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/25 11:34
S41	8	(candidate with vector with motion) near4 (merg$4 set list subset) same (motion vector) near4 search$4 same block and subset and "375".clas.	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/25 11:42
S42	2	(candidate with vector with motion) near4 (merg$4 set list subset) same (motion vector) near4 search$4 same block and subset and (remov$4 exclud$4) with (list set merg$4 subset)	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/25 11:45
S43	50	("5719627" "5815602" "4989089" "5428403" "5781249" "5838391" "4851906" "4989087" "5235419" "5371549" "5414469" "5457481" "5506622" "5521642" "5532746" "5546129" "5557341" "5574663" "5579050" "5581308" "5587741" "5598216" "5612743" "5614954" "5617144" "5619281" "5625417" "5627591" "5638129" "5642166" "5646867" "5654761" "5689306" "5694487" "5717463" "5719630" "5724369" "5731851" "5751362" "5862261" "5903672" "5991447" "6005980" "6020925" "6023298" "6026195" "6057884" "6091777" "6154519" "6205177").pn.	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/25 13:29
S44	25	S43 and (candidate same motion)	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/25 13:30
S45	0	S43 and (candidate same motion) and merg$4	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/25 13:30
S46	4	S43 and (candidate same motion) and exclud$4	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/25 13:31
S47	4	S43 and (candidate) with (vector motion) and exclud$4	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/25 13:32
S48	3	(US-20130034162-$ or US-20120106645-$ or US-20120106638-	US-PGPUB	OR	ON	2015/06/25 13:44

		$).did.				
S49	0	S48 and "PU "	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/06/25 13:44
S50	2	S48 and prediction with unit	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/06/25 13:44
S52	9	((Mehmet) near2 (BICI)).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/26 06:02
S53	85	((Jani) near2 (LAINEMA)).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/26 06:02
S54	59	((Kemal) near2 (UGUR)).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/26 06:02
S55	104	S52 S53 S54	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/26 06:02
S56	55	S55 and candidate with motion with vector	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/26 06:02
S57	10	S55 and candidate with motion with vector and transcod$4	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/26 06:03
S58	8	S55 and candidate with motion with vector and transcod$4 and encod$4	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/26 06:04
S59	53	S55 and candidate with motion with vector and encod$4	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/26 06:05
S60	29	S55 and candidate with motion with vector same encod$4	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/26 06:05
S61	24	S55 and candidate with motion with vector same encod$4 and unit and (block macroblock)	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/26 06:07
S62	18	S55 and candidate with motion with vector same encod$4 and (unit near predict$5) and (block macroblock)	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/26 06:10
S63	23	S55 and prediction near unit	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/26 06:11
S64	22	S55 and prediction near unit and candidate	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/26 06:11
S65	872	prediction near unit and candidate near4 motion near4 vector	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/26 06:14
S66	713	prediction near unit and candidate near4	US-PGPUB;	OR	ON	2015/06/26

		motion near4 vector same block	USPAT; USOCR			06:14
S67	653	prediction near unit and candidate near4 motion near4 vector with block	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/26 06:14
S68	172	prediction near unit same candidate near4 motion near4 vector with block	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/26 06:14
S69	42	prediction near unit same candidate near4 motion near4 vector with block same encoded	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/26 06:15
S70	32	("prediction unit" PU) with block with encoded same candidate near4 motion near4 vector	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/26 06:17
S71	483	PU and candidate with motion with vector	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/26 06:35
S72	209	PU same candidate with motion with vector	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/26 06:36
S73	160	PU same candidate with motion with vector same block	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/26 06:36
S74	142	PU same candidate with motion with vector same block and "375".clas.	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/26 06:36
S75	1	(US-20120134415-$).did.	US-PGPUB	OR	ON	2015/06/26 07:05
S76	0	S75 and encoded	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/26 07:05
S77	0	S75 and encod$4 with block	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/26 07:05
S78	1	S75 and coded with block	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/26 07:05
S79	126	PU same candidate with motion with vector same block and merge with list	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/26 07:06
S80	1	(US-20120008688-$).did.	US-PGPUB	OR	ON	2015/06/26 08:47
S81	1	(US-20120008688-$).did.	US-PGPUB	OR	ON	2015/06/26 08:52
S82	1	(US-20120008688-$).did. and (PU prediction near unit)	US-PGPUB	OR	ON	2015/06/26 08:53
S83	1	(US-20120008688-$).did. and (PU prediction near unit) and receiv$4	US-PGPUB	OR	ON	2015/06/26 08:54
S84	1	(US-20120008688-$).did. and (PU prediction near unit) and (encod$4 cod$4 decod$4 receiv$4)	US-PGPUB	OR	ON	2015/06/26 08:55

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp

S51	0	"20130034162".pn. and (candidate)	USPAT; UPAD	OR	ON	2015/06/25 11:18

6/ 26/ 2015 1:09:19 PM
C:\ Users\ chilaire\ Documents\ EAST\ Workspaces\ 13666680.wsp

Application Data Sheet

Application Information

Application number	13/666,680
Filing Date:	November 1, 2012
Title:	Method for Coding and an Apparatus
Attorney Docket Number:	042933/467264

Applicant Information

Applicant 1

Assignee:		**Nokia Technologies Oy**
Legal Representative under 35 USC 117:		
Joint Inventor:	~~Mehmet Oguz Bici~~	
Person to whom the inventor is obligated to assign:		
Person who shows sufficient proprietary interest:		
If applicant is the legal representative, indicate the Authority to file the patent application, the inventor is:		
Name of the Deceased or Legally Incapacitated Inventor:		
If the Applicant is an Organization check here:		☒

Mailing Address

Address 1:	~~Tammelan puistokatu 1-3 D 46~~	**Karaportti 3**
Address 2:		
City:	~~Tampere~~	**Espoo**
State/Province:		
Country:	~~Finland~~	**Finland**
Postal Code:	~~33500~~	**02610**
Phone Number:		

Fax Number:

Email Address:

Applicant 2

Assignee:

Legal Representative under 35 USC 117:

Joint Inventor: ~~Jani Lainema~~

Person to whom the inventor is obligated to assign:

Person who shows sufficient proprietary interest:

If applicant is the legal representative, indicate the Authority to file the patent application, the inventor is:

Name of the Deceased or Legally Incapacitated Inventor:

If the Applicant is an Organization check here: ☐

Mailing Address

Address 1: ~~Kisakentankatu 12 B 6~~

Address 2:

City: ~~Tampere~~

State/Province:

Country: ~~Finland~~

Postal Code: ~~33230~~

Phone Number:

Fax Number:

Email Address:

Applicant 3

Assignee:

Legal Representative under 35 USC 117:

Joint Inventor: ~~Kemal Ugur~~

Person to whom the inventor is obligated to assign:

Person who shows sufficient proprietary interest:

If applicant is the legal representative, indicate the
Authority to file the patent application, the inventor is:

Name of the Deceased or Legally Incapacitated Inventor:

If the Applicant is an Organization check here: ☐

Mailing Address

Address 1:	~~Lapintie 6D 25~~
Address 2:	
City:	~~Tampere~~
State/Province:	
Country:	~~Finland~~
Postal Code:	~~33100~~
Phone Number:	
Fax Number:	
Email Address:	

Submitted by:

Signature /Guy R. Gosnell/ Date 2015-09-09

Printed Name Guy R. Gosnell Registration Number 34,610

Attorney's Docket No. 042933/467264 PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re:	Mehmet Oguz Bici	Confirmation No.:	4782
Appl. No.:	13/666,680	Group Art No.:	2488
Filing Date:	November 1, 2012	Examiner:	Clifford Hilaire
Title:	METHOD FOR CODING AND AN APPARATUS		

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Request to Correct or Update Applicant Name Under 37 CFR § 1.46(c)

This is a request to correct or update the original naming of Applicant(s) for the above-identified application.

☒ Please correct or update the name of the Applicant(s) to:

Applicant No. 1: Nokia Technologies Oy

☒ A Power of Attorney and 3.73(c) statement from each corrected or updated Applicant accompanies this Request.

☒ An Application Data Sheet with an updated Applicant Information Section accompanies this Request.

Applicant(s) respectfully requests that an updated Filing Receipt confirming these changes be issued.

Respectfully submitted,

/Guy R. Gosnell/

Guy R. Gosnell
Registration No. 34,610

CUSTOMER NO. 10949
ALSTON & BIRD LLP
Bank of America Plaza
101 South Tryon Street, Suite 4000
Charlotte, NC 28280-4000
Tel Charlotte Office (704) 444-1000
Fax Charlotte Office (704) 444-1111

Electronic Acknowledgement Receipt

EFS ID:	23441894
Application Number:	13666680
International Application Number:	
Confirmation Number:	4782
Title of Invention:	METHOD FOR CODING AND AN APPARATUS
First Named Inventor/Applicant Name:	Mehmet Oguz BICI
Customer Number:	73658
Filer:	Guy Randall Gosnell/Kim Shaul
Filer Authorized By:	Guy Randall Gosnell
Attorney Docket Number:	NC77198-US-NP
Receipt Date:	09-SEP-2015
Filing Date:	01-NOV-2012
Time Stamp:	15:16:39
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Miscellaneous Incoming Letter	467264Request.pdf	20500 2dccd2109905ebdab4e4597df533541a0f7088a2	no	1

Warnings:

Information:

2	Application Data Sheet	467264ADS.pdf	25395 84cb6ff32afa006fa7005a82d07f093bc8d39819	no	3
Warnings:					
Information:					
This is not an USPTO supplied ADS fillable form					
3	Assignee showing of ownership per 37 CFR 3.73	467264statement.pdf	86424 4e4d98087753bd84e5ac8d19b81401ce0db40934	no	3
Warnings:					
Information:					
4	Power of Attorney	467264POA.pdf	508180 7e639ecf8f0ac7d5dd08a8d7867bd94d76c92e9a	no	2
Warnings:					
Information:					
			Total Files Size (in bytes):	640499	

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

TRANSMITTAL FOR POWER OF ATTORNEY TO ONE OR MORE REGISTERED PRACTITIONERS

NOTE: This form is to be submitted with the Power of Attorney by Applicant form (PTO/AIA/82B) to identify the application to which the Power of Attorney is directed, in accordance with 37 CFR 1.5, unless the application number and filing date are identified in the Power of Attorney by Applicant form. If neither form PTO/AIA/82A nor form PTO/AIA82B identifies the application to which the Power of Attorney is directed, the Power of Attorney will not be recognized in the application.

Application Number	13/666,680
Filing Date	11-01-2012
First Named Inventor	Mehmet Oguz BICI
Title	METHOD FOR CODING AND AN APPARATUS
Art Unit	2488
Examiner Name	HILAIRE, CLIFFORD
Attorney Docket Number	042933/467264

SIGNATURE of Applicant or Patent Practitioner

Signature	/Guy R. Gosnell/	Date (Optional)	9/9/2015
Name	Guy R. Gosnell	Registration Number	34,610
Title (if Applicant is a juristic entity)	Patent Practitioner		
Applicant Name (if Applicant is a juristic entity)	Nokia Technologies Oy		

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. If more than one applicant, use multiple forms.

☐ *Total of ___________ forms are submitted.

Doc Code: PA..
Document Description: Power of Attorney

PTO/AIA/82B (07-13)
Approved for use through 11/30/2014. OMB 0651-0051
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number

POWER OF ATTORNEY BY APPLICANT

I hereby revoke all previous powers of attorney given in the application identified in <u>either</u> the attached transmittal letter or the boxes below.

Application Number	Filing Date

(Note: The boxes above may be left blank if information is provided on form PTO/AIA/82A.)

☑ I hereby appoint the Patent Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above: 10949

OR

☐ I hereby appoint Practitioner(s) named in the attached list (form PTO/AIA/82C) as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the patent application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above. (Note: Complete form PTO/AIA/82C.)

Please recognize or change the correspondence address for the application identified in the attached transmittal letter or the boxes above to:

☑ The address associated with the above-mentioned Customer Number

OR

☐ The address associated with Customer Number:

OR

Firm or Individual Name					
Address					
City		State		Zip	
Country					
Telephone		Email			

I am the Applicant (if the Applicant is a juristic entity, list the Applicant name in the box):

NOKIA TECHNOLOGIES OY

☐ Inventor or Joint Inventor (title not required below)

☐ Legal Representative of a Deceased or Legally Incapacitated Inventor (title not required below)

☑ Assignee or Person to Whom the Inventor is Under an Obligation to Assign (provide signer's title if applicant is a juristic entity)

☐ Person Who Otherwise Shows Sufficient Proprietary Interest (e.g., a petition under 37 CFR 1.46(b)(2) was granted in the application or is concurrently being filed with this document) (provide signer's title if applicant is a juristic entity)

SIGNATURE of Applicant for Patent

The undersigned (whose title is supplied below) is authorized to act on behalf of the applicant (e.g., where the applicant is a juristic entity).

Signature	[illegible]	Date (Optional)	23 January 2015
Name	[illegible]		
Title	Director, [illegible] Legal and [illegible] Property		

NOTE: Signature - This form must be signed by the applicant in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. If more than one applicant, use multiple forms.

☐ Total of forms are submitted.

Jukka Nihtilä
Head, Business Development
Legal & IP

STATEMENT UNDER 37 CFR 3.73(c)

Applicant/Patent Owner: Nokia Technologies Oy

Application No./Patent No.: 13/666,680 Filed/Issue Date: 11-01-2012

Titled: METHOD FOR CODING AND AN APPARATUS

Nokia Technologies Oy, a corporation

(Name of Assignee) (Type of Assignee, e.g., corporation, partnership, university, government agency, etc.)

states that, for the patent application/patent identified above, it is (choose **one** of options 1, 2, 3 or 4 below):

1. ☑ The assignee of the entire right, title, and interest.

2. ☐ An assignee of less than the entire right, title, and interest (check applicable box):

☐ The extent (by percentage) of its ownership interest is ____________%. Additional Statement(s) by the owners holding the balance of the interest must be submitted to account for 100% of the ownership interest.

☐ There are unspecified percentages of ownership. The other parties, including inventors, who together own the entire right, title and interest are:

Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

3. ☐ The assignee of an undivided interest in the entirety (a complete assignment from one of the joint inventors was made). The other parties, including inventors, who together own the entire right, title, and interest are:

Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

4. ☐ The recipient, via a court proceeding or the like (*e.g.*, bankruptcy, probate), of an undivided interest in the entirety (a complete transfer of ownership interest was made). The certified document(s) showing the transfer is attached.

The interest identified in option 1, 2 or 3 above (not option 4) is evidenced by either (choose **one** of options A or B below):

A. ☐ An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel ____________, Frame ____________, or for which a copy thereof is attached.

B. ☑ A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:

1. From: Inventors To: Nokia Corporation

The document was recorded in the United States Patent and Trademark Office at Reel 029555, Frame 0001, or for which a copy thereof is attached.

2. From: Nokia Corporation To: Nokia Technologies Oy

The document was recorded in the United States Patent and Trademark Office at Reel 035258, Frame 0075, or for which a copy thereof is attached.

STATEMENT UNDER 37 CFR 3.73(c)

3. From: ______________________________ To: ______________________________

The document was recorded in the United States Patent and Trademark Office at

Reel ____________, Frame ____________, or for which a copy thereof is attached.

4. From: ______________________________ To: ______________________________

The document was recorded in the United States Patent and Trademark Office at

Reel ____________, Frame ____________, or for which a copy thereof is attached.

5. From: ______________________________ To: ______________________________

The document was recorded in the United States Patent and Trademark Office at

Reel ____________, Frame ____________, or for which a copy thereof is attached.

6. From: ______________________________ To: ______________________________

The document was recorded in the United States Patent and Trademark Office at

Reel ____________, Frame ____________, or for which a copy thereof is attached.

☐ Additional documents in the chain of title are listed on a supplemental sheet(s).

☑ As required by 37 CFR 3.73(c)(1)(i), the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.

[NOTE: A separate copy (i.e., a true copy of the original assignment document(s)) must be submitted to Assignment Division in accordance with 37 CFR Part 3, to record the assignment in the records of the USPTO. See MPEP 302.08]

The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.

/Guy R. Gosnell/	9/9/2015
Signature	Date
Guy R. Gosnell	34,610
Printed or Typed Name	Title or Registration Number

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
13/666,680	11/01/2012	2488	2640	NC77198-US-NP	20	8

CONFIRMATION NO. 4782

REPLACEMENT FILING RECEIPT

OC000000077483223

10949
Nokia Corporation and Alston & Bird LLP
c/o Alston & Bird LLP
Bank of America Plaza, 101 South Tryon Street
Suite 4000
Charlotte, NC 28280-4000

Date Mailed: 09/17/2015

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Inventor(s)

Mehmet Oguz BICI, Tampere, TURKEY;
Jani LAINEMA, Tampere, FINLAND;
Kemal UGUR, Tampere, FINLAND;

Applicant(s)

Nokia Technologies Oy, Espoo, FINLAND;

Assignment For Published Patent Application

NOKIA CORPORATION, Espoo, FINLAND

Power of Attorney: The patent practitioners associated with Customer Number 10949

Domestic Priority data as claimed by applicant

This appln claims benefit of 61/555,703 11/04/2011

Foreign Applications for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.) - None.
Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.

If Required, Foreign Filing License Granted: 11/20/2012

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 13/666,680**

Projected Publication Date: Not Applicable

Non-Publication Request: No

Early Publication Request: No

Title

METHOD FOR CODING AND AN APPARATUS

Preliminary Class

375

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications:

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at http://www.uspto.gov/web/offices/pac/doc/general/index.html.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, http://www.stopfakes.gov. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

LICENSE FOR FOREIGN FILING UNDER

Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

GRANTED

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign AssetsControl, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

SelectUSA

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The U.S. offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to promote and facilitate business investment. SelectUSA provides information assistance to the international investor community; serves as an ombudsman for existing and potential investors; advocates on behalf of U.S. cities, states, and regions competing for global investment; and counsels U.S. economic development organizations on investment attraction best practices. To learn more about why the United States is the best country in the world to develop technology, manufacture products, deliver services, and grow your business, visit http://www.SelectUSA.gov or call +1-202-482-6800.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
13/666,680	11/01/2012	Mehmet Oguz BICI	NC77198-US-NP

CONFIRMATION NO. 4782

POA ACCEPTANCE LETTER

OC000000077463222

10949
Nokia Corporation and Alston & Bird LLP
c/o Alston & Bird LLP
Bank of America Plaza, 101 South Tryon Street
Suite 4000
Charlotte, NC 28280-4000

Date Mailed: 09/17/2015

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 09/09/2015.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/hsarwari/

<u>**Application Data Sheet**</u>

Application Information

Application number:	13/666,680
Filing Date:	November 1, 2012
Application Type:	Nonprovisional
Subject Matter:	Utility
Title:	METHOD FOR CODING AND AN APPARATUS
Attorney Docket Number:	042933/467264
Total Drawing Sheets:	13

Inventor Information

Inventor 1

Status:	Full Capacity
Given Name:	Mehmet
Middle Name:	Oguz
Family Name:	BICI
Non US Residency:	Yes
City of Residence:	Tampere
Country of Residence:	~~TR~~ <u>**FI**</u>
Street of Mailing Address:	Tammelan puistokatu 1-3 D 46
City of Mailing Address:	Tampere
Country of mailing address:	FI
Postal or Zip Code of mailing address:	33500

Inventor 2

Status:	Full Capacity
Given Name:	Jani
Middle Name:	
Family Name:	LAINEMA
Non US Residency:	Yes
City of Residence:	Tampere

Country of Residence:	FI
Street of Mailing Address:	Kisakentankatu 12 B 6
City of Mailing Address:	Tampere
Country of mailing address:	FI
Postal or Zip Code of mailing address:	33230

Inventor 3

Status:	Full Capacity
Given Name:	Kemal
Middle Name:	
Family Name:	UGUR
Non US Residency:	Yes
City of Residence:	Tampere
Country of Residence:	FI
Street of Mailing Address:	Lapintie 6D 25
City of Mailing Address:	Tampere
Country of mailing address:	FI
Postal or Zip Code of mailing address:	33100

Submitted by:

Signature /Douglas E. McKay/ Date 09/17/2015

Printed Name Douglas E. McKay Registration Number 70,175

Attorney's Docket No. 042933/467264

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re:	Bici et al.	Confirmation No.:	4782
Appl. No.:	13/666,680	Group Art Unit:	2488
Filed:	November 1, 2012		
For:	METHOD FOR CODING AND AN APPARATUS		

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

REQUEST FOR CORRECTED FILING RECEIPT

The Application Data Sheet filed on November 1, 2012 contained errors in the Inventor Information section. Specifically, the residence provided for Inventor 1 is incorrect. A Subsequent Application Data Sheet is being filed concurrently herewith. Applicant requests that a corrected Filing Receipt be issued.

Respectfully submitted,

/Douglas E. McKay/

Douglas E. McKay
Registration No. 70,175

Customer No. 10949
ALSTON & BIRD LLP
Bank of America Plaza
101 South Tryon Street, Suite 4000
Charlotte, NC 28280-4000
Tel Charlotte Office (704) 444-1000
Fax Charlotte Office (704) 444-1111

Electronic Acknowledgement Receipt

EFS ID:	23533004
Application Number:	13666680
International Application Number:	
Confirmation Number:	4782
Title of Invention:	METHOD FOR CODING AND AN APPARATUS
First Named Inventor/Applicant Name:	Mehmet Oguz BICI
Customer Number:	10949
Filer:	Jason P. Cooper/Dennis Avery
Filer Authorized By:	Jason P. Cooper
Attorney Docket Number:	042933/467264
Receipt Date:	18-SEP-2015
Filing Date:	01-NOV-2012
Time Stamp:	11:14:08
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Request for Corrected Filing Receipt	467264_Request_CFR_09-17-2015.pdf	90639 a561778649bc24d9c55fc4db0e007e76494434c2	no	1

Warnings:

Information:

2	Application Data Sheet	467264_Subsequent_ADS_09-17-2015.pdf	117748 42d38e4061da0c3c6ad9bfafeee3861c3800c2a3	no	2

Warnings:
Information:
This is not an USPTO supplied ADS fillable form

Total Files Size (in bytes):	208387

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

<u>New Applications Under 35 U.S.C. 111</u>
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

<u>National Stage of an International Application under 35 U.S.C. 371</u>
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

<u>New International Application Filed with the USPTO as a Receiving Office</u>
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
13/666,680	11/01/2012	2488	2640	042933/467264	20	8

CONFIRMATION NO. 4782

CORRECTED FILING RECEIPT

OC000000077598891

10949
Nokia Corporation and Alston & Bird LLP
c/o Alston & Bird LLP
Bank of America Plaza, 101 South Tryon Street
Suite 4000
Charlotte, NC 28280-4000

Date Mailed: 09/23/2015

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Inventor(s)

Mehmet Oguz BICI, Tampere, FINLAND;
Jani LAINEMA, Tampere, FINLAND;
Kemal UGUR, Tampere, FINLAND;

Applicant(s)

Nokia Technologies Oy, Espoo, FINLAND;

Assignment For Published Patent Application

NOKIA CORPORATION, Espoo, FINLAND

Power of Attorney: The patent practitioners associated with Customer Number 10949

Domestic Priority data as claimed by applicant

This appln claims benefit of 61/555,703 11/04/2011

Foreign Applications for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.) - None.
Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.

If Required, Foreign Filing License Granted: 11/20/2012

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 13/666,680**

Projected Publication Date: Not Applicable

Non-Publication Request: No

Early Publication Request: No

Title

METHOD FOR CODING AND AN APPARATUS

Preliminary Class

375

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications:

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

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For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, http://www.stopfakes.gov. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

LICENSE FOR FOREIGN FILING UNDER

Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

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NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

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Substitute for form SB08 (Revised 07/09) **INFORMATION DISCLOSURE STATEMENT BY APPLICANT** *(Use as many sheets as necessary)*				**Complete if Known**	
				Application Number	13/666,680
				Filing Date	11/01/2012
				First Named Inventor	Mehmet Oguz Bici
				Art Unit	2488
				Examiner Name	Clifford Hilaire
Sheet	*1*	of	1	Attorney Docket Number	042933/467264

OTHER DOCUMENTS

Examiner Initials*	Cite No.	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s) , volume-issue number(s), publisher, city and/or country where published.	English Language Translation Attached
	1	Office Action from corresponding Korean Patent Application No. 2014-7015093, dated August 21, 2015	YES
	2	**Wiegand, Tomas, et al.**; *"WD3: Working Draft 3 of High-Efficiency Video Coding"*; Joint Collaborative Team on Video Coding (JCT-VC) of ITU-T SG16 WP3 and ISO/IEC JTC1/SC29/WG11; 5th Meeting; Geneva, CH, 16-23 March, 2011; Document JCTVC-E603; 239 pages	
	3	**Bross, Benjamin, et al.**; *"WD4: Working Draft 4 of High-Efficiency Video Coding"*; Joint Collaborative Team on Video Coding (JCT-VC) of ITU-T SG16 WP3 and ISO/IEC JTC1/SC29/WG11; 6th Meeting; Torino, IT; 14-22 July 2011; Document JCTVC-F803_d; 232 pages	
	4	**J.-L. Lin, Y.-W. Chen, Y.-W. Huang, S. Lei;** *"CE9: Results of Experiment ROB04";* JCT-VC Doc. JCTVC-F052, Turin; Jul 2011	

Examiner Signature		Date Considered	

**Examiner: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

CLT#35874174v1

Submitted September 25, 2015

Electronic Acknowledgement Receipt

EFS ID:	23601419
Application Number:	13666680
International Application Number:	
Confirmation Number:	4782
Title of Invention:	METHOD FOR CODING AND AN APPARATUS
First Named Inventor/Applicant Name:	Mehmet Oguz BICI
Customer Number:	10949
Filer:	Jonathan Abbott Thomas/Lisa Rone
Filer Authorized By:	Jonathan Abbott Thomas
Attorney Docket Number:	042933/467264
Receipt Date:	25-SEP-2015
Filing Date:	01-NOV-2012
Time Stamp:	10:31:38
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$180
RAM confirmation Number	15369
Deposit Account	160605
Authorized User	ALSTON & BIRD, LLP

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		467264-IDS.pdf	235156 65432fbc59050c9e93188186e9c6073aacfd8cea	yes	2

Multipart Description/PDF files in .zip description

Document Description	Start	End
Transmittal Letter	1	1
Information Disclosure Statement (IDS) Form (SB08)	2	2

Warnings:

Information:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
2	Non Patent Literature	467264-Wiegand_WD3_Working_Draft_NPL.pdf	2552498 6e5d2c619ddf428cb37523ca491d58e77199e47d	no	239

Warnings:

Information:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
3	Non Patent Literature	467264-Bross_WD4_Working_Draft_NPL.PDF	1821768 ff07664392395047264 8d8d18c05a12d1d410332	no	232

Warnings:

Information:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
4	Non Patent Literature	467264-CE9_Results_NPL.pdf	102529 bd54227d992df8178fbbff95920c624d3e147acd	no	7

Warnings:

Information:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
5	Non Patent Literature	467264-korean_office_action.pdf	1383331 9634634c15decfe289d2e6919da9563a3890d373	no	7

Warnings:

Information:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
6	Fee Worksheet (SB06)	fee-info.pdf	30676 ed0745d0ae47b4e1a977cd1ce56cf34b1f05e758	no	2

Warnings:

Information:

Total Files Size (in bytes):	6125958

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

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New International Application Filed with the USPTO as a Receiving Office
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PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re:	Mehmet Oguz Bici	Confirmation No.:	4782
Appl. No.:	13/666,680	Group Art Unit:	2488
Filed:	11/01/2012	Examiner:	Clifford Hilaire
For:	METHOD FOR CODING AND AN APPARATUS		

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

INFORMATION DISCLOSURE STATEMENT
UNDER 37 C.F.R. § 1.97(c)

Attached is a list of documents on form PTO-1449 along with a copy of any cited foreign patent documents and non-patent literature document in accordance with 37 CFR 1.98(a)(2). Also enclosed is a translation or a concise explanation of each non-English language document.

It is requested that the Examiner consider these documents and officially make them of record in accordance with the provisions of 37 C.F.R. § 1.97 and Section 609 of the MPEP. By identifying the listed documents, Applicant in no way makes any admission as to the prior art status of the listed documents, but is instead identifying the listed documents for the sake of full disclosure.

This Information Disclosure Statement is submitted in accordance with 37 C.F.R. § 1.97(c), before final Office Action or Allowance, whichever is earlier.

The $180.00 fee specified in 37 C.F.R. § 1.17(p) is being paid at the time of e-filing. The Commissioner is authorized to charge any additional fee, or credit any refund, to our Deposit Account No. 16-0605.

Respectfully submitted,

/Douglas E. McKay/

Douglas E. McKay
Registration No. 70,175

CUSTOMER NO. 10949
ALSTON & BIRD LLP
Bank of America Plaza
101 South Tryon Street, Suite 4000
Charlotte, NC 28280-4000
Tel Charlotte Office (704) 444-1000
Fax Charlotte Office (704) 444-1111

Electronic Patent Application Fee Transmittal

Application Number:	13666680
Filing Date:	01-Nov-2012
Title of Invention:	METHOD FOR CODING AND AN APPARATUS
First Named Inventor/Applicant Name:	Mehmet Oguz BICI
Filer:	Jonathan Abbott Thomas/Lisa Rone
Attorney Docket Number:	042933/467264

Filed as Large Entity

Filing Fees for **Utility under 35 USC 111(a)**

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
Submission- Information Disclosure Stmt	1806	1	180	180
		Total in USD ($)		**180**

Attorney's Docket No. 042933/467264

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re:	Bici et al.	Confirmation No.:	4782
Appl. No.:	13/666,680	Group Art Unit:	2488
Filed:	November 1, 2012		
For:	METHOD FOR CODING AND AN APPARATUS		

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

REQUEST FOR CORRECTED FILING RECEIPT

In reviewing the Filing Receipt for the above-referenced application, Applicant notes that errors appear as noted on the enclosed copy of the Filing Receipt. Applicant requests that a corrected Filing Receipt be issued.

Respectfully submitted,

/Douglas E. McKay/

Douglas E. McKay
Registration No. 70,175

Customer No. 10949
ALSTON & BIRD LLP
Bank of America Plaza
101 South Tryon Street, Suite 4000
Charlotte, NC 28280-4000
Tel Charlotte Office (704) 444-1000
Fax Charlotte Office (704) 444-1111

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United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
13/666,680	11/01/2012	2488	2640	042933/467264	20	8

CONFIRMATION NO. 4782

CORRECTED FILING RECEIPT

OC000000077598891

10949
Nokia Corporation and Alston & Bird LLP
c/o Alston & Bird LLP
Bank of America Plaza, 101 South Tryon Street
Suite 4000
Charlotte, NC 28280-4000

Date Mailed: 09/23/2015

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Inventor(s)

Mehmet Oguz BICI, Tampere, FINLAND;
Jani LAINEMA, Tampere, FINLAND;
Kemal UGUR, Tampere, FINLAND;

Applicant(s)

Nokia Technologies Oy, Espoo, FINLAND;

Assignment For Published Patent Application

~~NOKIA CORPORATION, Espoo, FINLAND~~ **Nokia Technologies Oy, Espoo, FINLAND;**

Power of Attorney: The patent practitioners associated with Customer Number 10949

Domestic Priority data as claimed by applicant

This appln claims benefit of 61/555,703 11/04/2011

Foreign Applications for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.) - None.
Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.

If Required, Foreign Filing License Granted: 11/20/2012

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 13/666,680**

Projected Publication Date: Not Applicable

Non-Publication Request: No

Early Publication Request: No

Title

METHOD FOR CODING AND AN APPARATUS

Preliminary Class

375

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications:

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

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For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, http://www.stopfakes.gov. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

LICENSE FOR FOREIGN FILING UNDER

Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

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The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

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NOT GRANTED

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SelectUSA

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Electronic Acknowledgement Receipt

EFS ID:	24423480
Application Number:	13666680
International Application Number:	
Confirmation Number:	4782
Title of Invention:	METHOD FOR CODING AND AN APPARATUS
First Named Inventor/Applicant Name:	Mehmet Oguz BICI
Customer Number:	10949
Filer:	Jason P. Cooper/Dennis Avery
Filer Authorized By:	Jason P. Cooper
Attorney Docket Number:	042933/467264
Receipt Date:	21-DEC-2015
Filing Date:	01-NOV-2012
Time Stamp:	12:26:50
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Request for Corrected Filing Receipt	467264_CFR_Request_12-21-2015.pdf	403255 af9d84ebd189ca2ae5ddcd1155dffc6e99a180b8	no	4

Warnings:

Information:

Total Files Size (in bytes):	403255

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Substitute for form SB08 (Revised 07/09) **INFORMATION DISCLOSURE STATEMENT BY APPLICANT** *(Use as many sheets as necessary)*				**Complete if Known**	
				Application Number	13/666,680
				Filing Date	11/01/2012
				First Named Inventor	Mehmet Oguz Bici
				Art Unit	2488
				Examiner Name	Clifford Hilaire
Sheet	*1*	of	1	Attorney Docket Number	042933/467264

U. S. PATENT DOCUMENTS

Examiner Initials*	Cite No.	Document Number Number - Kind Code (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages of Relevant Figures Appear
	1	US-2004/0234144 A1	11-25-2004	Sugimoto et al.	
	2	US-2008/0159401 A1	07-03-2008	Lee et al.	
	3	US-2011/0182362 A1	07-28-2011	Kim et al.	

OTHER DOCUMENTS

Examiner Initials*	Cite No.	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s) , volume-issue number(s), publisher, city and/or country where published.	English Language Translation Attached
	4	Taiwanese Office Action and Search Report from Taiwanese Patent Application No. 101140777 dated December 2, 2015	

Examiner Signature		Date Considered	

**Examiner: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

CLT#36095683v1

Submitted December 29, 2015

Electronic Acknowledgement Receipt

EFS ID:	24475845
Application Number:	13666680
International Application Number:	
Confirmation Number:	4782
Title of Invention:	METHOD FOR CODING AND AN APPARATUS
First Named Inventor/Applicant Name:	Mehmet Oguz BICI
Customer Number:	10949
Filer:	Jonathan Abbott Thomas/Lisa Rone
Filer Authorized By:	Jonathan Abbott Thomas
Attorney Docket Number:	042933/467264
Receipt Date:	29-DEC-2015
Filing Date:	01-NOV-2012
Time Stamp:	11:45:02
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		467264-IDS.pdf	249813 115b2e7eaac9960db50101b5741ce29b28c6f2c5	yes	2

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Transmittal Letter	1	1
	Information Disclosure Statement (IDS) Form (SB08)	2	2

Warnings:

Information:

2	Non Patent Literature	467264-TW_OA_and_Search_Report.pdf	475313 30a566fc9522ecae69e884a5094097fca66cbb94	no	3

Warnings:

Information:

Total Files Size (in bytes):	725126

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Attorney's Docket No. 042933/467264

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re:	Mehmet Oguz Bici	Confirmation No.:	4782
Appl. No.:	13/666,680	Group Art Unit:	2488
Filed:	11/01/2012	Examiner:	Clifford Hilaire
For:	METHOD FOR CODING AND AN APPARATUS		

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

INFORMATION DISCLOSURE STATEMENT
UNDER 37 C.F.R. § 1.97(c)

Attached is a list of documents on form PTO-1449 along with a copy of any cited foreign patent documents and non-patent literature document in accordance with 37 CFR 1.98(a)(2). Also enclosed is a translation or a concise explanation of each non-English language document.

It is requested that the Examiner consider these documents and officially make them of record in accordance with the provisions of 37 C.F.R. § 1.97 and Section 609 of the MPEP. By identifying the listed documents, Applicant in no way makes any admission as to the prior art status of the listed documents, but is instead identifying the listed documents for the sake of full disclosure.

This Information Disclosure Statement is submitted in accordance with 37 C.F.R. § 1.97(c), before final Office Action or Allowance, whichever is earlier.

In accordance with the requirements of 37 C.F.R. § 1.97(c), the following statement as specified in 37 C.F.R. § 1.97(e) is made:

Each item of information contained in this statement was first cited in a communication from a foreign patent office in a counterpart foreign application not more than three (3) months prior to the filing of this statement. In this regard, Applicants note that the communication from the foreign patent office was not received by any individual designated by 37 CFR 1.56(c) more than thirty (30) days prior to the filing of this Information Disclosure Statement.

Respectfully submitted,

/Douglas E. McKay/

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UNITED STATES PATENT AND TRADEMARK OFFICE

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Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
13/666,680	11/01/2012	Mehmet Oguz BICI	042933/467264

CONFIRMATION NO. 4782

IMPROPER CFR REQUEST

OC000000079594886

10949
Nokia Corporation and Alston & Bird LLP
c/o Alston & Bird LLP
Bank of America Plaza, 101 South Tryon Street
Suite 4000
Charlotte, NC 28280-4000

Date Mailed: 12/30/2015

RESPONSE TO REQUEST FOR CORRECTED FILING RECEIPT

Power of Attorney, Claims, Fees, System Limitations, and Miscellaneous

In response to your request for a corrected Filing Receipt, the Office is unable to comply with your request because:

• An Application Data Sheet is needed to make this change.

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/sstephanos/

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appl. No.:	13/666,680	Confirmation No.: 4782
Applicant(s):	Bici et al.	
Filed:	November 1, 2012	
Art Unit:	2488	
Examiner:	Clifford Hilaire	
Title:	METHOD FOR CODING AND AN APPARATUS	

Docket No.:	042933/467264
Customer No.:	10949

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

AMENDMENT UNDER 37 C.F.R. § 1.111

In response to the Office Action dated July 6, 2015, please amend the above-identified application as follows:

Amendments to the Claims are reflected in the listing of claims beginning on page 2 of this paper.

Remarks begin on page 13 of this paper.

Amendments to the Claims:

1. (Currently Amended) A method comprising:

receiving a block of pixels including a prediction unit;

determining a set of spatial motion vector prediction candidates for the block of pixels; the spatial motion vector prediction candidates being provided with motion information;

selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit, where the merge list is selected based on the motion information;

determining a subset of spatial motion vector ~~predictions~~ prediction candidates based on the location of the block associated with the first spatial motion vector prediction candidate;

comparing motion information of the first spatial motion vector prediction candidate with motion information of ~~the~~ spatial motion vector prediction ~~candidate~~ candidates in the determined subset of spatial motion vector prediction candidates; and

if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other, excluding the first spatial motion vector prediction candidate from the merge list.

2. (Original) The method according to claim 1 comprising selecting spatial motion vector prediction candidates from the set of spatial motion vector prediction candidates as the potential spatial motion vector prediction candidate in a predetermined order.

3. (Original) The method according to claim 1 , comprising comparing motion information of the potential spatial motion vector prediction candidate with motion information of at most one other spatial motion vector prediction candidate of the set of spatial motion vector prediction candidates.

4. (Original) The method according to claim 1 comprising examining whether the received block of pixels is divided into a first prediction unit and a second prediction unit; and if so, excluding the potential spatial motion vector prediction candidate from the merge list if the prediction unit is the second prediction unit.

5. (Original) The method according to claim 1, further comprising

determining a maximum number of spatial motion vector prediction candidates to be included in a merge list; and

limiting the number of spatial motion vector prediction candidates in the merge list smaller or equal to the maximum number .

6. (Currently Amended) The method according to claim ~~1~~ 5 comprising:

examining, if the number of spatial motion vector prediction candidates in the merge list smaller than the maximum number;

if so, examining whether a prediction unit to which the potential spatial motion vector prediction candidate belongs is available for motion prediction;

if so, performing at least one of the following:

for the potential spatial motion vector prediction candidate on the left side of the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled:

- the received block of pixels is vertically divided into a first prediction unit and a second prediction unit, and the prediction unit is the second prediction unit;
- the received block of pixels is horizontally divided into a first prediction unit and a second prediction unit, and if the prediction unit is the second prediction unit, and the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate above the prediction unit;

for the potential spatial motion vector prediction candidate above the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled:

– the received block of pixels is horizontally divided into a first prediction unit and a second prediction unit, and the prediction unit is the second prediction unit;

– the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit;

for the potential spatial motion vector prediction candidate, which is on the right side of the potential spatial motion vector prediction candidate above the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate above the prediction unit;

for the potential spatial motion vector prediction candidate, which is below the potential spatial motion vector prediction candidate on the left side of the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit;

for the potential spatial motion vector prediction candidate cornerwise neighbouring the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled:

– all the other potential spatial motion vector prediction candidates have been included in the merge list;

– the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate above the prediction unit;

– the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit.

7. (Original) The method according to claim 1 further comprising including a temporal motion prediction candidate into the merge list.

8. (Original) The method according to claim 1 comprising selecting one motion vector prediction candidate from the merge list to represent a motion vector prediction for the block of pixels.

9. (Currently Amended) A method comprising:

receiving an encoded block of pixels including a prediction unit;

determining a set of spatial motion vector prediction candidates for the encoded block of pixels; the spatial motion vector prediction candidates being provided with motion information;

selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit, where the merge list is selected based on the motion information;

determining a subset of spatial motion vector ~~predictions~~ prediction candidates based on the location of the block associated with the first spatial motion vector prediction candidate;

comparing motion information of the first spatial motion vector prediction candidate with motion information of another spatial motion vector prediction candidate of the set of spatial motion vector prediction candidates; and

if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other, excluding the first spatial motion vector prediction candidate from the merge list.

10. (Original) The method according to claim 9 comprising comparing motion information of the potential spatial motion vector prediction candidate with motion information of at most one other spatial motion vector prediction candidate of the set of spatial motion vector prediction candidates.

11. (Original) The method according to claim 9 comprising examining whether the received encoded block of pixels is divided into a first prediction unit and a second prediction unit; and if so, excluding the potential spatial motion vector prediction candidate from the merge list if the prediction unit is the second prediction unit.

12. (Original) The method according to claim 9 further comprising

determining a maximum number of spatial motion vector prediction candidates to be included in a merge list; and

limiting the number of spatial motion vector prediction candidates in the merge list smaller or equal to the maximum number.

13. (Currently Amended) The method according to claim 9 12 comprising:

examining, if the number of spatial motion vector prediction candidates in the merge list smaller than the maximum number;

if so, examining whether a prediction unit to which the potential spatial motion vector prediction candidate belongs is available for motion prediction;

if so, performing at least one of the following:

for the potential spatial motion vector prediction candidate on the left side of the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled:

- the received encoded block of pixels is vertically divided into a first prediction unit and a second prediction unit, and the prediction unit is the second prediction unit;

– the received encoded block of pixels is horizontally divided into a first prediction unit and a second prediction unit, and if the prediction unit is the second prediction unit, and the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate above the prediction unit;

for the potential spatial motion vector prediction candidate above the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled:

– the received encoded block of pixels is horizontally divided into a first prediction unit and a second prediction unit, and the prediction unit is the second prediction unit;

– the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit;

for the potential spatial motion vector prediction candidate, which is on the right side of the potential spatial motion vector prediction candidate above the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate above the prediction unit;

for the potential spatial motion vector prediction candidate, which is below the potential spatial motion vector prediction candidate on the left side of the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit; and

for the potential spatial motion vector prediction candidate cornerwise neighbouring the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled:

– all the other potential spatial motion vector prediction candidates have been included in the merge list;

– the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate above the prediction unit;

– the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit.

14. (Original) The method according to claim 9 comprising selecting one motion vector prediction candidate from the merge list to represent a motion vector prediction for the received encoded block of pixels.

15. (Currently Amended) An apparatus comprising a processor and a memory including computer program code, the memory and the computer program code configured to, with the processor, cause the apparatus to:

~~receiving~~ receive a block of pixels including a prediction unit;

~~determining~~ determine a set of spatial motion vector prediction candidates for the block of pixels; the spatial motion vector prediction candidates being provided with motion information;

~~selecting~~ select a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit, where the merge list is selected based on the motion information;

~~determining~~ determine a subset of spatial motion vector ~~predictions~~ prediction candidates based on the location of the block associated with the first spatial motion vector prediction candidate;

~~comparing~~ compare motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates; and

if at least one the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other, excluding the first spatial motion vector prediction candidate from the merge list.

16. (Currently Amended) An apparatus comprising a processor and a memory including computer program code, the memory and the computer program code configured to, with the processor, cause the apparatus to:

receive an encoded block of pixels including a prediction unit;

determine a set of spatial motion vector prediction candidates for the encoded block of pixels; the spatial motion vector prediction candidates being provided with motion information;

select a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit, where the merge list is selected based on the motion information;

determine a subset of spatial motion vector ~~predictions~~ prediction candidates based on the location of the block associated with the first spatial motion vector prediction candidate;

compare motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates; and

exclude the first spatial motion vector prediction candidate from the merge list, if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other

17. (Currently Amended) A ~~storage~~ non-transitory computer readable medium having stored thereon a computer executable program code for use by an encoder, said program codes comprise instructions for use by an encoder, said program code comprises instructions for:

receiving a block of pixels including a prediction unit;

determining a set of spatial motion vector prediction candidates for the block of pixels; the spatial motion vector prediction candidates being provided with motion information;

selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit, where the merge list is selected based on the motion information;

determining a subset of spatial motion vector ~~predictions~~ prediction candidates based on the location of the block associated with the first spatial motion vector prediction candidate;

comparing motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates; and

if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other, excluding the first spatial motion vector prediction candidate from the merge list.

18. (Currently Amended) A ~~storage~~ non-transitory computer readable medium having stored thereon a computer executable program code for use by an encoder, said program codes comprise instructions for use by an encoder, said program code comprises instructions for:

receiving an encoded block of pixels including a prediction unit;

determining a set of spatial motion vector prediction candidates for the encoded block of pixels; the spatial motion vector prediction candidates being provided with motion information;

selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit, where the merge list is selected based on the motion information;

determining a subset of spatial motion vector ~~predictions~~ prediction candidates based on the location of the block associated with the first spatial motion vector prediction candidate;

comparing motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates; and

if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other, excluding the first spatial motion vector prediction candidate from the merge list.

19. (Currently Amended) An apparatus comprising:

means for receiving a block of pixels including a prediction unit;

means for determining a set of spatial motion vector prediction candidates for the block of pixels; the spatial motion vector prediction candidates being provided with motion information;

means for selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit, where the merge list is selected based on the motion information;

means for determining a subset of spatial motion vector ~~predictions~~ prediction candidates based on the location of the block associated with the first spatial motion vector prediction candidate;

means for comparing motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates; and

means for excluding the first spatial motion vector prediction candidate from the merge list, if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other.

20. (Currently Amended) An apparatus comprising:

means for receiving an encoded block of pixels including a prediction unit;

means for determining a set of spatial motion vector prediction candidates for the encoded block of pixels; the spatial motion vector prediction candidates being provided with motion information;

means for selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit, where the merge list is selected based on the motion information;

means for determining a subset of spatial motion vector ~~predictions~~ prediction candidates based on the location of the block associated with the first spatial motion vector prediction candidate;

means for comparing motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates; and

means for excluding the first spatial motion vector prediction candidate from the merge list, if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other.

Electronic Acknowledgement Receipt

EFS ID:	24547373
Application Number:	13666680
International Application Number:	
Confirmation Number:	4782
Title of Invention:	METHOD FOR CODING AND AN APPARATUS
First Named Inventor/Applicant Name:	Mehmet Oguz BICI
Customer Number:	10949
Filer:	Jonathan Abbott Thomas/Patricia Forbes
Filer Authorized By:	Jonathan Abbott Thomas
Attorney Docket Number:	042933/467264
Receipt Date:	06-JAN-2016
Filing Date:	01-NOV-2012
Time Stamp:	17:03:36
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$1400
RAM confirmation Number	3991
Deposit Account	160605
Authorized User	ALSTON & BIRD, LLP

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

Charge any Additional Fees required under 37 CFR 1.16 (National application filing, search, and examination fees)

Charge any Additional Fees required under 37 CFR 1.17 (Patent application and reexamination processing fees)

Charge any Additional Fees required under 37 CFR 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		467264_AmendmentEoT.PDF	9560286 60e084100ccf40d17eeeaab52ca9571509ddf617	yes	17

Multipart Description/PDF files in .zip description

Document Description	Start	End
Extension of Time	1	1
Amendment/Req. Reconsideration-After Non-Final Reject	2	2
Claims	3	13
Applicant Arguments/Remarks Made in an Amendment	14	17

Warnings:

Information:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
2	Fee Worksheet (SB06)	fee-info.pdf	31097 b07533a5c61db03227ce80bafcfb6a3fa14f3328	no	2

Warnings:

Information:

Total Files Size (in bytes):	9591383

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<u>National Stage of an International Application under 35 U.S.C. 371</u>
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<u>New International Application Filed with the USPTO as a Receiving Office</u>
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

REMARKS

Claim Rejections - 35 USC § 112

Claims 1, 6, 9,13, 15, 16, 17, 18, 19, and 20 were rejected under 35 USC § 112(b) or 35 USC § 112 (pre-AIA), second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventor or a joint inventor, or for pre-AIA the applicant regards as the invention. These claims have been amended. No new matter is added. Reconsideration of this rejection is respectfully requested.

Claim Rejections - 35 USC § 101

Claims 17 and 18 were rejected under 35 USC § 101 as not falling within one of the four statutory categories of invention. Claims 17 and 18 have been amended so as to no longer recite "A storage medium." Instead, the independent Claims 17 and 18 has been amended to recite "A ~~storage~~ non-transitory computer readable medium" as suggested by the Office Action. As such, it is submitted that the rejection under 35 USC § 101 of independent Claims 17 and 18, as amended, is overcome.

Claim Rejections - 35 USC § 103

Claims 1, 2, 3, 4, 5, 6, 7, 9, 10, 11, 12, 14, 15, 16, 17, 18, 19, and 20 were rejected under pre-AIA 35 USC § 103(a) as being unpatentable over Han et al. (*Improved Video Compression Efficiency Through Flexible Unit Representation and Corresponding Extension of Coding Tools*) in view of Tai et al. (*A Multi-Pass True Motion Estimation Scheme With Motion Vector Propagation for Frame Rate Up-Conversion Applications.*).

The Office Action agrees that the Han does not teach or suggest the feature of "selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit; determining a subset of spatial motion vector prediction candidates based on the location of the block associated with the first spatial motion vector prediction candidate; comparing motion information of the first spatial motion vector prediction candidate with motion information of ~~the~~ spatial motion vector prediction candidates in the determined subset of spatial motion vector prediction candidates; if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other, excluding the first spatial motion vector prediction candidate from the merge list," and cite Tai for these missing teaching from Han. (See the Office Action, page 5-6) Applicant respectfully asserts that Tai fails to cure the deficiencies of Han. While Applicants respectfully disagree with the above-noted rejections, Applicants have amended the independent claims to clarify and further distinguish the claims from the cited art. In this regard, the independent claims have been amended to recite that the merge list is selected based on the motion information and if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other, excluding the first spatial motion vector prediction candidate from the merge list. Support for the amendment is provided at least by paragraphs [0120]-[0122] of the published application.

Applicant respectfully asserts that Tai fails to cure the deficiencies of Han. Specifically, the Office Action cites Col 1, ¶ 4-5 of Tai with respect to the rejection of these recitations of the independent claims. However, neither the cited portion and, indeed, no other portion of Tai teaches or suggests these elements. Instead, the cited portion describes selecting minimum distortion in the current pass to refer in the future pass. However, Tai fails to teach or suggest the "selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit, where the merge list is selected based on the motion information," as recited in independent Claims 1, 9, and 15-20. Specifically, Tai doesn't disclose various merge lists and select certain merge list based on the motion information to store spatial motion vector prediction candidate. As such, Tai fails to teach excluding the spatial motion vector prediction candidate from the selected merge list. In addition, Tai does not teach such exclusion as Tai merely select PMV pattern with minimal distortion. Consequently, Tai does not teach or suggest "selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit, where the merge list is selected based on the motion information...if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other, excluding the first spatial motion vector prediction candidate from the merge list," as recited in independent Claims 1, 9, and 15-20.

Applicants therefore assert that none of the cited references, taken alone or in combination, teach or suggest: "selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit, where the merge list is selected based on the motion information; determining a subset of spatial motion vector prediction candidates based on the location of the block associated with the first spatial motion vector prediction candidate; comparing motion information of the first spatial motion vector prediction candidate with motion information of ~~the~~ spatial motion vector prediction candidates in the determined subset of spatial motion vector prediction candidates; if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other, excluding the first spatial motion vector prediction candidate from the merge list," as recited by independent Claims 1, 9, and 15-20. For each of the foregoing reasons, it is submitted that the rejection under pre-AIA 35 USC § 103(a) of the independent claims, as amended, as well as the claims which depend therefrom, is overcome.

CONCLUSION

In view of the amendments to the claims and the remarks presented above, it is respectfully submitted that all of the claims of the present application are in condition for immediate allowance. It is therefore respectfully requested that a Notice of Allowance be issued. The Examiner is encouraged to contact Applicant's undersigned attorney to resolve any remaining issues in order to expedite examination of the present application.

The patentability of the independent claims has been argued as set forth above and thus Applicants will not take this opportunity to argue the merits of the rejection with regard to specific dependent claims. However, Applicants do not concede that the dependent claims are not independently patentable and reserve the right to argue the patentability of dependent claims at a later date if necessary.

It is not believed that extensions of time or fees for net addition of claims are required, beyond those that may otherwise be provided for in documents accompanying this paper. However, in the event that additional extensions of time are necessary to allow consideration of this paper, such extensions are hereby petitioned under 37 CFR § 1.136(a), and any fee required therefor (including fees for net addition of claims) is hereby authorized to be charged to Deposit Account No. 16-0605.

Respectfully submitted,

/Guy R. Gosnell/

Guy R. Gosnell
Registration No. 34,610

Customer No. Error! Reference source not found.
ALSTON & BIRD LLP
Bank of America Plaza
101 South Tryon Street, Suite 4000
Charlotte, NC 28280-4000
Tel Charlotte Office (704) 444-1000
Fax Charlotte Office (704) 444-1111

ELECTRONICALLY FILED USING THE EFS-WEB ELECTRONIC FILING SYSTEM OF THE UNITED STATES PATENT & TRADEMARK OFFICE ON January 6, 2016

Electronic Patent Application Fee Transmittal

Application Number:	13666680
Filing Date:	01-Nov-2012
Title of Invention:	METHOD FOR CODING AND AN APPARATUS
First Named Inventor/Applicant Name:	Mehmet Oguz BICI
Filer:	Jonathan Abbott Thomas/Patricia Forbes
Attorney Docket Number:	042933/467264

Filed as Large Entity

Filing Fees for **Utility under 35 USC 111(a)**

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension - 3 months with $0 paid	1253	1	1400	1400
Miscellaneous:				
		Total in USD ($)		**1400**

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 13/666,680	Filing Date 11/01/2012	☐ To be Mailed

ENTITY: ☒ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED – PART I

FOR	NUMBER FILED (Column 1)	NUMBER EXTRA (Column 2)	RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).			
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL	

APPLICATION AS AMENDED – PART II

AMENDMENT 01/06/2016	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	* 20	Minus	** 20	=	X $ =	
Independent (37 CFR 1.16(h))	* 8	Minus	***8	=	X $ =	
☐ Application Size Fee (37 CFR 1.16(s))						
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
					TOTAL ADD'L FEE	

AMENDMENT	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =	
☐ Application Size Fee (37 CFR 1.16(s))						
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
					TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

LIE
/KATRINA . TURNER/

PTO/AIA/22 (03-13)
Approved for use through 7/31/2016. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PETITION FOR EXTENSION OF TIME UNDER 37 CFR 1.136(a)

Docket Number (Optional): 042933/467264

Application Number: 13/666,680

Filed: November 1, 2012

For: METHOD FOR CODING AND AN APPARATUS

Art Unit: 2488

Examiner: Clifford Hilaire

This is a request under the provisions of 37 CFR 1.136(a) to extend the period for filing a reply in the above-identified application.

The requested extension and fee are as follows (check time period desired and enter the appropriate fee below):

		Fee	Small Entity Fee	Micro Entity Fee	
☐	One month (37 CFR 1.17(a)(1))	$200	$100	$50	$
☐	Two months (37 CFR 1.17(a)(2))	$600	$300	$150	$
☑	Three months (37 CFR 1.17(a)(3))	$1,400	$700	$350	$ 1,400.00
☐	Four months (37 CFR 1.17(a)(4))	$2,200	$1,100	$550	$
☐	Five months (37 CFR 1.17(a)(5))	$3,000	$1,500	$750	$

☐ Applicant asserts small entity status. See 37 CFR 1.27.

☐ Applicant certifies micro entity status. See 37 CFR 1.29.
Form PTO/SB/15A or B or equivalent must either be enclosed or have been submitted previously.

☐ A check in the amount of the fee is enclosed.

☐ Payment by credit card. Form PTO-2038 is attached.

☐ The Director has already been authorized to charge fees in this application to a Deposit Account.

☑ The Director is hereby authorized to charge any fees which may be required, or credit any overpayment, to Deposit Account Number 16-0605.

☐ Payment made via EFS-Web.

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

I am the

☐ applicant.

☑ attorney or agent of record. Registration number 34,610.

☐ attorney or agent acting under 37 CFR 1.34. Registration number ______.

/Guy R. Gosnell/	January 6, 2016
Signature	Date
Guy R. Gosnell	704-444-1000
Typed or printed name	Telephone Number

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. Submit multiple forms if more than one signature is required, see below*.

☐ * Total of ______ forms are submitted.

Electronic Acknowledgement Receipt

EFS ID:	25031319
Application Number:	13666680
International Application Number:	
Confirmation Number:	4782
Title of Invention:	METHOD FOR CODING AND AN APPARATUS
First Named Inventor/Applicant Name:	Mehmet Oguz BICI
Customer Number:	10949
Filer:	Jonathan Abbott Thomas/Lisa Rone
Filer Authorized By:	Jonathan Abbott Thomas
Attorney Docket Number:	042933/467264
Receipt Date:	26-FEB-2016
Filing Date:	01-NOV-2012
Time Stamp:	11:49:52
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$180
RAM confirmation Number	26404
Deposit Account	160605
Authorized User	ALSTON & BIRD, LLP
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		467264-IDS.pdf	245878 2fa85713aac87f68cb81de29abc00477ff8dd822	yes	3

Multipart Description/PDF files in .zip description

Document Description	Start	End
Transmittal Letter	1	2
Information Disclosure Statement (IDS) Form (SB08)	3	3

Warnings:

Information:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
2	Non Patent Literature	467264-CA_Office_Action.PDF	233204 44e03b31166c821c910d3f6d66754c488ed6830c	no	6

Warnings:

Information:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
3	Fee Worksheet (SB06)	fee-info.pdf	30676 a906aa9e86a6b7f17f9d46c5e856cae7c1ba1bf1	no	2

Warnings:

Information:

Total Files Size (in bytes): 509758

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Substitute for form SB08 (Revised 07/09)				Complete if Known	
				Application Number	13/666,680
INFORMATION DISCLOSURE STATEMENT BY APPLICANT				Filing Date	11/01/2012
(Use as many sheets as necessary)				First Named Inventor	Mehmet Oguz Bici
				Art Unit	2488
				Examiner Name	Clifford Hilaire
Sheet	*1*	of	1	Attorney Docket Number	042933/467264

OTHER DOCUMENTS

Examiner Initials*	Cite No.	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s) , volume-issue number(s), publisher, city and/or country where published.	English Language Translation Attached
	1	Office Action from corresponding Canadian Patent Application No. 2,854,495, dated October 7, 2015	YES

Examiner Signature		Date Considered	

**Examiner: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

CLT#36219768v1

Submitted February 26, 2016

Electronic Acknowledgement Receipt

EFS ID:	25031319
Application Number:	13666680
International Application Number:	
Confirmation Number:	4782
Title of Invention:	METHOD FOR CODING AND AN APPARATUS
First Named Inventor/Applicant Name:	Mehmet Oguz BICI
Customer Number:	10949
Filer:	Jonathan Abbott Thomas/Lisa Rone
Filer Authorized By:	Jonathan Abbott Thomas
Attorney Docket Number:	042933/467264
Receipt Date:	26-FEB-2016
Filing Date:	01-NOV-2012
Time Stamp:	11:49:52
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$180
RAM confirmation Number	26404
Deposit Account	160605
Authorized User	ALSTON & BIRD, LLP

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		467264-IDS.pdf	245878 2fa85713aac87f68cb81de29abc00477ff8dd822	yes	3

Multipart Description/PDF files in .zip description		
Document Description	**Start**	**End**
Transmittal Letter	1	2
Information Disclosure Statement (IDS) Form (SB08)	3	3

Warnings:

Information:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
2	Non Patent Literature	467264-CA_Office_Action.PDF	233204 44e03b31166c821c910d3f6d66754c488ed6830c	no	6

Warnings:

Information:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
3	Fee Worksheet (SB06)	fee-info.pdf	30676 a906aa9e86a6b7f17f9d46c5e856cae7c1ba1bf1	no	2

Warnings:

Information:

Total Files Size (in bytes):	509758

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

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If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Attorney's Docket No. 042933/467264

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re:	Mehmet Oguz Bici	Confirmation No.:	4782
Appl. No.:	13/666,680	Group Art Unit:	2488
Filed:	11/01/2012	Examiner:	Clifford Hilaire
For:	METHOD FOR CODING AND AN APPARATUS		

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

**INFORMATION DISCLOSURE STATEMENT
UNDER 37 C.F.R. § 1.97(c)**

Attached is a list of documents on form PTO-1449 along with a copy of any cited foreign patent documents and non-patent literature document in accordance with 37 CFR 1.98(a)(2). Also enclosed is a translation or a concise explanation of each non-English language document.

It is requested that the Examiner consider these documents and officially make them of record in accordance with the provisions of 37 C.F.R. § 1.97 and Section 609 of the MPEP. By identifying the listed documents, Applicant in no way makes any admission as to the prior art status of the listed documents, but is instead identifying the listed documents for the sake of full disclosure.

This Information Disclosure Statement is submitted in accordance with 37 C.F.R. § 1.97(c), before final Office Action or Allowance, whichever is earlier.

The $180.00 fee specified in 37 C.F.R. § 1.17(p) is being paid at the time of e-filing. The Commissioner is authorized to charge any additional fee, or credit any refund, to our Deposit Account No. 16-0605.

Respectfully submitted,

/Guy R. Gosnell/

Guy R. Gosnell
Registration No. 34,610

CUSTOMER NO. 10949
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101 South Tryon Street, Suite 4000
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Electronic Patent Application Fee Transmittal

Application Number:	13666680
Filing Date:	01-Nov-2012
Title of Invention:	METHOD FOR CODING AND AN APPARATUS
First Named Inventor/Applicant Name:	Mehmet Oguz BICI
Filer:	Jonathan Abbott Thomas/Lisa Rone
Attorney Docket Number:	042933/467264

Filed as Large Entity

Filing Fees for **Utility under 35 USC 111(a)**

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
Submission- Information Disclosure Stmt	1806	1	180	180
	Total in USD ($)			**180**

Substitute for form SB08 (Revised 07/09) **INFORMATION DISCLOSURE STATEMENT BY APPLICANT** *(Use as many sheets as necessary)*				**Complete if Known**	
				Application Number	13/666,680
				Filing Date	11/01/2012
				First Named Inventor	Mehmet Oguz Bici
				Art Unit	2488
				Examiner Name	Clifford Hilaire
Sheet	1	of	1	Attorney Docket Number	042933/467264

U. S. PATENT DOCUMENTS

Examiner Initials*	Cite No.	Document Number Number - Kind Code (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages of Relevant Figures Appear
	1	US-2004/0234144 A1	11-25-2004	Sugimoto et al.	
	2	US-2008/0159401 A1	07-03-2008	Lee et al.	
	3	US-2011/0182362 A1	07-28-2011	Kim et al.	

OTHER DOCUMENTS

Examiner Initials*	Cite No.	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s) , volume-issue number(s), publisher, city and/or country where published.	English Language Translation Attached
	4	Taiwanese Office Action and Search Report from Taiwanese Patent Application No. 101140777 dated December 2, 2015	

Examiner Signature	/CLIFFORD HILAIRE/	Date Considered	02/19/2016

**Examiner: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

CLT#36095683v1

Submitted December 29, 2015

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.H/

Substitute for form SB08 (Revised 07/09)				Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT *(Use as many sheets as necessary)*				Application Number	13/666,680
				Filing Date	11/01/2012
				First Named Inventor	Mehmet Oguz Bici
				Art Unit	2488
				Examiner Name	Clifford Hilaire
Sheet	*1*	of	1	Attorney Docket Number	042933/467264

OTHER DOCUMENTS

Examiner Initials*	Cite No.	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s) , volume-issue number(s), publisher, city and/or country where published.	English Language Translation Attached
	1	Office Action from corresponding Korean Patent Application No. 2014-7015093, dated August 21, 2015	YES
	2	**Wiegand, Tomas, et al.**; *"WD3: Working Draft 3 of High-Efficiency Video Coding"*; Joint Collaborative Team on Video Coding (JCT-VC) of ITU-T SG16 WP3 and ISO/IEC JTC1/SC29/WG11; 5th Meeting; Geneva, CH, 16-23 March, 2011; Document JCTVC-E603; 239 pages	
	3	**Bross, Benjamin, et al.**; *"WD4: Working Draft 4 of High-Efficiency Video Coding"*; Joint Collaborative Team on Video Coding (JCT-VC) of ITU-T SG16 WP3 and ISO/IEC JTC1/SC29/WG11; 6th Meeting; Torino, IT; 14-22 July 2011; Document JCTVC-F803_d; 232 pages	
	4	**J.-L. Lin, Y.-W. Chen, Y.-W. Huang, S. Lei;** *"CE9: Results of Experiment ROB04";* JCT-VC Doc. JCTVC-F052, Turin; Jul 2011	

Examiner Signature	/CLIFFORD HILAIRE/	Date Considered	02/19/2016

**Examiner: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

CLT#35874174v1

Submitted September 25, 2015

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.H/

Notice of References Cited	Application/Control No. 13/666,680	Applicant(s)/Patent Under Reexamination BICI ET AL.	
	Examiner CLIFFORD HILAIRE	Art Unit 2488	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
	A	US-				
	B	US-				
	C	US-				
	D	US-				
	E	US-				
	F	US-				
	G	US-				
	H	US-				
	I	US-				
	J	US-				
	K	US-				
	L	US-				
	M	US-				

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	Han, Woo-Jin, et al. "Improved video compression efficiency through flexible unit representation and corresponding extension of coding tools." Circuits and Systems for Video Technology, IEEE Transactions on 20.12 (2010): 1709-1720. (Previously Presented But with additional annotations)
	V	Tai, Shen-Chuan, et al. "A multi-pass true motion estimation scheme with motion vector propagation for frame rate up-conversion applications." Journal of display technology 4.2 (2008): 188-197. (Previously Presented But with additional annotations)
	W	Huang, Ai-Mei, and Truong Q. Nguyen. "A multistage motion vector processing method for motion-compensated frame interpolation." Image Processing, IEEE Transactions on 17.5 (2008): 694-708.
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
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BIB DATA SHEET

CONFIRMATION NO. 4782

SERIAL NUMBER	FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
13/666,680	11/01/2012 **RULE**	375	2488	042933/467264

APPLICANTS
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** **CONTINUING DATA** *************************
This appln claims benefit of 61/555,703 11/04/2011

** **FOREIGN APPLICATIONS** *************************

** **IF REQUIRED, FOREIGN FILING LICENSE GRANTED** **
11/20/2012

		STATE OR COUNTRY	SHEETS DRAWINGS	TOTAL CLAIMS	INDEPENDENT CLAIMS
Foreign Priority claimed ☐ Yes ☑ No 35 USC 119(a-d) conditions met ☐ Yes ☑ No Verified and Acknowledged /CLIFFORD HILAIRE/ Examiner's Signature	☐ Met after Allowance Initials	FINLAND	13	20	8

ADDRESS

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UNITED STATES

TITLE

METHOD FOR CODING AND AN APPARATUS

FILING FEE RECEIVED		
2640	FEES: Authority has been given in Paper No.____________ to charge/credit DEPOSIT ACCOUNT No.____________ for following:	☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other ________________ ☐ Credit

BIB (Rev. 05/07).

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/666,680	11/01/2012	Mehmet Oguz BICI	042933/467264	4782

10949 7590 03/01/2016

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EXAMINER	
HILAIRE, CLIFFORD	

ART UNIT	PAPER NUMBER
2488	

NOTIFICATION DATE	DELIVERY MODE
03/01/2016	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

usptomail@alston.com

Office Action Summary	Application No. 13/666,680	Applicant(s) BICI ET AL.	
	Examiner CLIFFORD HILAIRE	Art Unit 2488	AIA (First Inventor to File) Status No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *01/06/2016*.
☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on ____.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on ____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

5)☒ Claim(s) *1-20* is/are pending in the application.
5a) Of the above claim(s) ____ is/are withdrawn from consideration.
6)☐ Claim(s) ____ is/are allowed.
7)☒ Claim(s) *1-20* is/are rejected.
8)☐ Claim(s) ____ is/are objected to.
9)☐ Claim(s) ____ are subject to restriction and/or election requirement.

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

Application Papers

10)☐ The specification is objected to by the Examiner.
11)☒ The drawing(s) filed on *11/01/2012* is/are: a)☒ accepted or b)☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
Certified copies:
a)☒ All b)☐ Some** c)☐ None of the:
1.☒ Certified copies of the priority documents have been received.
2.☐ Certified copies of the priority documents have been received in Application No. ____.
3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☒ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date *09/25/2015;12/29/2015*.
3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. ____ .
4) ☐ Other: ____.

DETAILED ACTION

Notice of Pre-AIA or AIA Status

1. The present application is being examined under the pre-AIA first to invent provisions.

Applicant(s) Response to Official Action

2. The response filed on 01/06/2016 has been entered and made of record.

Response to Arguments/Amendments

3. Presented arguments have been fully considered, but are rendered moot in view of the new ground(s) of rejection necessitated by amendment(s) initiated by the applicant(s).

Claim Rejections - 35 USC § 112

The following is a quotation of 35 U.S.C. 112(b):

> (b) CONCLUSION.—The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the inventor or a joint inventor regards as the invention.

The following is a quotation of 35 U.S.C. 112 (pre-AIA), second paragraph:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims 6 & 13 rejected under 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA), second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventor or a joint inventor, or for pre-AIA the applicant regards as the invention.

5. Claims 6 & 13 recites the limitations:

“**the** potential spatial motion vector prediction candidate **on the left side of** the prediction unit",

“**the** spatial motion vector prediction candidate **above** the prediction unit”,

“**the** potential spatial motion vector prediction candidate **above** the prediction unit”,

“**the** spatial motion vector prediction candidate on **the left side** of the prediction unit”,

“**the** potential spatial motion vector prediction candidate, **which is on the right side of** the potential spatial motion vector prediction candidate above the prediction unit”,

“**the** potential spatial motion vector prediction candidate, **which is below** the potential spatial motion vector prediction candidate on the left side of the prediction unit”, and

“**the** potential spatial motion vector prediction candidate **cornerwise** neighboring the prediction unit” in lines 7, 16, 18, 26, 28, 33 and 39 respectively.

There are insufficient antecedent bases for these limitation in the claims.

6. Claim 6 recites the limitations:

"- **the received block of pixels** is vertically divided into a first prediction unit and a second prediction unit, and **the prediction unit** is the second prediction unit" *(line 10)*,

"- **the received block of pixels** is horizontally divided into a first prediction unit and a second prediction unit, and if **the prediction unit** is the second prediction unit" *(line 13)* and

"- **the received block of pixels** is horizontally divided into a first prediction unit and a second prediction unit, and **the prediction unit** is the second prediction unit" *(line 21)*.

The original antecedent basis for "**received block of pixels**" is traced back to claim 1 "receiving a **block of pixels** including a **prediction unit**" *(line 2)*. From the latter citation, "**received block of pixels**" can be interpreted as a set of prediction units (RBP_N) and "a **prediction unit**" can be identified as (PU_i); where $RBP_N = \{PU_i | i \in [1, N]\}$ and N is a non-zero number of prediction unit included in RBP_N.

Then in claim 6, "**a prediction unit**" *(line 4)* is introduced anew to the one in claim 1, as underlined above, without mentioning any correspondence to (RBP_N). If "**the received block of pixels** is vertically divided into a first prediction unit and a second prediction unit **"** or "**the received block of pixels** is horizontally divided into a first prediction unit and a second prediction unit", said set of prediction units if further limited to $RBP_2 = \{PU_1, PU_2\}$ where any of PU_1 or PU_2 is "**the prediction unit**" for which the antecedent basis resides in claim 1.

Finally, "**the prediction unit** is the second prediction unit" does not bring any substance or limitation since it has already been proven, as described above, that "**the prediction unit**" can either be PU_1 or PU_2, where any one of them can be a first prediction unit and a second prediction unit. Therefore, conditions "for the potential spatial motion vector prediction candidate on the left side of the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled" and "for the potential spatial motion vector prediction candidate above the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled:" will always have at least the above analyzed condition true. Examiner cannot resolve the conflict on whether "prediction unit" in claim 1 is the same or different from the introduced "prediction unit" in claim 6 and how it applies to the conditions for "excluding the potential spatial motion vector prediction candidate from the merge list".

7. Claim 13 recites the limitations:

"- **the received encoded block of pixels** is vertically divided into a first prediction unit and a second prediction unit, and **the prediction unit** is the second prediction unit" *(line 10),*

"- **the received encoded block of pixels** is horizontally divided into a first prediction unit and a second prediction unit, and if **the prediction unit** is the second prediction unit" *(line 13),* and

"- **the received encoded block of pixels** is horizontally divided into a first prediction unit and a second prediction unit, and **the prediction unit** is the second prediction unit" *(line 21)*.

The original antecedent basis for "**received block of pixels**" is traced back to claim 9 "receiving an **encoded block of pixels** including a **prediction unit**". From the latter citation, "**received encoded block of pixels**" can be interpreted as a set of prediction units (RBP_N) and "a **prediction unit**" can be identified as (PU_i) where $RBP_N = \{PU_i |\ i \in [1, N]\}$ and N is a non-zero number of prediction unit included in RBP_N.

Then in claim 13, "**a prediction unit**" is introduced anew to the one in claim 9, as underlined above, without mentioning any correspondence to (RBP_N). If "**the received encoded block of pixels** is vertically divided into a first prediction unit and a second prediction unit **"** or "**the received encoded block of pixels** is horizontally divided into a first prediction unit and a second prediction unit", said set of prediction units if further limited to $RBP_2 = \{PU_1, PU_2\}$ where any of PU_1 or PU_2 is "**the prediction unit**" for which the antecedent basis resides in claim 9.

Finally, "**the prediction unit** is the second prediction unit" does not bring any substance or limitation since it has already been proven, as described above, that "**the prediction unit**" can either be PU_1 orPU_2, where any one of them can be a first prediction unit and a second prediction unit. Therefore, conditions "for the potential spatial motion vector prediction candidate on the left side of the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled” and “for the potential spatial motion vector prediction candidate above the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled:” will always have at least the above analyzed condition true. Examiner cannot resolve the conflict on whether "prediction unit" in claim 9 is same or different from the introduced “prediction unit” in claim 13 and how it applies to the conditions for “excluding the potential spatial motion vector prediction candidate from the merge list”.

Important Note:

Examiner will attempt to interpret and examine the claims in his best abilities, despite the multiple indefiniteness issue found in the claims, using representation in the Application presented in fig. 5a and 5b for the encoder in claim 6; 8a and 8b for the decoder in claim 13 and fig 9 regarding the block pixel in both claims.

Claim Rejections - 35 USC § 103

The following is a quotation of pre-AIA 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1,
148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under pre-AIA 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under pre-AIA 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of pre-AIA 35 U.S.C. 103(c) and potential pre-AIA 35 U.S.C. 102(e), (f) or (g) prior art under pre-AIA 35 U.S.C. 103(a).

8. Claims 1, 2, 3, 4, 5, 6, 7, 9, 10, 11, 12, 13, 14, 15, 16, 17. 18, 19 and 20 rejected under pre-AIA 35 U.S.C. 103 (a) as being unpatentable over Woo-Jin Han et al. *[“Improved Video Compression Efficiency Through Flexible Unit Representation and Corresponding Extension of Coding Tools”]* in view of Shen-Chuan Tai et al.*[“A Multi-Pass True Motion Estimation Scheme With Motion Vector Propagation for Frame Rate Up-Conversion Applications”]* and further in view of Ai-Mei Huang et al. *[“A Multistage Motion Vector Processing Method for Motion-Compensated Frame Interpolation”]*.

Regarding claim 1, Han teaches

1. A method comprising *(i.e. a novel video compression scheme based on a highly flexible hierarchy of unit representation which includes three block concepts: coding unit (CU), prediction unit (PU), and transform unit (TU) - Abstract)*:

receiving a block of pixels including a prediction *(i.e. prediction unit (PU)- Abstract)* unit *(i.e. Fig. 1 shows all proposed building blocks of the decoder. All the coding tools are extended to support the proposed flexible architecture. Intra prediction is extended to support an arbitrary number of angles rather than the conventional 9-modes defined in H.264/AVC. Fast integer transforms larger than 8 × 8 are developed to support large TU sizes. Edge definition for the deblocking filter is modified according to the CU, PU, and TU concepts. Partition information in quadtreebased adaptive loop filter (QALF) [13] is replaced with CU splitting information- page 1710, ¶ 3)*;

However, Han does not teach explicitly:

determining a set of spatial motion vector prediction candidates for the block of pixels;

the spatial motion vector prediction candidates being provided with motion information;

selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit,

determining a subset of spatial motion vector predictions based on the location of the block associated with the first spatial motion vector prediction candidate;

comparing motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates;

In the same field of endeavor, Tai teaches:

determining a set *(i.e. $CS^i(\vec{X},t)$)* of spatial motion vector prediction candidates for the block of pixels *(i.e. The MV search in block in the ith pass is performed in accordance with (1). As shown, the search is confined to the vectors defined in the **candidate vector set** $CS^i(\vec{X},t)$), i.e., a full search is not performed- Page 189, Col 2, ¶ 3)*;

the spatial motion vector prediction candidates being provided with motion information *(i.e. The basic principle of the multi-pass ME strategy proposed in this study is to utilize **the motion information** relating to neighboring blocks* *generated in the previous pass to gradually refine the accuracy of the MV in the current block- Page 189, Col 2, ¶ 3)*;

selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates *(i.e. $\vec{V}$ - Equation 2)* as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit *(i.e. Every motion vector $\vec{V}$ in the candidate vector set is comprised by a single PMV and a update vector $\vec{U}$ selected from update vector set- page 190, Col 1, ¶ 3),*

determining a subset of spatial motion vector predictions based on the location of the block associated *(i.e. $\vec{X}$ represent the current block location as shown in fig 2- Page 190, Col 1, ¶ 3)* with the first spatial motion vector prediction candidate (*i.e. for each pass, i takes an integer α value between 1 and 12 included thereby defining a subset of $CS^{\alpha}(\vec{X},t)$ which is defined for different linear combination of $\overrightarrow{PMV}^{\alpha}$ and $\vec{U} \in US^{\alpha}$ - Page 190, Col 1, ¶ 3, equation 2)*;

comparing motion information of the first spatial motion vector prediction candidate *(i.e. The metric, $\overrightarrow{MV}^{i}(\vec{X},t) = arg_{\vec{V} \in CS^{i}(\vec{X},t)} \min\left(e\left(\vec{V},\vec{X},t\right)\right), 1 \leq i \leq 12,$ is used to compare determine PMV pattern which has minimal distortion among all $\vec{V}$ of the subset $CS^{\alpha}(\vec{X},t)$ - Page 190, col 1, ¶ 5, equation 1)* with motion information of the spatial motion vector prediction candidates in the determined subset of spatial motion vector prediction candidates *(i.e. Each pass in the proposed ME scheme is performed using one of the PMV predictor patterns (see*

Fig. 3) and then one MV in the selected PMV pattern which has minimal distortion is selected as the final PMV of this pass- Page 190; Col 1, ¶ 5); and

It would have been obvious to one with ordinary skill in the art at the time of invention, to modify the teachings of Han with the teachings of Tai to use the geometric relationship proposed in [2] describing the correlation between the current block position and the motion edge to reduce the number of PMV predictors to be evaluated *(Tai- Page 190, Col 1, ¶ 4)*.

However, Han and Tai do not teach explicitly:

<u>where the merge list is selected based on the motion information;</u>

if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other, excluding the first spatial motion vector prediction candidate from the merge list.

In the same field of endeavor, Huang teaches:

<u>where the merge list is selected based on the motion</u> *(i.e. reliability of MV- Page 697, ¶ 2; equation 2)* <u>information</u> *(i.e. The merging process is performed on a MB basis, and all MBs that contain unreliable MVs will be examined in a raster scan order- page 697, ¶ 10)*;

if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other *(i.e. if MV's is reliable or possibly reliable will not be merged in a group- page 697, ¶ 10)*, excluding the first spatial motion vector prediction candidate from the merge list *(i.e. That is, onlythose **MBs** that have unreliable **MVs** connecting to each* *other in vertical, horizontal and diagonal directions will be merged- page 697, ¶ 10).*

It would have been obvious to one with ordinary skill in the art at the time of invention, to modify the teachings of Han and Tai with the teachings of Huang to preserve edge information and maintain the integrity of moving object structure, we use MB merging to correct unreliable MVs by finding a best single MV*(Huang- Page 698, ¶ 4).*

Regarding claim 2, Han, Tai and Huang teach all the limitations of claim 1. Han further teaches:

comprising selecting spatial motion vector prediction candidates from the set of spatial motion vector prediction candidates as the potential spatial motion vector prediction candidate in a predetermined order *(i.e. comprising selecting spatial motion vector prediction candidates from the set of spatial motion vector prediction candidates as the potential spatial motion vector prediction candidate in a predetermined order- page 1712, Col 2, ¶ 4).*

Regarding claim 3, Han, Tai and Huang teach all the limitations of claim 1. However, Han and Huang not teach explicitly:

comprising comparing motion information of the potential spatial motion vector prediction candidate with motion information of at most one other spatial motion vector prediction candidate of the set of spatial motion vector prediction candidates.

In the same field of endeavor, Tai teaches:

comprising comparing motion information of the potential spatial motion vector prediction candidate *(i.e.* $\overrightarrow{MV}^{i}(\vec{X}, t) = arg_{\vec{V} \in CS^{i}(\vec{X},t)} \min\left(e(\vec{V}, \vec{X}, t)\right), 1 \leq i \leq 12;$ *equation 1)*with motion information of at most one other spatial motion vector prediction candidate of the set of spatial motion vector prediction candidates *(i.e. Each pass in the proposed ME scheme is performed using one of the PMV predictor patterns (see Fig. 3) and then one MVin the selected PMV pattern which has minimal distortion is selected as the final PMV of this pass- Page 190; Col 1, ¶ 5).*

Regarding claim 4, Han, Tai and Huang teach all the limitations of claim 1. Han further teaches:

comprising examining whether the received block of pixels is divided into a first prediction unit and a second prediction unit *(i.e. tu size flag is equal to one)*; and if so, excluding the potential spatial motion vector prediction candidate from the merge list *(i.e. the transform may be applied to the residue generated by multiple PU partitions with different motion vectors or prediction methods- Page 1711, ¶ 4-5)* if the prediction unit is the second prediction unit *(i.e. When the tu size flag is equal to zero, the TU size is set equal to that of the CU which it belongs to. When tu size flag is equal to one, the TU size is set as N × N for symmetric PU* *splitting's and N/2 × N/2 for asymmetric PU splitting's, respectively. This ensures that the transform which is not applied across motion boundaries can be tested in the rate-distortion optimization process for asymmetric PU partitions. It should be noted that the transform may be applied to the residue generated by multiple PU partitions with different motion vectors or prediction methods- Page 1711, ¶ 4-5)*

Regarding claim 5, Han, Tai and Huang teach all the limitations of claim 1. Han further teaches:

further comprising determining a maximum number *(i.e. N)* of spatial motion vector prediction candidates to be included in a merge *(i.e. A')* list *(i.e. Fig. 3 shows the spatially adjacent motion vectors which can be considered the candidate for the prediction. Let* $A = \{\mathbf{a}_0, \mathbf{a}_1, \ldots, \mathbf{a}_N\}$, $A' \subset A$, *and* $I_{A'}$ *denote the set of motion vectors above the current PU, the set of the available motion vectors in A, and the set which includes the indices of the elements in A' respectively- page 1712, col 2, ¶ 3)*; and

limiting the number *(i.e.* $A' \subset A$*)* of spatial motion vector prediction candidates in the merge list smaller or equal to the maximum number *(i.e. The set of the available motion vectors, A', is derived from A by verifying whether the corresponding reference index is the same as that of the current PU partition- page 1712, col 2, ¶ 3).*

Regarding claim 6, Han, Tai and Huang teach all the limitations of claim 5. Han further teaches:

comprising:

examining *(i.e. When A'= Ø, the candidate motion vector **a** from A' is excluded from the candidate set, and a zero vector is used when taking the median of spatial motion vector predictors- Page 1712, ¶ 3)*, if the number of spatial motion vector prediction candidates in the merge list smaller *(i.e. if the subset of A' is not the empty set must be a smaller set of A- page 1712, ¶ 3)* than the maximum number *(i.e. When A'= Ø, the candidate motion vector **a** from A' is excluded from the candidate set, and a zero vector is used when taking the median of spatial motion vector predictors. The candidate motion vectors **b** and **c** from B = {**b**0… $\boldsymbol{b}_M$} and C = {**c**0, **c**1, **c**2} are also determined using the same algorithm, and the resulting spatially adjacent motion vectors are used in the proposed AMVP method.- Page 1712, ¶ 3)*;

if so, examining whether a prediction unit to which the potential spatial motion vector prediction candidate belongs is available for motion prediction *(i.e. The set of the available motion vectors, A' is derived from A by verifying whether the corresponding reference index is the same as that of the current PU partition- Page 1712, ¶ 3)*;

if so, performing at least **one** of the following *(i.e. The overhead for signaling the index of the best predictor is reduced by re-organizing the set of candidate predictors- page 1712, ¶ 4)*:

for the potential spatial motion vector prediction candidate on the left side of the prediction unit, excluding *()* the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled *(i.e.* ***duplicate predictors*** *and the predictors which* ***can be excluded*** *based on the parsed* ***MVD*** *values at the decoder side are eliminated from the set- page 1712, ¶ 4)*:

- the received block of pixels is vertically divided into a first prediction unit and a second prediction unit, and the prediction unit is the second prediction unit;

- the received block of pixels is horizontally divided into a first prediction unit and a second prediction unit, and if the prediction unit is the second prediction unit, and the potential spatial motion vector prediction candidate has essentially similar *(i.e. duplicate- page 1712, ¶ 4)* motion information than the spatial motion vector prediction candidate above the prediction unit *(i.e.* ***duplicate predictors*** *and the predictors which can be excluded based on the parsed* ***MVD*** *values at the decoder side are eliminated from the set- page 1712, ¶ 4)*;

for the potential spatial motion vector prediction candidate above the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled:

- the received block of pixels is horizontally divided into a first prediction unit and a second prediction unit, and the prediction unit is the second prediction unit;

- the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit;

for the potential spatial motion vector prediction candidate, which is on the right side of the potential spatial motion vector prediction candidate above the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate above the prediction unit;

Note: The claim has been interpreted to the Examiner's best abilities for prior reference rejection despite the multiple 112(b) issues it presents.

Regarding claim 7, Han, Tai and Huang teach all the limitations of claim 1. Han further teaches:

further comprising including a temporal motion prediction candidate into the merge list *(i.e. This paper proposes the AMVP method, which is adapted to the proposed flexible unit representation. It allows the selection of the best predictor from the set which consists of three spatially adjacent motion vectors, their median, and a temporal motion vector- Page 1712, Col 2, ¶ 2).*

Regarding claim 8, Han, Tai and Huang teach all the limitations of claim 1. Han further teaches:

comprising selecting one motion vector prediction candidate *(i.e. the best predictor is selected)* from the merge list to represent a motion vector prediction for the block of pixels*(i.e. the best predictor is selected from a given set through rate-distortion optimization- Page 1712, Col 2, ¶ 1).*

Regarding claim 9, Han teaches

9. A method comprising *(i.e. a novel video compression scheme based on a highly flexible hierarchy of unit representation which includes three block concepts: coding unit (CU), prediction unit (PU), and transform unit (TU)- Abstract)*:

receiving a encoded block of pixels including a prediction unit *(i.e. Fig. 1 shows all proposed building blocks of the decoder. All the coding tools are extended to support the proposed flexible architecture. Intra prediction is extended to support an arbitrary number of angles rather than the conventional 9-modes defined in H.264/AVC. Fast integer transforms larger than 8 × 8 are developed to support large TU sizes. Edge definition for the deblocking filter is modified according to the CU, PU, and TU concepts. Partition information in quadtreebased adaptive loop filter (QALF) [13] is replaced with CU splitting information- page 1710, ¶ 3)*;

However, Lin does not teach explicitly:

determining a set of spatial motion vector prediction candidates for the encoded block of pixels;

the spatial motion vector prediction candidates being provided with motion information;

selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit,

determining a subset of spatial motion vector predictions based on the location of the block associated with the first spatial motion vector prediction candidate;

comparing motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates;

In the same field of endeavor, Tai teaches:

determining a set *(i.e.* $CS^i(\vec{X},t)$*)* of spatial motion vector prediction candidates for the encoded block of pixels *(i.e. The MV search in block in the ith pass is performed in accordance with (1). As shown, the search is confined to the vectors defined in the* ***candidate vector set*** $CS^i(\vec{X},t)$*), i.e., a full search is not performed- Page 189, Col 2, ¶ 3)*;

the spatial motion vector prediction candidates being provided with motion information *(i.e. The basic principle of the multi-pass ME strategy proposed in this study is to utilize* ***<u>the motion information</u>*** *relating to neighboring blocks* *generated in the previous pass to gradually refine the accuracy of the MV in the current block- Page 189, Col 2, ¶ 3)*;

selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates *(i.e.* $\vec{V}$ *- Equation 2)* as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit *(i.e. Every motion vector* $\vec{V}$ *in the candidate vector set is comprised by a single PMV and a update vector* $\vec{U}$ *selected from update vector set- page 190, Col 1, ¶ 3),*

determining a subset of spatial motion vector predictions based on the location of the block associated *(i.e.* $\vec{X}$ *represent the current block location as shown in fig 2- Page 190, Col 1, ¶ 3)* with the first spatial motion vector prediction candidate (*i.e. for each pass, i takes an integer α value between 1 and 12 included thereby defining a subset of* $CS^{\alpha}(\vec{X},t)$ *which is defined for different linear combination of* $\overrightarrow{PMV}^{\alpha}$ *and* $\vec{U} \in US^{\alpha}$ *- Page 190, Col 1, ¶ 3, equation 2)*;

comparing motion information of the first spatial motion vector prediction candidate *(i.e.* $\overrightarrow{MV}^{i}(\vec{X},t) = arg_{\vec{V} \in CS^{i}(\vec{X},t)} \min\left(e(\vec{V},\vec{X},t)\right), 1 \leq i \leq 12;$ *equation 1)* with motion information of another spatial motion vector prediction candidate of the set of spatial motion vector prediction candidates *(i.e. Each pass in the proposed ME scheme is performed using one of the PMV predictor patterns (see Fig. 3) and then one MV in the selected PMV pattern which has minimal distortion is selected as the final PMV of this pass- Page 190; Col 1, ¶ 5)*; and

However, Han and Tai do not teach explicitly:

where the merge list is selected based on the motion information;

if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other, excluding the first spatial motion vector prediction candidate from the merge list.

In the same field of endeavor, Huang teaches:

where the merge list is selected based on the motion *(i.e. reliability of MV- Page 697, ¶ 2; equation 2)* information *(i.e. The merging process is performed on a MB basis, and all MBs that contain unreliable MVs will be examined in a raster scan order- page 697, ¶ 10)*;

if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other *(i.e. if MV's is reliable or possibly reliable will not be merged in a group- page 697, ¶ 10)*, excluding the first spatial motion vector prediction candidate from the merge list *(i.e. That is, onlythose* ***MBs*** *that have unreliable* ***MVs*** *connecting to each other in vertical, horizontal and diagonal directions will be merged- page 697, ¶ 10)*.

Regarding claim 10, Han, Tai and Huang teach all the limitations of claim 9.

However, Han and Huang do not teach explicitly:

comprising comparing motion information of the potential spatial motion vector prediction candidate with motion information of at most one other spatial motion vector prediction candidate of the set of spatial motion vector prediction candidates.

In the same field of endeavor, Tai teaches:

comprising comparing motion information of the potential spatial motion vector prediction candidate *(i.e.* $\overrightarrow{MV}^i(\overrightarrow{X},t) = arg_{\vec{V}\in CS^i(\vec{X},t)} \min\left(e(\vec{V},\vec{X},t)\right), 1 \leq i \leq 12;$ *equation 1)*with motion information of at most one other spatial motion vector prediction candidate of the set of spatial motion vector prediction candidates *(i.e. Each pass in the proposed ME scheme is performed using one of the PMV predictor patterns (see Fig. 3) and then one MVin the selected PMV pattern which has minimal distortion is selected as the final PMV of this pass- Page 190; Col 1, ¶ 5).*

Regarding claim 11, Han, Tai and Huang teach all the limitations of claim 9. Han further teaches:

comprising examining whether the received encoded block of pixels is divided into a first prediction unit and a second prediction unit *(i.e. tu size flag is equal to one)*; and if so, excluding the potential spatial motion vector prediction candidate from the merge list *(i.e. the transform may be applied to the residue generated by multiple PU partitions with different motion vectors or prediction methods)* if the prediction unit is the second prediction unit *(i.e. When the tu size flag is equal to zero, the TU size is set equal to that of the CU which it belongs to. When tu size flag is equal to one, the TU size is set as N × N for symmetric PU splitting's and*

N/2 × N/2 for asymmetric PU splitting's, respectively. This ensures that the transform which is not applied across motion boundaries can be tested in the rate-distortion optimization process for asymmetric PU partitions. It should be noted that the transform may be applied to the residue generated by multiple PU partitions with different motion vectors or prediction methods- Page 1711, ¶ 4-5)

Regarding claim 12, Han and Tai teach all the limitations of claim 9. Han further teaches:

further comprising determining a maximum number *(i.e. N)* of spatial motion vector prediction candidates to be included in a merge *(i.e. A')* list *(i.e. Fig. 3 shows the spatially adjacent motion vectors which can be considered the candidate for the prediction. Let* $A = \{\mathbf{a}_0, \mathbf{a}_1, \ldots, \mathbf{a}_N\}$, $A' \subset A$, *and* $I_{A'}$ *denote the set of motion vectors above the current PU, the set of the available motion vectors in A, and the set which includes the indices of the elements in A' respectively- page 1712, col 2, ¶ 3)*; and

limiting the number *(i.e.* $A' \subset A$*)* of spatial motion vector prediction candidates in the merge list smaller or equal to the maximum number *(i.e. The set of the available motion vectors, A', is derived from A by verifying whether the corresponding reference index is the same as that of the current PU partition- page 1712, col 2, ¶ 3).*

Regarding claim 13, Han, Tai and Huang teach all the limitations of claim 12.

Han further teaches:

comprising:

examining *(i.e. When A'= Ø, the candidate motion vector **a** from A' is excluded from the candidate set, and a zero vector is used when taking the median of spatial motion vector predictors- Page 1712, ¶ 3)*, if the number of spatial motion vector prediction candidates in the merge list smaller *(i.e. if the subset of A' is not the empty set must be a smaller set of A- page 1712, ¶ 3)* than the maximum number *(i.e. When A'= Ø, the candidate motion vector **a** from A' is excluded from the candidate set, and a zero vector is used when taking the median of spatial motion vector predictors. The candidate motion vectors **b** and **c** from B = {**b**0… **b**$_M$} and C = {**c**0, **c**1, **c**2} are also determined using the same algorithm, and the resulting spatially adjacent motion vectors are used in the proposed AMVP method.- Page 1712, ¶ 3)*;

if so, examining whether a prediction unit to which the potential spatial motion vector prediction candidate belongs is available for motion prediction *(i.e. The set of the available motion vectors, A' is derived from A by verifying whether the corresponding reference index is the same as that of the current PU partition- Page 1712, ¶ 3)*;

if so, performing at least **<u>one</u>** of the following *(i.e. The overhead for signaling the index of the best predictor is reduced by re-organizing the set of candidate predictors- page 1712, ¶ 4)*:

for the potential spatial motion vector prediction candidate on the left side of the prediction unit, excluding *(i.e.* ***can be excluded****- page 1712, ¶ 4)* the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled *(i.e.* ***duplicate predictors*** *and the predictors which* ***can be excluded*** *based on the parsed* ***MVD*** *values at the decoder side are eliminated from the set- page 1712, ¶ 4)*:

- the received encoded block of pixels is vertically divided into a first prediction unit and a second prediction unit, and the prediction unit is the second prediction unit;

- the received encoded block of pixels is horizontally divided into a first prediction unit and a second prediction unit, and if the prediction unit is the second prediction unit, and the potential spatial motion vector prediction candidate has essentially similar *(i.e. duplicate- page 1712, ¶ 4)* motion information than the spatial motion vector prediction candidate above the prediction unit *(i.e.* ***duplicate predictors*** *and the predictors which can be excluded based on the parsed* ***MVD*** *values at the decoder side are eliminated from the set- page 1712, ¶ 4)*;

for the potential spatial motion vector prediction candidate above the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled:

- the received encoded block of pixels is horizontally divided into a first prediction unit and a second prediction unit, and the prediction unit is the second prediction unit;
- the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit;

for the potential spatial motion vector prediction candidate, which is on the right side of the potential spatial motion vector prediction candidate above the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate above the prediction unit;

Note: The claim has been interpreted to the Examiner's best abilities for prior reference rejection despite the multiple 112(b) issues it presents.

Regarding claim 14, Han and Tai teach all the limitations of claim 9. Han further teaches:

comprising selecting one motion vector prediction candidate *(i.e. the best predictor is selected)* from the merge list to represent a motion vector prediction for the received encoded block of pixels*(i.e. the best predictor is selected from a given set through rate-distortion optimization- Page 1712, Col 2, ¶ 1).*

Regarding claim 15 and 19, apparatus claim 15 and 19 is drawn to the apparatus using/performing the same method as claimed in claim 1. Therefore apparatus claim 15 and 19 corresponds to method claim 1, and is rejected for the same reasons of obviousness as used above.

Regarding claim 16 and 20, apparatus claim 16 and 20 is drawn to the apparatus using/performing the same method as claimed in claim 9. Therefore apparatus claim 16 and 20 corresponds to method claim 9, and is rejected for the same reasons of obviousness as used above.

Regarding claim 17, computer-readable medium storing instructions claim 17 corresponds to the same method as claimed in claim 1, and therefore is also rejected for the same reasons of obviousness as listed above.

Regarding claim 18, computer-readable medium storing instructions claim 50 corresponds to the same method as claimed in claim 9, and therefore is also rejected for the same reasons of obviousness as listed above.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP

§ 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to CLIFFORD HILAIRE whose telephone number is (571)272-8397. The examiner can normally be reached on Monday-Friday- 0800-1700, EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Sathyanarayanan Perungavoor can be reached on (571)272-7455. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/C. H./
Examiner, Art Unit 2488

/Geepy Pe/
Primary Examiner, Art Unit 2488
2/24/16

Index of Claims	Application/Control No. 13666680	Applicant(s)/Patent Under Reexamination BICI ET AL.
	Examiner CLIFFORD HILAIRE	Art Unit 2488

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	06/26/2015	02/22/2016							
	1	✓	✓							
	2	✓	✓							
	3	✓	✓							
	4	✓	✓							
	5	✓	✓							
	6	✓	✓							
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	18	✓	✓							
	19	✓	✓							
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Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13666680	BICI ET AL.
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CPC- SEARCHED

Symbol	Date	Examiner
H04N19/52; H04N19/513; H04N19/176; H04N19/61; H04N19/51; H04N19/597; H04N19/56; H04N19/139; H04N19/573; H04N19/521; H04N19/103; H04N19/30	6/25/2015	CH

CPC COMBINATION SETS - SEARCHED

Symbol	Date	Examiner

US CLASSIFICATION SEARCHED

Class	Subclass	Date	Examiner
375	240	6/25/2015	CH

SEARCH NOTES

Search Notes	Date	Examiner
See Attached EAST Search History Document	2/24/2016	CH
IEEEXplore Search	2/24/2016	CH
Google Scholar	2/24/2016	CH

INTERFERENCE SEARCH

US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner

/CLIFFORD HILAIRE/
Examiner.Art Unit 2488

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S3	9	((Mehmet) near2 (BICI)).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/24 17:00
S4	85	((Jani) near2 (LAINEMA)).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/24 17:00
S5	59	((Kemal) near2 (UGUR)).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/24 17:00
S6	4	("20110170602" | "20120307905").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/06/25 09:41
S7	2	("20110170602" | "20120307905").PN.	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/25 09:41
S8	9	((Mehmet) near2 (BICI)).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/25 09:43
S9	85	((Jani) near2 (LAINEMA)).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/25 09:43
S10	59	((Kemal) near2 (UGUR)).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/25 09:43
S11	104	S8 S9 S10	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/25 09:43
S12	45	S11 and merg$4	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/25 09:43
S13	12	S11 and merg$4 near list$4	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/25 09:44
S14	45	S11 and merg$4	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/25 09:44
S15	18	S11 and merg$4 same candidate	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/25 10:10
S16	67	S11 and candidate	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/25 10:11
S17	63	S11 and candidate with motion	US-PGPUB; USPAT;	OR	ON	2015/06/25 10:13

			USOCR			
S18	55	S11 and candidate with motion with vector	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/25 10:13
S19	45	S11 and candidate with motion with vector same block	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/25 10:14
S20	28	S11 and (candidate and list and vector)	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/25 10:15
S21	5805	S11 and (candidate and list and vector)".clm"	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/25 10:15
S22	4	S11 and (candidate and list and vector).clm.	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/25 10:15
S23	1	"20130114723".pn.	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/25 10:52
S24	1	"20130114723".pn. and (candidate with vector with motion) same (merg$4 set list subset)	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/25 10:53
S25	1812	(candidate with vector with motion) same (merg$4 set list subset)	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/25 10:55
S26	27634	((H04N19/52 OR H04N19/513 OR H04N19/176 OR H04N19/61 OR H04N19/51 OR H04N19/597 OR H04N19/56 OR H04N19/139 OR H04N19/573 OR H04N19/521 OR H04N19/103 OR H04N19/30).CPC.)	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/25 10:57
S27	1	"20130034162".pn.	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/25 11:08
S28	1	"20130034162".pn. and (candidate with motion with vector)	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/25 11:16
S29	1	"20130034162".pn. and (candidate with motion with vector) same block	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/25 11:17
S30	1	"20130034162".pn. and (candidate)	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/25 11:18
S31	1	"20130034162".pn. and (candidate) and (list set subset)	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/25 11:19
S32	1	"20130034162".pn. and (candidate same block) and (list set subset)	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/25 11:19
S33	1274	(candidate with vector with motion) same (merg$4 set list subset) and (motion vector) with search$4	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/25 11:32
S34	1064	(candidate with vector with motion) same (merg$4 set list subset) and (motion vector) near4 search$4	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/25 11:32
S35	888	(candidate with vector with motion) with (merg$4 set list subset) and	US-PGPUB; USPAT;	OR	ON	2015/06/25 11:32

		(motion vector) near4 search$4	USOCR			
S36	618	(candidate with vector with motion) near4 (merg$4 set list subset) and (motion vector) near4 search$4	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/25 11:33
S37	112	(candidate with vector with motion) near4 (merg$4 set list subset) same (motion vector) near4 search$4	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/25 11:33
S38	92	(candidate with vector with motion) near4 (merg$4 set list subset) same (motion vector) near4 search$4 and "375".clas.	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/25 11:33
S39	150592	(candidate with vector with motion) near4 (merg$4 set list subset) same (motion vector) near4 search$4 same block "375".clas.	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/25 11:33
S40	51	(candidate with vector with motion) near4 (merg$4 set list subset) same (motion vector) near4 search$4 same block and "375".clas.	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/25 11:34
S41	8	(candidate with vector with motion) near4 (merg$4 set list subset) same (motion vector) near4 search$4 same block and subset and "375".clas.	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/25 11:42
S42	2	(candidate with vector with motion) near4 (merg$4 set list subset) same (motion vector) near4 search$4 same block and subset and (remov$4 exclud$4) with (list set merg$4 subset)	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/25 11:45
S43	50	("5719627" "5815602" "4989089" "5428403" "5781249" "5838391" "4851906" "4989087" "5235419" "5371549" "5414469" "5457481" "5506622" "5521642" "5532746" "5546129" "5557341" "5574663" "5579050" "5581308" "5587741" "5598216" "5612743" "5614954" "5617144" "5619281" "5625417" "5627591" "5638129" "5642166" "5646867" "5654761" "5689306" "5694487" "5717463" "5719630" "5724369" "5731851" "5751362" "5862261" "5903672" "5991447" "6005980" "6020925" "6023298" "6026195" "6057884" "6091777" "6154519" "6205177").pn.	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/25 13:29
S44	25	S43 and (candidate same motion)	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/25 13:30
S45	0	S43 and (candidate same motion) and merg$4	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/25 13:30
S46	4	S43 and (candidate same motion) and exclud$4	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/25 13:31
S47	4	S43 and (candidate) with (vector motion) and exclud$4	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/25 13:32
S48	3	(US-20130034162-$ or US-	US-PGPUB	OR	ON	2015/06/25

		20120106645-$ or US-20120106638-$).did.				13:44
S49	0	S48 and "PU "	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/06/25 13:44
S50	2	S48 and prediction with unit	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/06/25 13:44
S52	9	((Mehmet) near2 (BICI)).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/26 06:02
S53	85	((Jani) near2 (LAINEMA)).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/26 06:02
S54	59	((Kemal) near2 (UGUR)).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/26 06:02
S55	104	S52 S53 S54	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/26 06:02
S56	55	S55 and candidate with motion with vector	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/26 06:02
S57	10	S55 and candidate with motion with vector and transcod$4	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/26 06:03
S58	8	S55 and candidate with motion with vector and transcod$4 and encod$4	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/26 06:04
S59	53	S55 and candidate with motion with vector and encod$4	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/26 06:05
S60	29	S55 and candidate with motion with vector same encod$4	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/26 06:05
S61	24	S55 and candidate with motion with vector same encod$4 and unit and (block macroblock)	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/26 06:07
S62	18	S55 and candidate with motion with vector same encod$4 and (unit near predict$5) and (block macroblock)	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/26 06:10
S63	23	S55 and prediction near unit	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/26 06:11
S64	22	S55 and prediction near unit and candidate	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/26 06:11
S65	872	prediction near unit and candidate near4 motion near4 vector	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/26 06:14

S66	713	prediction near unit and candidate near4 motion near4 vector same block	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/26 06:14
S67	653	prediction near unit and candidate near4 motion near4 vector with block	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/26 06:14
S68	172	prediction near unit same candidate near4 motion near4 vector with block	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/26 06:14
S69	42	prediction near unit same candidate near4 motion near4 vector with block same encoded	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/26 06:15
S70	32	("prediction unit" PU) with block with encoded same candidate near4 motion near4 vector	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/26 06:17
S71	483	PU and candidate with motion with vector	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/26 06:35
S72	209	PU same candidate with motion with vector	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/26 06:36
S73	160	PU same candidate with motion with vector same block	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/26 06:36
S74	142	PU same candidate with motion with vector same block and "375".clas.	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/26 06:36
S75	1	(US-20120134415-$).did.	US-PGPUB	OR	ON	2015/06/26 07:05
S76	0	S75 and encoded	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/26 07:05
S77	0	S75 and encod$4 with block	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/26 07:05
S78	1	S75 and coded with block	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/26 07:05
S79	126	PU same candidate with motion with vector same block and merge with list	US-PGPUB; USPAT; USOCR	OR	ON	2015/06/26 07:06
S80	1	(US-20120008688-$).did.	US-PGPUB	OR	ON	2015/06/26 08:47
S81	1	(US-20120008688-$).did.	US-PGPUB	OR	ON	2015/06/26 08:52
S82	1	(US-20120008688-$).did. and (PU prediction near unit)	US-PGPUB	OR	ON	2015/06/26 08:53
S83	1	(US-20120008688-$).did. and (PU prediction near unit) and receiv$4	US-PGPUB	OR	ON	2015/06/26 08:54
S84	1	(US-20120008688-$).did. and (PU prediction near unit) and (encod$4 cod$4 decod$4 receiv$4)	US-PGPUB	OR	ON	2015/06/26 08:55
S85	3	"20130114723".pn.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	OR	ON	2016/02/19 16:31

			DERWENT; IBM_TDB			
S86	2	"20130114723".pn. and exclud$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/02/19 16:33
S87	2	"20130114723".pn. and "merge list"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/02/19 16:34
S88	2	"20130114723".pn. and "merge list" same compar$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/02/19 16:37
S89	0	"20130114723".pn. and "merge list" same "not" near includ$3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/02/19 16:40
S90	0	"20130114723".pn. and "merge list" same "not" near3 includ$3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/02/19 16:40
S91	1	"20130114723".pn. and "merge list" same2 compare	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/02/19 16:42
S92	2	"20130114723".pn. and "merge list" same2 compar$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/02/19 16:42
S93	1	"20130114723".pn.	US-PGPUB; USPAT; USOCR	OR	ON	2016/02/23 11:08
S94	1	"20130114723".pn. and "5a"	US-PGPUB; USPAT; USOCR	OR	ON	2016/02/23 11:10
S95	1	"20130114723".pn. and "90"?	US-PGPUB; USPAT; USOCR	OR	ON	2016/02/23 12:02

S97	1	"20120236942".pn.	US-PGPUB; USPAT; USOCR	OR	ON	2016/02/23 14:45
S98	1	"20120236942".pn. and (left upper right above)	US-PGPUB; USPAT; USOCR	OR	ON	2016/02/23 14:51
S99	1	"20120236942".pn. and (left upper right above lower)	US-PGPUB; USPAT; USOCR	OR	ON	2016/02/23 15:07
S100	1	"20130114723".pn. and "90"? and "A"? and "B"?	US-PGPUB; USPAT; USOCR	OR	ON	2016/02/23 15:12
S101	1	"20120236942".pn. and (left upper right above lower) and merg$4	US-PGPUB; USPAT; USOCR	OR	ON	2016/02/23 15:31
S102	1	"20120236942".pn. and (left upper right above lower) and merg$4 and remov$4	US-PGPUB; USPAT; USOCR	OR	ON	2016/02/23 15:33
S103	28401	"20120236942".pn. and (left upper right above lower) and merg$4 and remov$4 "b.sub.0"	US-PGPUB; USPAT; USOCR	OR	ON	2016/02/23 15:34
S104	1	"20120236942".pn. and (left upper right above lower) and merg$4 and remov$4 and "b.sub.0"	US-PGPUB; USPAT; USOCR	OR	ON	2016/02/23 15:35
S105	1	"20120236942".pn. and (left upper right above lower top) and merg$4 and remov$4 and "b.sub.0"	US-PGPUB; USPAT; USOCR	OR	ON	2016/02/23 15:35
S106	1	"20120236942".pn. and (left upper right above lower top bottom) and merg$4 and remov$4 and "b.sub.0"	US-PGPUB; USPAT; USOCR	OR	ON	2016/02/23 15:36
S107	1	"20130230103".pn.	US-PGPUB; USPAT; USOCR	OR	ON	2016/02/23 15:45
S108	644	"merge list"	US-PGPUB; USPAT; USOCR	OR	ON	2016/02/23 15:54
S109	142	"merge list" same candidate	US-PGPUB; USPAT; USOCR	OR	ON	2016/02/23 15:54
S110	51	"merge list" same candidate same spatial	US-PGPUB; USPAT; USOCR	OR	ON	2016/02/23 15:54
S111	252	merg$4 near2 (list set) same candidate same spatial	US-PGPUB; USPAT; USOCR	OR	ON	2016/02/23 15:55
S112	221	merg$4 near2 (list set) same candidate with spatial	US-PGPUB; USPAT; USOCR	OR	ON	2016/02/23 15:55
S113	62	merg$4 near2 (list set) same candidate with spatial same (remov$4 exclud$4 flag)	US-PGPUB; USPAT; USOCR	OR	ON	2016/02/23 15:56
S114	527	"merge mode" same skip	US-PGPUB; USPAT; USOCR	OR	ON	2016/02/23 16:02
S115	252	"merge mode" same skip same (candidate potential)	US-PGPUB; USPAT; USOCR	OR	ON	2016/02/23 16:02

S116	193	"merge mode" same skip same (candidate potential) same vector	US-PGPUB; USPAT; USOCR	OR	ON	2016/02/23 16:03
S117	190	"merge mode" same skip same (candidate potential) same vector near3 motion	US-PGPUB; USPAT; USOCR	OR	ON	2016/02/23 16:03
S118	182	"merge mode" same skip same (candidate potential) same vector near3 motion and spatial	US-PGPUB; USPAT; USOCR	OR	ON	2016/02/23 16:03
S119	1	(US-20120134415-$).did.	US-PGPUB	OR	ON	2016/02/23 16:05

2/24/2016 10:30:33 AM
C:\Users\chilaire\Documents\EAST\Workspaces\13666680.wsp

Substitute for form SB08 (Revised 07/09)	Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT *(Use as many sheets as necessary)*	Application Number	13/666,680
	Filing Date	November 1, 2012
	First Named Inventor	Bici et al.
	Art Unit	2488
	Examiner Name	Clifford Hilaire
Sheet *1* of *1*	Attorney Docket Number	042933/467264

OTHER DOCUMENTS

Examiner Initials*	Cite No.	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s) , volume-issue number(s), publisher, city and/or country where published.	English Language Translation Attached
	1	Extended European Search Report for corresponding European Application No. 12845839.5 dated March 21, 2016, 10 pages	
	2	**Nakamura, H. et al.**, *Unification of derivation process for merge mode and MVP*, Joint Collaborative Team on Video Coding (JCT-VC) of ITU-T SG16 WP3 and ISO/IEC JTC1/SC29/WG11, 6th Meeting; Torino, IT, 14-22 July, 2011; Document JCTVC-F419; URL: http://wftp3.itu.int/AV-ARCH/JCTVC-SITE/2011_07_F_Torino/, 10 pages	
	3	**Zheng, Y. et al**., *Merge Candidate Selection in 2NxN, Nx2N, and NxN Mode*, Joint Collaborative Team on Video Coding (JCT-VC) of ITU-T SG16 WP3 and ISO/IEC JTC1/SC29/WG11, 6th Meeting, Torino, IT, 14-22 July, 2011; Document JCTVC-F302, 6 pages	
	4	**Bross, B. et al.**, *Core Experiment 9: MV Coding and Skip/Merge Operations*, Joint Collaborative Team on Video Coding (JCT-VC) of ITU-T SG16 WP3 and ISO/IEC JTC1/SC29/WG11, 6th Meeting, Torino, IT, 14-22 July, 2011; Document JCTVC-F909, 13 pages	
	5	**Jeon, Y. et al**., *On MVP list pruning process*, Joint Collaborative Team on Video Coding (JCT-VC) of ITU-T SG16 WP3 and ISO/IEC JTC1/SC29/WG11, 6th Meeting, Torino, IT, 14-22 July, 2011, Document JCTVC-F105, 7 pages	
	6	**Bici, O. et al.**, *Non-CE13: Simplification of merge mode*, Joint Collaborative Team on Video Coding (JCT-VC) of ITU-T SG16 WP3 and ISO/IEC JTC1/SC29/WG11, 7th Meeting: Geneva, CH, 21-30 November, 2011, Document JCTVC-G593; URL: HTTP://WFTP3.ITU.INT/AV-ARCH/JCTVC-SITE/, 13 pages	

Examiner Signature		Date Considered	

*Examiner: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. LEGAL02/32811780v3

Submitted April 25, 2016

Electronic Acknowledgement Receipt

EFS ID:	25582769
Application Number:	13666680
International Application Number:	
Confirmation Number:	4782
Title of Invention:	METHOD FOR CODING AND AN APPARATUS
First Named Inventor/Applicant Name:	Mehmet Oguz BICI
Customer Number:	10949
Filer:	Guy Randall Gosnell/Jennifer Son
Filer Authorized By:	Guy Randall Gosnell
Attorney Docket Number:	042933/467264
Receipt Date:	25-APR-2016
Filing Date:	01-NOV-2012
Time Stamp:	11:57:03
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$180
RAM confirmation Number	10067
Deposit Account	160605
Authorized User	Son, Jennifer

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

Charge any Additional Fees required under 37 CFR 1.16 (National application filing, search, and examination fees)

Charge any Additional Fees required under 37 CFR 1.17 (Patent application and reexamination processing fees)

Charge any Additional Fees required under 37 CFR 1.19 (Document supply fees)

Charge any Additional Fees required under 37 CFR 1.20 (Post Issuance fees)

Charge any Additional Fees required under 37 CFR 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		467264IDS.pdf	55539 2d8a67e936197b231403b2c5f2527a0e64077a81	yes	2

Multipart Description/PDF files in .zip description

Document Description	Start	End
Transmittal Letter	1	1
Information Disclosure Statement (IDS) Form (SB08)	2	2

Warnings:

Information:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
2	Non Patent Literature	467264EPSearchReport.pdf	409069 18bcd27e8123f6fb6e1cf16a492a8efcf6456fba	no	10

Warnings:

Information:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
3	Non Patent Literature	467264Nakamura.pdf	111757 b48f442aa41baa31284cd4d6f51e92bcbdff93fa	no	10

Warnings:

Information:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
4	Non Patent Literature	467264Zheng.pdf	71392 0e99b072d5795e76a4c8b9cf52152094370fefbc	no	6

Warnings:

Information:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
5	Non Patent Literature	467264Jeon.pdf	189110 152b68a3d2351235d1a13b37ab011b7526be04c7	no	7

Warnings:

Information:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
6	Non Patent Literature	467264Bici.pdf	151614 26faa339bbc8cc9472aa2ca49c403dc615a13dd1	no	13

Warnings:

Information:

7	Non Patent Literature	467264Bross.pdf	141579 fbcd49e67ab749f018fe313b5b018ca5dffa7a1b	no	11
Warnings:					
Information:					
8	Fee Worksheet (SB06)	fee-info.pdf	30676 f625f35af130b8f9315ab07547d4f4712386c286	no	2
Warnings:					
Information:					
			Total Files Size (in bytes):	1160736	

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

<u>New Applications Under 35 U.S.C. 111</u>
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

<u>National Stage of an International Application under 35 U.S.C. 371</u>
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

<u>New International Application Filed with the USPTO as a Receiving Office</u>
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Attorney's Docket No. 042933/467264

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re:	Bici et al.	Confirmation No.:	4782
Appl. No.:	13/666,680	Group Art Unit:	2488
Filed:	November 1, 2012	Examiner:	Clifford Hilaire
For:	METHOD FOR CODING AND AN APPARATUS		

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

INFORMATION DISCLOSURE STATEMENT
UNDER 37 C.F.R. § 1.97(d)

This Information Disclosure Statement is being filed after a Final Office Action under 37 C.F.R. § 1.113. The Final Office Action was mailed on March 1, 2016.

Attached is a list of documents on form SB08 along with any cited foreign patent documents and non-patent literature documents in accordance with 37 CFR 1.98(a)(2). Also enclosed is a translation or a concise explanation of each non-English language document.

By identifying the listed documents, Applicant in no way makes any admission as to the prior art status of the listed documents, but is instead identifying the listed documents for the sake of full disclosure.

In accordance with the requirements of 37 C.F.R. § 1.97(d)(2), the following statement as specified in 37 C.F.R. § 1.97(e) is made:

Each item of information contained in this statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three (3) months prior to the filing of this statement.

The $180.00 fee specified in 37 C.F.R. § 1.17(p) is being paid at the time of e-filing. The Commissioner is authorized to charge any additional fee, or credit any refund, to our Deposit Account No. 16-0605.

Respectfully submitted,

/Guy R. Gosnell/

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Electronic Patent Application Fee Transmittal

Application Number:	13666680
Filing Date:	01-Nov-2012
Title of Invention:	METHOD FOR CODING AND AN APPARATUS
First Named Inventor/Applicant Name:	Mehmet Oguz BICI
Filer:	Guy Randall Gosnell/Jennifer Son
Attorney Docket Number:	042933/467264

Filed as Large Entity

Filing Fees for **Utility under 35 USC 111(a)**

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
Submission- Information Disclosure Stmt	1806	1	180	180
		Total in USD ($)		**180**

PATENT

RESPONSE UNDER 37 C.F.R. 1.116 - EXPEDITED PROCEDURE - EXAMINING GROUP 2488

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appl. No.:	13/666,680	Confirmation No.: 4782
Applicant(s):	Bici et al.	
Filed:	November 1, 2012	
Art Unit:	2488	
Examiner:	Clifford Hilaire	
Title:	METHOD FOR CODING AND AN APPARATUS	

Docket No.:	042933/467264
Customer No.:	10949

Mail Stop AF
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

AMENDMENT AFTER FINAL UNDER 37 CFR § 1.116

In response to the Final Office Action dated March 1, 2016, please amend the above-identified application as follows:

Amendments to the Claims are reflected in the listing of claims beginning on page 2 of this paper.

Remarks begin on page 13 of this paper.

Doc Code: A.NE.AFCP
Document Description: After Final Consideration Pilot Program Request

PTO/SB/434 (05-13)

CERTIFICATION AND REQUEST FOR CONSIDERATION UNDER THE AFTER FINAL CONSIDERATION PILOT PROGRAM 2.0

Practitioner Docket No.:	Application No.:	Filing Date:
042933/467264	13/666680	11/1/12
First Named Inventor:	Title:	
Bici et al.	METHOD FOR CODING AND AN APPARATUS	

APPLICANT HEREBY CERTIFIES THE FOLLOWING AND REQUESTS CONSIDERATION UNDER THE AFTER FINAL CONSIDERATION PILOT PROGRAM 2.0 (AFCP 2.0) OF THE ACCOMPANYING RESPONSE UNDER 37 CFR 1.116.

1. The above-identified application is (i) an original utility, plant, or design nonprovisional application filed under 35 U.S.C. 111(a) [a continuing application (*e.g.*, a continuation or divisional application) is filed under 35 U.S.C. 111(a) and is eligible under (i)], or (ii) an international application that has entered the national stage in compliance with 35 U.S.C. 371(c).
2. The above-identified application contains an outstanding final rejection.
3. Submitted herewith is a response under 37 CFR 1.116 to the outstanding final rejection. The response includes an amendment to at least one independent claim, and the amendment does not broaden the scope of the independent claim in any aspect.
4. This certification and request for consideration under AFCP 2.0 is the only AFCP 2.0 certification and request filed in response to the outstanding final rejection.
5. Applicant is willing and available to participate in any interview requested by the examiner concerning the present response.
6. This certification and request is being filed electronically using the Office's electronic filing system (EFS-Web).
7. Any fees that would be necessary consistent with current practice concerning responses after final rejection under 37 CFR 1.116, *e.g.*, extension of time fees, are being concurrently filed herewith. [There is no additional fee required to request consideration under AFCP 2.0.]
8. By filing this certification and request, applicant acknowledges the following:

- Reissue applications and reexamination proceedings are not eligible to participate in AFCP 2.0.
- The examiner will verify that the AFCP 2.0 submission is compliant, *i.e.*, that the requirements of the program have been met (see items 1 to 7 above). For compliant submissions:
  - The examiner will review the response under 37 CFR 1.116 to determine if additional search and/or consideration (i) is necessitated by the amendment and (ii) could be completed within the time allotted under AFCP 2.0. If additional search and/or consideration is required but cannot be completed within the allotted time, the examiner will process the submission consistent with current practice concerning responses after final rejection under 37 CFR 1.116, *e.g.*, by mailing an advisory action.
  - If the examiner determines that the amendment does not necessitate additional search and/or consideration, or if the examiner determines that additional search and/or consideration is required and could be completed within the allotted time, then the examiner will consider whether the amendment places the application in condition for allowance (after completing the additional search and/or consideration, if required). If the examiner determines that the amendment does not place the application in condition for allowance, then the examiner will contact the applicant and request an interview.
    - The interview will be conducted by the examiner, and if the examiner does not have negotiation authority, a primary examiner and/or supervisory patent examiner will also participate.
    - If the applicant declines the interview, or if the interview cannot be scheduled within ten (10) calendar days from the date that the examiner first contacts the applicant, then the examiner will proceed consistent with current practice concerning responses after final rejection under 37 CFR 1.116.

Signature	Date
/Guy R. Gosnell/	2016-07-01
Name (Print/Typed) Guy R. Gosnell	Practitioner Registration No. 34610

***Note**: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. Submit multiple forms if more than one signature is required, see below*.*

☐ * Total of ________ forms are submitted.

Amendments to the Claims:

1. (Currently Amended) A method comprising:

receiving a block of pixels including a prediction unit;

determining a set of spatial motion vector prediction candidates for the block of pixels; the spatial motion vector prediction candidates being provided with motion information;

selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit, where the merge list is selected based on the motion information;

determining a subset of spatial motion vector prediction candidates based on the location of the block associated with the first spatial motion vector prediction candidate;

comparing motion information of the first spatial motion vector prediction candidate with motion information of spatial motion vector prediction candidates in the determined subset of spatial motion vector prediction candidates without making a comparison with other spatial motion vector prediction candidates that are not included within the subset; and

if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other, excluding the first spatial motion vector prediction candidate from the merge list.

2. (Original) The method according to claim 1 comprising selecting spatial motion vector prediction candidates from the set of spatial motion vector prediction candidates as the potential spatial motion vector prediction candidate in a predetermined order.

3. (Original) The method according to claim 1 , comprising comparing motion information of the potential spatial motion vector prediction candidate with motion information of at most one other spatial motion vector prediction candidate of the set of spatial motion vector prediction candidates.

4. (Original) The method according to claim 1 comprising examining whether the received block of pixels is divided into a first prediction unit and a second prediction unit; and if so, excluding the potential spatial motion vector prediction candidate from the merge list if the prediction unit is the second prediction unit.

5. (Original) The method according to claim 1, further comprising

determining a maximum number of spatial motion vector prediction candidates to be included in a merge list; and

limiting the number of spatial motion vector prediction candidates in the merge list smaller or equal to the maximum number .

6. (Currently Amended) The method according to claim 5 comprising:

examining, if the number of spatial motion vector prediction candidates in the merge list smaller than the maximum number;

if so, examining whether [[a]] the prediction unit to which the potential spatial motion vector prediction candidate belongs is available for motion prediction;

if so, performing at least one of the following:

for [[the]] a potential spatial motion vector prediction candidate on [[the]] a left side of the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled:

- the received block of pixels is vertically divided into a first prediction unit and a second prediction unit~~, and the prediction unit is the second prediction unit~~;
- the received block of pixels is horizontally divided into a first prediction unit and a second prediction unit, and if the prediction unit is the second prediction unit, and the potential spatial motion vector prediction

candidate has essentially similar motion information than [[the]] a spatial motion vector prediction candidate above the prediction unit;

for [[the]] a potential spatial motion vector prediction candidate above the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled:

– the received block of pixels is horizontally divided into a first prediction unit and a second prediction unit, and the prediction unit is the second prediction unit;

– the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit;

for [[the]] a potential spatial motion vector prediction candidate, which is on [[the]] a right side of the potential spatial motion vector prediction candidate above the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate above the prediction unit;

for [[the]] a potential spatial motion vector prediction candidate, which is below the potential spatial motion vector prediction candidate on the left side of the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit;

for [[the]] a potential spatial motion vector prediction candidate cornerwise neighbouring the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled:

– all the other potential spatial motion vector prediction candidates have been included in the merge list;

– the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate above the prediction unit;

– the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit.

7. (Original) The method according to claim 1 further comprising including a temporal motion prediction candidate into the merge list.

8. (Original) The method according to claim 1 comprising selecting one motion vector prediction candidate from the merge list to represent a motion vector prediction for the block of pixels.

9. (Currently Amended) A method comprising:

receiving an encoded block of pixels including a prediction unit;

determining a set of spatial motion vector prediction candidates for the encoded block of pixels; the spatial motion vector prediction candidates being provided with motion information;

selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit, where the merge list is selected based on the motion information;

determining a subset of spatial motion vector prediction candidates based on the location of the block associated with the first spatial motion vector prediction candidate;

comparing motion information of the first spatial motion vector prediction candidate with motion information of another spatial motion vector prediction candidate of the set of spatial motion vector prediction candidates without making a comparison with other spatial motion vector prediction candidates that are not included within the subset; and

if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other, excluding the first spatial motion vector prediction candidate from the merge list.

10. (Original) The method according to claim 9 comprising comparing motion information of the potential spatial motion vector prediction candidate with motion information of at most one other spatial motion vector prediction candidate of the set of spatial motion vector prediction candidates.

11. (Original) The method according to claim 9 comprising examining whether the received encoded block of pixels is divided into a first prediction unit and a second prediction unit; and if so, excluding the potential spatial motion vector prediction candidate from the merge list if the prediction unit is the second prediction unit.

12. (Original) The method according to claim 9 further comprising

determining a maximum number of spatial motion vector prediction candidates to be included in a merge list; and

limiting the number of spatial motion vector prediction candidates in the merge list smaller or equal to the maximum number.

13. (Currently Amended) The method according to claim 12 comprising:

examining, if the number of spatial motion vector prediction candidates in the merge list smaller than the maximum number;

if so, examining whether [[a]] <u>the</u> prediction unit to which the potential spatial motion vector prediction candidate belongs is available for motion prediction;

if so, performing at least one of the following:

for [[the]] a potential spatial motion vector prediction candidate on [[the]] a left side of the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled:

– the received encoded block of pixels is vertically divided into a first prediction unit and a second prediction unit~~, and the prediction unit is the second prediction unit~~;

– the received encoded block of pixels is horizontally divided into a first prediction unit and a second prediction unit, and if the prediction unit is the second prediction unit, and the potential spatial motion vector prediction candidate has essentially similar motion information than [[the]] a spatial motion vector prediction candidate above the prediction unit;

for [[the]] a potential spatial motion vector prediction candidate above the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled:

– the received encoded block of pixels is horizontally divided into a first prediction unit and a second prediction unit, and the prediction unit is the second prediction unit;

– the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit;

for [[the]] a potential spatial motion vector prediction candidate, which is on [[the]] a right side of the potential spatial motion vector prediction candidate above the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate above the prediction unit;

for [[the]] a potential spatial motion vector prediction candidate, which is below the potential spatial motion vector prediction candidate on the left side of the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit; and

for [[the]] a potential spatial motion vector prediction candidate cornerwise neighbouring the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled:

– all the other potential spatial motion vector prediction candidates have been included in the merge list;

– the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate above the prediction unit;

– the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit.

14. (Original) The method according to claim 9 comprising selecting one motion vector prediction candidate from the merge list to represent a motion vector prediction for the received encoded block of pixels.

15. (Currently Amended) An apparatus comprising a processor and a memory including computer program code, the memory and the computer program code configured to, with the processor, cause the apparatus to:

receive a block of pixels including a prediction unit;

determine a set of spatial motion vector prediction candidates for the block of pixels; the spatial motion vector prediction candidates being provided with motion information;

select a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit, where the merge list is selected based on the motion information;

determine a subset of spatial motion vector-prediction candidates based on the location of the block associated with the first spatial motion vector prediction candidate;

compare motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates without making a comparison with other spatial motion vector prediction candidates that are not included within the subset; and

if at least one the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other, excluding the first spatial motion vector prediction candidate from the merge list.

16. (Currently Amended) An apparatus comprising a processor and a memory including computer program code, the memory and the computer program code configured to, with the processor, cause the apparatus to:

receive an encoded block of pixels including a prediction unit;

determine a set of spatial motion vector prediction candidates for the encoded block of pixels; the spatial motion vector prediction candidates being provided with motion information;

select a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit, where the merge list is selected based on the motion information;

determine a subset of spatial motion vector prediction candidates based on the location of the block associated with the first spatial motion vector prediction candidate;

compare motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates without making a comparison with other spatial motion vector prediction candidates that are not included within the subset; and

exclude the first spatial motion vector prediction candidate from the merge list, if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other

17. (Currently Amended) A non-transitory computer readable medium having stored thereon a computer executable program code for use by an encoder, said program codes comprise instructions for use by an encoder, said program code comprises instructions for:

receiving a block of pixels including a prediction unit;

determining a set of spatial motion vector prediction candidates for the block of pixels; the spatial motion vector prediction candidates being provided with motion information;

selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit, where the merge list is selected based on the motion information;

determining a subset of spatial motion vector prediction candidates based on the location of the block associated with the first spatial motion vector prediction candidate;

comparing motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates without making a comparison with other spatial motion vector prediction candidates that are not included within the subset; and

if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other, excluding the first spatial motion vector prediction candidate from the merge list.

18. (Currently Amended) A non-transitory computer readable medium having stored thereon a computer executable program code for use by an encoder, said program codes comprise instructions for use by an encoder, said program code comprises instructions for:

receiving an encoded block of pixels including a prediction unit;

determining a set of spatial motion vector prediction candidates for the encoded block of pixels; the spatial motion vector prediction candidates being provided with motion information;

selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit, where the merge list is selected based on the motion information;

determining a subset of spatial motion vector prediction candidates based on the location of the block associated with the first spatial motion vector prediction candidate;

comparing motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates without making a comparison with other spatial motion vector prediction candidates that are not included within the subset; and

if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other, excluding the first spatial motion vector prediction candidate from the merge list.

19. (Currently Amended) An apparatus comprising:

means for receiving a block of pixels including a prediction unit;

means for determining a set of spatial motion vector prediction candidates for the block of pixels; the spatial motion vector prediction candidates being provided with motion information;

means for selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit, where the merge list is selected based on the motion information;

means for determining a subset of spatial motion vector prediction candidates based on the location of the block associated with the first spatial motion vector prediction candidate;

means for comparing motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates without making a comparison with other spatial motion vector prediction candidates that are not included within the subset; and

means for excluding the first spatial motion vector prediction candidate from the merge list, if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other.

20. (Currently Amended) An apparatus comprising:

means for receiving an encoded block of pixels including a prediction unit;

means for determining a set of spatial motion vector prediction candidates for the encoded block of pixels; the spatial motion vector prediction candidates being provided with motion information;

means for selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit, where the merge list is selected based on the motion information;

means for determining a subset of spatial motion vector prediction candidates based on the location of the block associated with the first spatial motion vector prediction candidate;

means for comparing motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates without making a comparison with other spatial motion vector prediction candidates that are not included within the subset; and

means for excluding the first spatial motion vector prediction candidate from the merge list, if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other.

Electronic Acknowledgement Receipt

EFS ID:	26242185
Application Number:	13666680
International Application Number:	
Confirmation Number:	4782
Title of Invention:	METHOD FOR CODING AND AN APPARATUS
First Named Inventor/Applicant Name:	Mehmet Oguz BICI
Customer Number:	10949
Filer:	Guy Randall Gosnell/Lauren Martin
Filer Authorized By:	Guy Randall Gosnell
Attorney Docket Number:	042933/467264
Receipt Date:	01-JUL-2016
Filing Date:	01-NOV-2012
Time Stamp:	15:05:24
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$200
RAM confirmation Number	070516INTEFSW00002226160605
Deposit Account	160605
Authorized User	Lauren Martin

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

37 CFR 1.16 (National application filing, search, and examination fees)

37 CFR 1.17 (Patent application and reexamination processing fees)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		2016-07-01-467264-AmendAF-AFCP-AsFiled.PDF	272031 1baebd60cbbcec0935c82799c65aa6ac2b1c9154	yes	17

Multipart Description/PDF files in .zip description

Document Description	Start	End
Response After Final Action	1	1
Claims	2	12
Applicant Arguments/Remarks Made in an Amendment	13	16
After Final Consideration Program Request	17	17

Warnings:

Information:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
2	Fee Worksheet (SB06)	fee-info.pdf	30860 08f8a898cfff7c170be2f486b30584c8788eb2ee	no	2

Warnings:

Information:

Total Files Size (in bytes):	302891

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

<u>New Applications Under 35 U.S.C. 111</u>
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

<u>National Stage of an International Application under 35 U.S.C. 371</u>
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

<u>New International Application Filed with the USPTO as a Receiving Office</u>
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

REMARKS

Claim Rejections - 35 USC § 112

Claims 6 and 13 were rejected under 35 U.S.C. § 112(b) or 35 U.S.C. § 112 (pre-AIA), second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventor or a joint inventor, or for pre-AIA the applicant regards as the invention. Claims 6 and 13 were amended accordingly. No new matter is added by this amendment. The rejection of Claims 6 and 13 under 35 U.S.C. § 112(b) or 35 U.S.C. § 112 (pre-AIA), second paragraph, is therefore overcome.

Claim Rejections - 35 USC § 103

Claims 1, 2, 3, 4, 5, 6, 7, 9, 10, 11, 12, 14, 15, 16, 17, 18, 19, and 20 were rejected under pre-AIA 35 U.S.C. § 103(a) as being unpatentable over Woo-Jin Han et al. ("Improved video compression efficacy through flexible representation and corresponding extension of coding tools") in view of Shen-Chuan Tai et al ("A multi-pass true motion estimation scheme with motion vector propagation for frame rate up-conversion applications") and further in view of Ai-Mei Huang et al. (" A multistage motion vector processing method for motion-compensated frame interpolation")

The Office Action agrees that the Han does not teach or suggest the feature of "selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit; determining a subset of spatial motion vector prediction candidates based on the location of the block associated with the first spatial motion vector prediction candidate; comparing motion information of the first spatial motion vector prediction candidate with motion information of spatial motion vector prediction candidates in the determined subset of spatial motion vector prediction candidates; if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other, excluding the first spatial motion vector prediction candidate from the merge list," and cites Tai for these missing teachings from Han. (See the Office Action, page 10-11) Applicant respectfully asserts that Tai fails to cure the deficiencies of Han. While Applicants respectfully disagree with the above-noted rejections, Applicants have amended the independent claims to clarify and further distinguish the claims from the cited art. In this regard, the independent claims have been amended to recite that comparing motion information of the first spatial motion vector prediction candidate with motion information of spatial motion vector prediction candidates in the determined subset of spatial motion vector prediction candidates without making a comparison with other spatial motion vector prediction candidates that are not included within the subset. Support for the amendment is provided at least by paragraphs [0157]-[0159] and [0243] of the published application.

Applicant respectfully asserts that Tai fails to cure the deficiencies of Han. Specifically, the Office Action cites Col 1, ¶ 4-5 of Tai with respect to the rejection of these recitations of the independent claims (prior to their amendment). However, neither the cited portion nor any other portion of Tai teaches or suggests these elements. Instead, the cited portion describes selecting the minimum distortion in the current pass for reference in a future pass. Tai does not disclose or suggest various merge lists and the selection of certain merge list based on the motion information to store spatial motion vector prediction candidates. As such, Tai fails to teach or suggest excluding the spatial motion vector prediction candidate from the selected merge list. In addition, Tai does not teach or suggest such exclusion as Tai merely selects the PMV pattern with minimal distortion. Notably, Tai compares all the possible candidate pairs and does not teach or suggest comparing motion information of the first spatial motion vector prediction candidate with motion information of spatial motion vector prediction candidates in the determined subset of spatial motion vector prediction candidates without making a comparison with other spatial motion vector prediction candidates that are not included within the subset, as now recited by the amended independent claims.

Applicants therefore assert that none of the cited references and, therefore, no proper combination of the cited references teach or suggest: "comparing motion information of the first spatial motion vector prediction candidate with motion information of spatial motion vector prediction candidates in the determined subset of spatial motion vector prediction candidates without making a comparison with other spatial motion vector prediction candidates that are not included within the subset," as recited by independent Claims 1, 9, and 15-20. For each of the foregoing reasons, it is submitted that the rejection under pre-AIA 35 USC § 103(a) of the independent claims, as amended, as well as the claims which depend therefrom, is overcome.

CONCLUSION

In view of the amendments to the claims and the remarks presented above, it is respectfully submitted that all of the claims of the present application are in condition for immediate allowance. It is therefore respectfully requested that a Notice of Allowance be issued. The Examiner is encouraged to contact Applicant's undersigned attorney to resolve any remaining issues in order to expedite examination of the present application.

The patentability of the independent claims has been argued as set forth above and thus Applicants will not take this opportunity to argue the merits of the rejection with regard to specific dependent claims. However, Applicants do not concede that the dependent claims are not independently patentable and reserve the right to argue the patentability of dependent claims at a later date if necessary.

It is not believed that extensions of time or fees for net addition of claims are required, beyond those that may otherwise be provided for in documents accompanying this paper. However, in the event that additional extensions of time are necessary to allow consideration of this paper, such extensions are hereby petitioned under 37 CFR § 1.136(a), and any fee required therefor (including fees for net addition of claims) is hereby authorized to be charged to Deposit Account No. 16-0605.

Respectfully submitted,

/Guy R. Gosnell/

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ELECTRONICALLY FILED USING THE EFS-WEB ELECTRONIC FILING SYSTEM OF THE UNITED STATES PATENT & TRADEMARK OFFICE ON July 1, 2016

Electronic Patent Application Fee Transmittal

Application Number:	13666680
Filing Date:	01-Nov-2012
Title of Invention:	METHOD FOR CODING AND AN APPARATUS
First Named Inventor/Applicant Name:	Mehmet Oguz BICI
Filer:	Guy Randall Gosnell/Lauren Martin
Attorney Docket Number:	042933/467264

Filed as Large Entity

Filing Fees for **Utility under 35 USC 111(a)**

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension - 1 month with $0 paid	1251	1	200	200
Miscellaneous:				
		Total in USD ($)		**200**

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 13/666,680	Filing Date 11/01/2012	☐ To be Mailed

ENTITY: ☒ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED – PART I

FOR	NUMBER FILED (Column 1)	NUMBER EXTRA (Column 2)	RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).			
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL	

APPLICATION AS AMENDED – PART II

AMENDMENT	07/01/2016	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 20	Minus	** 20	= 0	x $80 =	0
	Independent (37 CFR 1.16(h))	* 8	Minus	***8	= 0	x $420 =	0
	☐ Application Size Fee (37 CFR 1.16(s))						
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
						TOTAL ADD'L FEE	**0**

AMENDMENT		CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =	
	☐ Application Size Fee (37 CFR 1.16(s))						
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
						TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

LIE
/GAIL WOOTEN/

AFCP 2.0 Decision	Application No. 13/666,680	Applicant(s) BICI ET AL.
	Examiner CLIFFORD HILAIRE	**Art Unit** 2488

This is in response to the After Final Consideration Pilot request filed 07/01/2016.

1. **Improper Request** – The AFCP 2.0 request is improper for the following reason(s) and the after final amendment submitted with the request will be treated under pre-pilot procedure.

   ☐ An AFCP 2.0 request form PTO/SB/434 (or equivalent document) was not submitted.

   ☐ A non-broadening amendment to at least one independent claim was not submitted.

   ☐ A proper AFCP 2.0 request was submitted in response to the most recent final rejection.

   ☐ Other:

2. **Proper Request**

   A. After final amendment submitted with the request will not be treated under AFCP 2.0.
   The after final amendment cannot be reviewed and a search conducted within the guidelines of the pilot program.

   ☒ The after final amendment will be treated under pre-pilot procedure.

   B. Updated search and/or completed additional consideration.
   The examiner performed an updated search and/or completed additional consideration of the after final amendment within the time authorized for the pilot program. The result(s) of the updated search and/or completed additional consideration are:

   ☐ 1. All of the rejections in the most recent final Office action are overcome and a Notice of Allowance is issued herewith.

   ☐ 2. The after final amendment would not overcome all of the rejections in the most recent final Office action. See attached interview summary for further details.

   ☐ 3. The after final amendment was reviewed, and it raises a new issue(s). See attached interview summary for further details.

   ☐ 4. The after final amendment raises new issues, but would overcome all of the rejections in the most recent final Office action. A decision on determining allowability could not be made within the guidelines of the pilot. See attached interview summary for further details, including any newly discovered prior art.

   ☐ 5. Other:

Examiner Note: Please attach an interview summary when necessary as described above.

07/05/2016

PATENT

RESPONSE UNDER 37 C.F.R. 1.116 - EXPEDITED PROCEDURE - EXAMINING GROUP 2488

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appl. No.:	13/666,680	Confirmation No.: 4782
Applicant(s):	Bici et al.	
Filed:	November 1, 2012	
Art Unit:	2488	
Examiner:	Clifford Hilaire	
Title:	METHOD FOR CODING AND AN APPARATUS	

Docket No.:	042933/467264
Customer No.:	10949

Mail Stop AF
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

AMENDMENT AFTER FINAL UNDER 37 CFR § 1.116

In response to the Final Office Action dated March 1, 2016, please amend the above-identified application as follows:

Amendments to the Claims are reflected in the listing of claims beginning on page 2 of this paper.

Remarks begin on page 13 of this paper.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/666,680	11/01/2012	Mehmet Oguz BICI	042933/467264	4782

10949 7590 07/11/2016

Nokia Corporation and Alston & Bird LLP
c/o Alston & Bird LLP
Bank of America Plaza, 101 South Tryon Street
Suite 4000
Charlotte, NC 28280-4000

EXAMINER	
HILAIRE, CLIFFORD	

ART UNIT	PAPER NUMBER
2488	

NOTIFICATION DATE	DELIVERY MODE
07/11/2016	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

usptomail@alston.com

Advisory Action Before the Filing of an Appeal Brief	**Application No.** 13/666,680	**Applicant(s)** BICI ET AL.	
	Examiner CLIFFORD HILAIRE	**Art Unit** 2488	**AIA (First Inventor to File) Status** No

--The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

THE REPLY FILED 01 July 2016 FAILS TO PLACE THIS APPLICATION IN CONDITION FOR ALLOWANCE.

NO NOTICE OF APPEAL FILED

1. ☒ The reply was filed after a final rejection. No Notice of Appeal has been filed. To avoid abandonment of this application, applicant must timely file one of the following replies: (1) an amendment, affidavit, or other evidence, which places the application in condition for allowance; (2) a Notice of Appeal (with appeal fee) in compliance with 37 CFR 41.31; or (3) a Request for Continued Examination (RCE) in compliance with 37 CFR 1.114 if this is a utility or plant application. Note that RCEs are not permitted in design applications. The reply must be filed within one of the following time periods:
   a) ☒ The period for reply expires 4 months from the mailing date of the final rejection.
   b) ☐ The period for reply expires on: (1) the mailing date of this Advisory Action; or (2) the date set forth in the final rejection, whichever is later. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of the final rejection.
   c) ☐ A prior Advisory Action was mailed more than 3 months after the mailing date of the final rejection in response to a first after-final reply filed within 2 months of the mailing date of the final rejection. The current period for reply expires months from the mailing date of *the prior Advisory Action* or SIX MONTHS from the mailing date of the final rejection, whichever is earlier.

   Examiner Note: If box 1 is checked, check either box (a), (b) or (c). ONLY CHECK BOX (b) WHEN THIS ADVISORY ACTION IS THE FIRST RESPONSE TO APPLICANT'S FIRST AFTER-FINAL REPLY WHICH WAS FILED WITHIN TWO MONTHS OF THE FINAL REJECTION. ONLY CHECK BOX (c) IN THE LIMITED SITUATION SET FORTH UNDER BOX (c). See MPEP 706.07(f).

Extensions of time may be obtained under 37 CFR 1.136(a). The date on which the petition under 37 CFR 1.136(a) and the appropriate extension fee have been filed is the date for purposes of determining the period of extension and the corresponding amount of the fee. The appropriate extension fee under 37 CFR 1.17(a) is calculated from: (1) the expiration date of the shortened statutory period for reply originally set in the final Office action; or (2) as set forth in (b) or (c) above, if checked. Any reply received by the Office later than three months after the mailing date of the final rejection, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

NOTICE OF APPEAL

2. ☐ The Notice of Appeal was filed on _____. A brief in compliance with 37 CFR 41.37 must be filed within two months of the date of filing the Notice of Appeal (37 CFR 41.37(a)), or any extension thereof (37 CFR 41.37(e)), to avoid dismissal of the appeal. Since a Notice of Appeal has been filed, any reply must be filed within the time period set forth in 37 CFR 41.37(a).

AMENDMENTS

3. ☒ The proposed amendments filed after a final rejection, but prior to the date of filing a brief, will not be entered because
   a) ☒ They raise new issues that would require further consideration and/or search (see NOTE below);
   b) ☐ They raise the issue of new matter (see NOTE below);
   c) ☒ They are not deemed to place the application in better form for appeal by materially reducing or simplifying the issues for appeal; and/or
   d) ☐ They present additional claims without canceling a corresponding number of finally rejected claims.

   NOTE: *See Continuation Sheet*. (See 37 CFR 1.116 and 41.33(a)).
4. ☐ The amendments are not in compliance with 37 CFR 1.121. See attached Notice of Non-Compliant Amendment (PTOL-324).
5. ☐ Applicant's reply has overcome the following rejection(s): _____.
6. ☐ Newly proposed or amended claim(s) _____ would be allowable if submitted in a separate, timely filed amendment canceling the non-allowable claim(s).
7. ☒ For purposes of appeal, the proposed amendment(s): (a) ☒ will not be entered, or (b) ☐ will be entered, and an explanation of how the new or amended claims would be rejected is provided below or appended.

AFFIDAVIT OR OTHER EVIDENCE

8. ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.
9. ☐ The affidavit or other evidence filed after final action, but before or on the date of filing a Notice of Appeal will not be entered because applicant failed to provide a showing of good and sufficient reasons why the affidavit or other evidence is necessary and was not earlier presented. See 37 CFR 1.116(e).
10. ☐ The affidavit or other evidence filed after the date of filing the Notice of Appeal, but prior to the date of filing a brief, will not be entered because the affidavit or other evidence failed to overcome all rejections under appeal and/or appellant fails to provide a showing of good and sufficient reasons why it is necessary and was not earlier presented. See 37 CFR 41.33(d)(1).
11. ☐ The affidavit or other evidence is entered. An explanation of the status of the claims after entry is below or attached.

REQUEST FOR RECONSIDERATION/OTHER

12. ☐ The request for reconsideration has been considered but does NOT place the application in condition for allowance because: _____.
13. ☐ Note the attached Information *Disclosure Statement*(s). (PTO/SB/08) Paper No(s). _____
14. ☒ Other: See Attachment PTO-2323.

STATUS OF CLAIMS

15. The status of the claim(s) is (or will be) as follows:
   Claim(s) allowed: .
   Claim(s) objected to: .
   Claim(s) rejected: 1-20.
   Claim(s) withdrawn from consideration: .

/CLIFFORD HILAIRE/ Examiner, Art Unit 2488	/Geepy Pe/ Primary Examiner, Art Unit 2488

Continuation of 3. NOTE: Amendments "without making a comparison with other spatial motion vector prediction candidates that are not included within the subset" to independent claims 1, 9, 15, 15, 17, 18, 19 and 20 changed the scope of the claim enough to require further extensive search. Applicant's request for entry into AFCP 2.0 is acknowledged, but is denied because the response cannot be reviewed and a search conducted in the limited amount of time authorized for this pilot program. Therefore, the response is being reviewed under pre-pilot practice.

UNITED STATES PATENT AND TRADEMARK OFFICE

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/666,680	11/01/2012	Mehmet Oguz BICI	042933/467264	4782

10949 7590 08/19/2016

Nokia Corporation and Alston & Bird LLP
c/o Alston & Bird LLP
Bank of America Plaza, 101 South Tryon Street
Suite 4000
Charlotte, NC 28280-4000

EXAMINER	
HILAIRE, CLIFFORD	

ART UNIT	PAPER NUMBER
2488	

NOTIFICATION DATE	DELIVERY MODE
08/19/2016	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

usptomail@alston.com

PTOL-90A (Rev. 04/07)

Applicant-Initiated Interview Summary	Application No.	Applicant(s)	
	13/666,680	BICI ET AL.	
	Examiner	Art Unit	
	CLIFFORD HILAIRE	2488	

All participants (applicant, applicant's representative, PTO personnel):

(1) CLIFFORD HILAIRE.

(2) GUY GOSNELL (Reg. No 34,610).

(3) RAGIP KURCEREN (Reg No. 60,158).

(4)_____.

Date of Interview: *09 August 2016*.

Type: ☒ Telephonic ☐ Video Conference
☐ Personal [copy given to: ☐ applicant ☐ applicant's representative]

Exhibit shown or demonstration conducted: ☐ Yes ☒ No.
If Yes, brief description: _____.

Issues Discussed ☐101 ☐112 ☐102 ☐103 ☒Others
(For each of the checked box(es) above, please describe below the issue and detailed description of the discussion)

Claim(s) discussed: *1*.

Identification of prior art discussed: *Woo-Jin Han et al. ["Improved Video Compression Efficiency Through Flexible Unit Representation and Corresponding Extension of Coding Tools"], Shen-Chuan Tai et al.["A Multi-Pass True Motion Estimation Scheme With Motion Vector Propagation for Frame Rate Up-Conversion Applications"] and Ai-Mei Huang et al. ["A Multistage Motion Vector Processing Method for Motion-Compensated Frame Interpolation"].*.

Substance of Interview
(For each issue discussed, provide a detailed description and indicate if agreement was reached. Some topics may include: identification or clarification of a reference or a portion thereof, claim interpretation, proposed amendments, arguments of any applied references etc...)

Applicant presented tentative amendment to limitation "comparing motion information of the first spatial motion vector prediction candidate with motion information of spatial motion vector prediction candidates in the determined subset of spatial motion vector prediction candidates" by appending "without making a comparison with other spatial motion vector prediction candidates that are not included within the subset" to overcome the prior references of record.
Examiner let the Applicant know that no support was found in the original disclosure to support such amendment as claimed.
Examiner further elaborate that more explicit language needs to be added to the claim to elaborate on the use of the role "merge list" vis-à-vis "determining a subset of spatial motion vector prediction candidates…" and distinguish the invention from the prior reference on record..

Applicant recordation instructions: The formal written reply to the last Office action must include the substance of the interview. (See MPEP section 713.04). If a reply to the last Office action has already been filed, applicant is given a non-extendable period of the longer of one month or thirty days from this interview date, or the mailing date of this interview summary form, whichever is later, to file a statement of the substance of the interview

Examiner recordation instructions: Examiners must summarize the substance of any interview of record. A complete and proper recordation of the substance of an interview should include the items listed in MPEP 713.04 for complete and proper recordation including the identification of the general thrust of each argument or issue discussed, a general indication of any other pertinent matters discussed regarding patentability and the general results or outcome of the interview, to include an indication as to whether or not agreement was reached on the issues raised.

☐ Attachment

/CLIFFORD HILAIRE/
Examiner, Art Unit 2488

Summary of Record of Interview Requirements

Manual of Patent Examining Procedure (MPEP), Section 713.04, Substance of Interview Must be Made of Record
A complete written statement as to the substance of any face-to-face, video conference, or telephone interview with regard to an application must be made of record in the application whether or not an agreement with the examiner was reached at the interview.

Title 37 Code of Federal Regulations (CFR) § 1.133 Interviews
Paragraph (b)

In every instance where reconsideration is requested in view of an interview with an examiner, a complete written statement of the reasons presented at the interview as warranting favorable action must be filed by the applicant. An interview does not remove the necessity for reply to Office action as specified in §§ 1.111, 1.135. (35 U.S.C. 132)

37 CFR §1.2 Business to be transacted in writing.
All business with the Patent or Trademark Office should be transacted in writing. The personal attendance of applicants or their attorneys or agents at the Patent and Trademark Office is unnecessary. The action of the Patent and Trademark Office will be based exclusively on the written record in the Office. No attention will be paid to any alleged oral promise, stipulation, or understanding in relation to which there is disagreement or doubt.

The action of the Patent and Trademark Office cannot be based exclusively on the written record in the Office if that record is itself incomplete through the failure to record the substance of interviews.

It is the responsibility of the applicant or the attorney or agent to make the substance of an interview of record in the application file, unless the examiner indicates he or she will do so. It is the examiner's responsibility to see that such a record is made and to correct material inaccuracies which bear directly on the question of patentability.

Examiners must complete an Interview Summary Form for each interview held where a matter of substance has been discussed during the interview by checking the appropriate boxes and filling in the blanks. Discussions regarding only procedural matters, directed solely to restriction requirements for which interview recordation is otherwise provided for in Section 812.01 of the Manual of Patent Examining Procedure, or pointing out typographical errors or unreadable script in Office actions or the like, are excluded from the interview recordation procedures below. Where the substance of an interview is completely recorded in an Examiners Amendment, no separate Interview Summary Record is required.

The Interview Summary Form shall be given an appropriate Paper No., placed in the right hand portion of the file, and listed on the "Contents" section of the file wrapper. In a personal interview, a duplicate of the Form is given to the applicant (or attorney or agent) at the conclusion of the interview. In the case of a telephone or video-conference interview, the copy is mailed to the applicant's correspondence address either with or prior to the next official communication. If additional correspondence from the examiner is not likely before an allowance or if other circumstances dictate, the Form should be mailed promptly after the interview rather than with the next official communication.

The Form provides for recordation of the following information:
- Application Number (Series Code and Serial Number)
- Name of applicant
- Name of examiner
- Date of interview
- Type of interview (telephonic, video-conference, or personal)
- Name of participant(s) (applicant, attorney or agent, examiner, other PTO personnel, etc.)
- An indication whether or not an exhibit was shown or a demonstration conducted
- An identification of the specific prior art discussed
- An indication whether an agreement was reached and if so, a description of the general nature of the agreement (may be by attachment of a copy of amendments or claims agreed as being allowable). Note: Agreement as to allowability is tentative and does not restrict further action by the examiner to the contrary.
- The signature of the examiner who conducted the interview (if Form is not an attachment to a signed Office action)

It is desirable that the examiner orally remind the applicant of his or her obligation to record the substance of the interview of each case. It should be noted, however, that the Interview Summary Form will not normally be considered a complete and proper recordation of the interview unless it includes, or is supplemented by the applicant or the examiner to include, all of the applicable items required below concerning the substance of the interview.

A complete and proper recordation of the substance of any interview should include at least the following applicable items:
1) A brief description of the nature of any exhibit shown or any demonstration conducted,
2) an identification of the claims discussed,
3) an identification of the specific prior art discussed,
4) an identification of the principal proposed amendments of a substantive nature discussed, unless these are already described on the Interview Summary Form completed by the Examiner,
5) a brief identification of the general thrust of the principal arguments presented to the examiner,
   (The identification of arguments need not be lengthy or elaborate. A verbatim or highly detailed description of the arguments is not required. The identification of the arguments is sufficient if the general nature or thrust of the principal arguments made to the examiner can be understood in the context of the application file. Of course, the applicant may desire to emphasize and fully describe those arguments which he or she feels were or might be persuasive to the examiner.)
6) a general indication of any other pertinent matters discussed, and
7) if appropriate, the general results or outcome of the interview unless already described in the Interview Summary Form completed by the examiner.

Examiners are expected to carefully review the applicant's record of the substance of an interview. If the record is not complete and accurate, the examiner will give the applicant an extendable one month time period to correct the record.

Examiner to Check for Accuracy

If the claims are allowable for other reasons of record, the examiner should send a letter setting forth the examiner's version of the statement attributed to him or her. If the record is complete and accurate, the examiner should place the indication, "Interview Record OK" on the paper recording the substance of the interview along with the date and the examiner's initials.

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appl. No.:	13/666,680	Confirmation No.: 4782
Applicant(s):	Bici et al.	
Filed:	November 1, 2012	
Art Unit:	2488	
Examiner:	Clifford Hilaire	
Title:	METHOD FOR CODING AND AN APPARATUS	

Docket No.:	042933/467264
Customer No.:	10949

Mail Stop RCE
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

AMENDMENT

In response to the Final Office Action dated March 1, 2016 and the Advisory Action dated July 11, 2016 and concurrent with the filing of a Request for Continued Examination, please amend the above-identified application as follows:

Amendments to the Claims are reflected in the listing of claims beginning on page 2 of this paper.

Remarks begin on page 16 of this paper.

Amendments to the Claims:

1. (Currently Amended) A method comprising:

receiving a block of pixels including a prediction unit;

determining a set of spatial motion vector prediction candidates for the block of pixels; the spatial motion vector prediction candidates being provided with motion information;

selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit, where the merge list is ~~selected~~ constructed based on the motion information of the spatial motion vector prediction candidates and is utilized to identify motion vector prediction candidates of which one spatial motion vector prediction candidate from the merge list is signaled as the motion information for the prediction unit;

determining a subset of spatial motion vector prediction candidates based on ~~the~~ a location of the block associated with the first spatial motion vector prediction candidate;

comparing motion information of the first spatial motion vector prediction candidate with motion information of spatial motion vector prediction candidates in the determined subset of spatial motion vector prediction candidates without making a comparison of each possible candidate pair from the set of spatial motion vector prediction candidates, wherein comparing comprises performing an equivalence check or comparing a difference in motion information to a threshold or other similarity metric; ~~and~~

if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other, excluding the first spatial motion vector prediction candidate from the merge list; and

causing information identifying the one spatial motion vector prediction candidate from the merge list to be transmitted to a decoder or to be stored.

2. (Original) The method according to claim 1 comprising selecting spatial motion vector prediction candidates from the set of spatial motion vector prediction candidates as the potential spatial motion vector prediction candidate in a predetermined order.

3. (Original) The method according to claim 1, comprising comparing motion information of the potential spatial motion vector prediction candidate with motion information of at most one other spatial motion vector prediction candidate of the set of spatial motion vector prediction candidates.

4. (Original) The method according to claim 1 comprising examining whether the received block of pixels is divided into a first prediction unit and a second prediction unit; and if so, excluding the potential spatial motion vector prediction candidate from the merge list if the prediction unit is the second prediction unit.

5. (Original) The method according to claim 1, further comprising

determining a maximum number of spatial motion vector prediction candidates to be included in a merge list; and

limiting the number of spatial motion vector prediction candidates in the merge list smaller or equal to the maximum number .

6. (Currently Amended) The method according to claim 5 comprising:

examining, if the number of spatial motion vector prediction candidates in the merge list smaller than the maximum number;

if so, examining whether [[a]] <u>the</u> prediction unit to which the potential spatial motion vector prediction candidate belongs is available for motion prediction;

if so, performing at least one of the following:

for [[the]] a potential spatial motion vector prediction candidate on [[the]] a left side of the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled:

– the received block of pixels is vertically divided into a first prediction unit and a second prediction unit~~, and the prediction unit is the second prediction unit~~;

– the received block of pixels is horizontally divided into a first prediction unit and a second prediction unit, and if the prediction unit is the second prediction unit, and the potential spatial motion vector prediction candidate has essentially similar motion information than [[the]] a spatial motion vector prediction candidate above the prediction unit;

for [[the]] a potential spatial motion vector prediction candidate above the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled:

– the received block of pixels is horizontally divided into a first prediction unit and a second prediction unit, and the prediction unit is the second prediction unit;

– the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit;

for [[the]] a potential spatial motion vector prediction candidate, which is on [[the]] a right side of the potential spatial motion vector prediction candidate above the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate above the prediction unit;

for [[the]] a potential spatial motion vector prediction candidate, which is below the potential spatial motion vector prediction candidate on the left side of the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit;

for [[the]] <u>a</u> potential spatial motion vector prediction candidate cornerwise neighbouring the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled:

– all the other potential spatial motion vector prediction candidates have been included in the merge list;

– the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate above the prediction unit;

– the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit.

7. (Original) The method according to claim 1 further comprising including a temporal motion prediction candidate into the merge list.

8. (Original) The method according to claim 1 comprising selecting one motion vector prediction candidate from the merge list to represent a motion vector prediction for the block of pixels.

9. (Currently Amended) A method comprising:

receiving an encoded block of pixels including a prediction unit <u>and information identifying a respective spatial motion vector prediction candidate from a merge list constructed by an encoder</u>;

determining a set of spatial motion vector prediction candidates for the encoded block of pixels; the spatial motion vector prediction candidates being provided with motion information;

selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit, where the merge list is ~~selected~~ constructed based on the motion information of the spatial motion vector prediction candidates;

determining a subset of spatial motion vector prediction candidates based on the location of the block associated with the first spatial motion vector prediction candidate;

comparing motion information of the first spatial motion vector prediction candidate with motion information of another spatial motion vector prediction candidate of the set of spatial motion vector prediction candidates without making a comparison of each possible candidate pair from the set of spatial motion vector prediction candidates, wherein comparing comprises performing an equivalence check or comparing a difference in motion information to a threshold or other similarity metric; ~~and~~

if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other, excluding the first spatial motion vector prediction candidate from the merge list; and

selecting a spatial motion vector prediction candidate from the merge list for use in decoding the encoded block of pixels, wherein the spatial motion vector prediction candidate is selected from the merge list using the information that was received identifying a respective spatial motion vector prediction candidate.

10. (Original) The method according to claim 9 comprising comparing motion information of the potential spatial motion vector prediction candidate with motion information of at most one other spatial motion vector prediction candidate of the set of spatial motion vector prediction candidates.

11. (Original) The method according to claim 9 comprising examining whether the received encoded block of pixels is divided into a first prediction unit and a second prediction

unit; and if so, excluding the potential spatial motion vector prediction candidate from the merge list if the prediction unit is the second prediction unit.

12. (Original) The method according to claim 9 further comprising

determining a maximum number of spatial motion vector prediction candidates to be included in a merge list; and

limiting the number of spatial motion vector prediction candidates in the merge list smaller or equal to the maximum number.

13. (Currently Amended) The method according to claim 12 comprising:

examining, if the number of spatial motion vector prediction candidates in the merge list smaller than the maximum number;

if so, examining whether [[a]] the prediction unit to which the potential spatial motion vector prediction candidate belongs is available for motion prediction;

if so, performing at least one of the following:

for [[the]] a potential spatial motion vector prediction candidate on [[the]] a left side of the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled:

– the received encoded block of pixels is vertically divided into a first prediction unit and a second prediction unit~~, and the prediction unit is the second prediction unit~~;

– the received encoded block of pixels is horizontally divided into a first prediction unit and a second prediction unit, and if the prediction unit is the second prediction unit, and the potential spatial motion vector prediction candidate has essentially similar motion information than [[the]] a spatial motion vector prediction candidate above the prediction unit;

for [[the]] a potential spatial motion vector prediction candidate above the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled:

- the received encoded block of pixels is horizontally divided into a first prediction unit and a second prediction unit, and the prediction unit is the second prediction unit;
- the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit;

for [[the]] a potential spatial motion vector prediction candidate, which is on [[the]] a right side of the potential spatial motion vector prediction candidate above the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate above the prediction unit;

for [[the]] a potential spatial motion vector prediction candidate, which is below the potential spatial motion vector prediction candidate on the left side of the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit; and

for [[the]] a potential spatial motion vector prediction candidate cornerwise neighbouring the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled:

- all the other potential spatial motion vector prediction candidates have been included in the merge list;
- the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate above the prediction unit;

– the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit.

14. (Original) The method according to claim 9 comprising selecting one motion vector prediction candidate from the merge list to represent a motion vector prediction for the received encoded block of pixels.

15. (Currently Amended) An apparatus comprising a processor and a memory including computer program code, the memory and the computer program code configured to, with the processor, cause the apparatus to:

receive a block of pixels including a prediction unit;

determine a set of spatial motion vector prediction candidates for the block of pixels; the spatial motion vector prediction candidates being provided with motion information;

select a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit, where the merge list is ~~selected~~ constructed based on the motion information of the spatial motion vector prediction candidates and is utilized to identify motion vector prediction candidates of which one spatial motion vector prediction candidate from the merge list is signaled as the motion information for the prediction unit;

determine a subset of spatial motion vector-prediction candidates based on the location of the block associated with the first spatial motion vector prediction candidate;

compare motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates without making a comparison of each possible candidate pair from the set of spatial motion vector prediction candidates, wherein comparing comprises performing an equivalence check or comparing a difference in motion information to a threshold or other similarity metric; ~~and~~

if at least one the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other, ~~excluding~~ exclude the first spatial motion vector prediction candidate from the merge list; and

cause information identifying the one spatial motion vector prediction candidate from the merge list to be transmitted to a decoder or to be stored.

16. (Currently Amended) An apparatus comprising a processor and a memory including computer program code, the memory and the computer program code configured to, with the processor, cause the apparatus to:

receive an encoded block of pixels including a prediction unit and information identifying a respective spatial motion vector prediction candidate from a merge list constructed by an encoder;

determine a set of spatial motion vector prediction candidates for the encoded block of pixels; the spatial motion vector prediction candidates being provided with motion information;

select a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit, where the merge list is ~~selected~~ constructed based on the motion information of the spatial motion vector prediction candidates;

determine a subset of spatial motion vector prediction candidates based on the location of the block associated with the first spatial motion vector prediction candidate;

compare motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates without making a comparison of each possible candidate pair from the set of spatial motion vector prediction candidates, wherein comparing comprises performing an equivalence check or comparing a difference in motion information to a threshold or other similarity metric; ~~and~~

exclude the first spatial motion vector prediction candidate from the merge list, if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other; and

select a spatial motion vector prediction candidate from the merge list for use in decoding the encoded block of pixels, wherein the spatial motion vector prediction candidate is selected from the merge list using the information that was received identifying a respective spatial motion vector prediction candidate.

17. (Currently Amended) A non-transitory computer readable medium having stored thereon a computer executable program code for use by an encoder, said program codes comprise instructions for use by an encoder, said program code comprises instructions for:

receiving a block of pixels including a prediction unit;

determining a set of spatial motion vector prediction candidates for the block of pixels; the spatial motion vector prediction candidates being provided with motion information;

selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit, where the merge list is ~~selected~~ constructed based on the motion information of the spatial motion vector prediction candidates and is utilized to identify motion vector prediction candidates of which one spatial motion vector prediction candidate from the merge list is signaled as the motion information for the prediction unit;

determining a subset of spatial motion vector prediction candidates based on the location of the block associated with the first spatial motion vector prediction candidate;

comparing motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates without making a comparison of each possible candidate pair from the set of spatial motion vector prediction candidates, wherein comparing comprises performing an equivalence check or comparing a difference in motion information to a threshold or other similarity metric; ~~and~~

if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other, excluding the first spatial motion vector prediction candidate from the merge list; and

causing information identifying the one spatial motion vector prediction candidate from the merge list to be transmitted to a decoder or to be stored.

18. (Currently Amended) A non-transitory computer readable medium having stored thereon a computer executable program code for use by an encoder, said program codes comprise instructions for use by an encoder, said program code comprises instructions for:

receiving an encoded block of pixels including a prediction unit and information identifying a respective spatial motion vector prediction candidate from a merge list constructed by an encoder;

determining a set of spatial motion vector prediction candidates for the encoded block of pixels; the spatial motion vector prediction candidates being provided with motion information;

selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit, where the merge list is ~~selected~~ constructed based on the motion information of the spatial motion vector prediction candidates;

determining a subset of spatial motion vector prediction candidates based on the location of the block associated with the first spatial motion vector prediction candidate;

comparing motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates without making a comparison of each possible candidate pair from the set of spatial motion vector prediction candidates, wherein comparing comprises performing an equivalence check or comparing a difference in motion information to a threshold or other similarity metric; ~~and~~

if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other, excluding the first spatial motion vector prediction candidate from the merge list; and

selecting a spatial motion vector prediction candidate from the merge list for use in decoding the encoded block of pixels, wherein the spatial motion vector prediction candidate is selected from the merge list using the information that was received identifying a respective spatial motion vector prediction candidate.

19. (Currently Amended) An apparatus comprising:

means for receiving a block of pixels including a prediction unit;

means for determining a set of spatial motion vector prediction candidates for the block of pixels; the spatial motion vector prediction candidates being provided with motion information;

means for selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit, where the merge list is ~~selected~~ constructed based on the motion information of the spatial motion vector prediction candidates and is utilized to identify motion vector prediction candidates of which one spatial motion vector prediction candidate from the merge list is signaled as the motion information for the prediction unit;

means for determining a subset of spatial motion vector prediction candidates based on the location of the block associated with the first spatial motion vector prediction candidate;

means for comparing motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates without making a comparison of each possible candidate pair from the set of spatial motion vector prediction candidates, wherein comparing comprises performing an equivalence check or comparing a difference in motion information to a threshold or other similarity metric; ~~and~~

means for excluding the first spatial motion vector prediction candidate from the merge list, if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other; and

means for causing information identifying the one spatial motion vector prediction candidate from the merge list to be transmitted to a decoder or to be stored.

20. (Currently Amended) An apparatus comprising:

means for receiving an encoded block of pixels including a prediction unit and information identifying a respective spatial motion vector prediction candidate from a merge list constructed by an encoder;

means for determining a set of spatial motion vector prediction candidates for the encoded block of pixels; the spatial motion vector prediction candidates being provided with motion information;

means for selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit, where the merge list is ~~selected~~ constructed based on the motion information of the spatial motion vector prediction candidates;

means for determining a subset of spatial motion vector prediction candidates based on the location of the block associated with the first spatial motion vector prediction candidate;

means for comparing motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates without making a comparison of each possible candidate pair from the set of spatial motion vector prediction candidates, wherein comparing comprises performing an equivalence check or comparing a difference in motion information to a threshold or other similarity metric; ~~and~~

means for excluding the first spatial motion vector prediction candidate from the merge list, if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other; and

<u>means for selecting a spatial motion vector prediction candidate from the merge list for use in decoding the encoded block of pixels, wherein the spatial motion vector prediction candidate is selected from the merge list using the information that was received identifying a respective spatial motion vector prediction candidate</u>.

Electronic Acknowledgement Receipt

EFS ID:	26817159
Application Number:	13666680
International Application Number:	
Confirmation Number:	4782
Title of Invention:	METHOD FOR CODING AND AN APPARATUS
First Named Inventor/Applicant Name:	Mehmet Oguz BICI
Customer Number:	10949
Filer:	Guy Randall Gosnell/Lauren Martin
Filer Authorized By:	Guy Randall Gosnell
Attorney Docket Number:	042933/467264
Receipt Date:	01-SEP-2016
Filing Date:	01-NOV-2012
Time Stamp:	16:35:02
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$2400
RAM confirmation Number	090216INTEFSW00003318160605
Deposit Account	160605
Authorized User	Lauren Martin

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

37 CFR 1.16 (National application filing, search, and examination fees)

37 CFR 1.17 (Patent application and reexamination processing fees)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		2016-09-01-467264-RCE-Amend-AsFiled.PDF	752411 555aaa5a75a6244503607603c43b3c94b8f9b9ca	yes	21

Multipart Description/PDF files in .zip description

Document Description	Start	End
Request for Continued Examination (RCE)	1	1
Amendment Submitted/Entered with Filing of CPA/RCE	2	2
Claims	3	16
Applicant Arguments/Remarks Made in an Amendment	17	21

Warnings:

Information:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
2	Fee Worksheet (SB06)	fee-info.pdf	32568 ab3d89e9cf3a91c0039e5cfa1afc48ae8b93c08a	no	2

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Information:

Total Files Size (in bytes):	784979

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New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PTO/SB/30 (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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Request for Continued Examination (RCE) Transmittal

Address to:
Mail Stop RCE
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Application Number	13/666,680
Filing Date	11/01/2012
First Named Inventor	Bici
Art Unit	2488
Examiner Name	Clifford Hilaire
Attorney Docket Number	042933/467264

This is a Request for Continued Examination (RCE) under 37 CFR 1.114 of the above-identified application.
Request for Continued Examination (RCE) practice under 37 CFR 1.114 does not apply to any utility or plant application filed prior to June 8, 1995, or to any design application. See Instruction Sheet for RCEs (not to be submitted to the USPTO) on page 2.

1. Submission required under 37 CFR 1.114 Note: If the RCE is proper, any previously filed unentered amendments and amendments enclosed with the RCE will be entered in the order in which they were filed unless applicant instructs otherwise. If applicant does not wish to have any previously filed unentered amendment(s) entered, applicant must request non-entry of such amendment(s).
   - a. ☐ Previously submitted. If a final Office action is outstanding, any amendments filed after the final Office action may be considered as a submission even if this box is not checked.
     - i. ☐ Consider the arguments in the Appeal Brief or Reply Brief previously filed on ____________
     - ii. ☐ Other ____________
   - b. ☑ Enclosed
     - I. ☑ Amendment/Reply
     - ii. ☐ Affidavit(s)/ Declaration(s)
     - iii. ☐ Information Disclosure Statement (IDS)
     - iv. ☐ Other ____________
2. Miscellaneous
   - a. ☐ Suspension of action on the above-identified application is requested under 37 CFR 1.103(c) for a period of ________ months. (Period of suspension shall not exceed 3 months; Fee under 37 CFR 1.17(i) required)
   - b. ☐ Other ____________
3. Fees The RCE fee under 37 CFR 1.17(e) is required by 37 CFR 1.114 when the RCE is filed.
   - a. ☑ The Director is hereby authorized to charge the following fees, any underpayment of fees, or credit any overpayments, to Deposit Account No. 16-0605.
     - i. ☑ RCE fee required under 37 CFR 1.17(e)
     - ii. ☑ Extension of time fee (37 CFR 1.136 and 1.17)
     - iii. ☐ Other ____________
   - b. ☐ Check in the amount of $ ____________ enclosed
   - c. ☐ Payment by credit card (Form PTO-2038 enclosed)

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED

Signature	/Guy R. Gosnell/	Date	2016-09-01
Name (Print/Type)	Guy R. Gosnell	Registration No.	34610

CERTIFICATE OF MAILING OR TRANSMISSION

I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Mail Stop RCE, Commissioner for Patents, P. O. Box 1450, Alexandria, VA 22313-1450 or facsimile transmitted to the U.S. Patent and Trademark Office on the date shown below.

Signature			
Name (Print/Type)		Date	

REMARKS

Interview

At the outset, Applicant's undersigned representative notes with appreciation the interview conducted August 9, 2016. During the interview, the claims were discussed and the Examiner suggested that the merge list be further defined in order to distinguish the claims from the cited references. The independent claims have now been amended to further define the merge list. In this regard, independent Claims 1, 15, 17 and 19 have been amended to recite that the merge list is utilized to identify motion vector prediction candidates of which one spatial motion vector prediction candidate from the merge list is signaled as the motion information for the prediction unit. See at least paragraph [0133] of the published application. Additionally, independent Claims 1, 15, 17 and 19 have been amended to recite that information identifying the one spatial motion vector prediction candidate from the merge list is caused to be transmitted to a decoder or to be stored. See at least paragraphs [0223] and [0244] of the published application. Similarly, independent Claims 9, 16, 18 and 20 have been amended to recite the receipt of information identifying a respective spatial motion vector prediction candidate from a merge list constructed by an encoder. See at least paragraph [0244] of the published application. Additionally, independent Claims 9, 16, 18 and 20 have been amended to recite that the spatial motion vector prediction candidate is selected from the merge list using the information that was received identifying a respective spatial motion vector prediction candidate. Id. Thus, the merge list has been further defined as suggested by the Examiner in order to further distinguish the claims from the cited references.

During the interview, the Examiner also suggested a couple of other terms that could be clarified and further defined. Each of these other terms identified by the Examiner has also been addressed by the amended set of claims. For example the manner in which motion information of the first spatial motion vector prediction candidate is compared with motion information of the subset spatial motion vector prediction candidates has been further defined by each of the independent claims. In this regard, the comparison has now been defined to include the performance of an equivalence check or comparing a difference in motion information to a threshold or other similarity metric.

Claim Rejections - 35 USC § 112

Claims 6 and 13 were rejected under 35 U.S.C. § 112(b) or 35 U.S.C. § 112 (pre-AIA), second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventor or a joint inventor, or for pre-AIA the applicant regards as the invention. Claims 6 and 13 were amended accordingly. No new matter is added by this amendment. The rejection of Claims 6 and 13 under 35 U.S.C. § 112(b) or 35 U.S.C. § 112 (pre-AIA), second paragraph, is therefore overcome.

Claim Rejections - 35 USC § 103

Claims 1, 2, 3, 4, 5, 6, 7, 9, 10, 11, 12, 14, 15, 16, 17, 18, 19 and 20 were rejected under pre-AIA 35 U.S.C. § 103(a) as being unpatentable over Woo-Jin Han et al. ("Improved video compression efficacy through flexible representation and corresponding extension of coding tools") in view of Shen-Chuan Tai et al ("A multi-pass true motion estimation scheme with motion vector propagation for frame rate up-conversion applications") and further in view of Ai-Mei Huang et al. (" A multistage motion vector processing method for motion-compensated frame interpolation")

The Office Action recognizes that the Han does not teach or suggest the feature of "selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit; determining a subset of spatial motion vector prediction candidates based on the location of the block associated with the first spatial motion vector prediction candidate; comparing motion information of the first spatial motion vector prediction candidate with motion information of spatial motion vector prediction candidates in the determined subset of spatial motion vector prediction candidates; if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other, excluding the first spatial motion vector prediction candidate from the merge list," and cites Tai for these missing teachings from Han. (See the Office Action, page 10-11) Applicant respectfully asserts that Tai fails to cure the deficiencies of Han. While Applicants respectfully disagree with the above-noted rejections, Applicants have amended the independent claims to clarify and further distinguish the claims from the cited art. In this regard, the independent claims have been amended to recite that comparing motion information of the first spatial motion vector prediction candidate with motion information of spatial motion vector prediction candidates in the determined subset of spatial motion vector prediction candidates is performed without making a comparison of each possible candidate pair from the set of spatial motion vector prediction candidates. Support for the amendment is provided at least by paragraphs [0153] and [0158] of the published application.

Applicant respectfully asserts that Tai fails to cure the deficiencies of Han. Specifically, the Office Action cites Col 1, ¶ 4-5 of Tai with respect to the rejection of these recitations of the independent claims (prior to their amendment). However, like, Han, neither the cited portion nor any other portion of Tai teaches or suggests comparing motion information of the first spatial motion vector prediction candidate with motion information of spatial motion vector prediction candidates in the determined subset of spatial motion vector prediction candidates without making a comparison of each possible candidate pair from the set of spatial motion vector prediction candidates, as recited by the amended independent claims. Instead, the cited portion of Tai describes selecting the minimum distortion in the current pass for reference in a future pass. Tai does not disclose or suggest the comparison of motion information of certain spatial motion vector prediction candidates during the construction of a merge list without comparing every possible candidate pair from the set of spatial motion vector prediction candidates. As such, Tai fails to teach or suggest excluding the spatial motion vector prediction candidate from the selected merge list. Indeed, Tai selects the PMV pattern with the minimal distortion following the comparison of all the possible candidate pairs.

Applicants therefore assert that none of the cited references and, therefore, no proper combination of the cited references teach or suggest: "comparing motion information of the first spatial motion vector prediction candidate with motion information of spatial motion vector prediction candidates in the determined subset of spatial motion vector prediction candidates without making a comparison of each possible candidate pair from the set of spatial motion vector prediction candidates," as recited by independent Claims 1, 9 and 15-20, as amended. For this reason as well as those highlighted above in conjunction with the amendments to the independent claims that were introduced as a result of the interview, it is submitted that the rejection under pre-AIA 35 USC § 103(a) of the independent claims, as amended, as well as the claims which depend therefrom, is overcome.

CONCLUSION

In view of the amendments to the claims and the remarks presented above, it is respectfully submitted that all of the claims of the present application are in condition for immediate allowance. It is therefore respectfully requested that a Notice of Allowance be issued. The Examiner is encouraged to contact Applicant's undersigned attorney to resolve any remaining issues in order to expedite examination of the present application.

The patentability of the independent claims has been argued as set forth above and thus Applicants will not take this opportunity to argue the merits of the rejection with regard to specific dependent claims. However, Applicants do not concede that the dependent claims are not independently patentable and reserve the right to argue the patentability of dependent claims at a later date if necessary.

It is not believed that extensions of time or fees for net addition of claims are required, beyond those that may otherwise be provided for in documents accompanying this paper. However, in the event that additional extensions of time are necessary to allow consideration of this paper, such extensions are hereby petitioned under 37 CFR § 1.136(a), and any fee required therefor (including fees for net addition of claims) is hereby authorized to be charged to Deposit Account No. 16-0605.

Respectfully submitted,

/Guy R. Gosnell/

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ELECTRONICALLY FILED USING THE EFS-WEB ELECTRONIC FILING SYSTEM OF THE UNITED STATES PATENT & TRADEMARK OFFICE ON September 1, 2016.

Electronic Patent Application Fee Transmittal

Application Number:	13666680
Filing Date:	01-Nov-2012
Title of Invention:	METHOD FOR CODING AND AN APPARATUS
First Named Inventor/Applicant Name:	Mehmet Oguz BICI
Filer:	Guy Randall Gosnell/Lauren Martin
Attorney Docket Number:	042933/467264

Filed as Large Entity

Filing Fees for **Utility under 35 USC 111(a)**

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension - 3 months with $200 paid	1253	1	1200	1200
Miscellaneous:				
RCE- 1st Request	1801	1	1200	1200
	Total in USD ($)			**2400**

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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 13/666,680	Filing Date 11/01/2012	☐ To be Mailed

ENTITY: ☒ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED – PART I

FOR	NUMBER FILED (Column 1)	NUMBER EXTRA (Column 2)	RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).			
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL	

APPLICATION AS AMENDED – PART II

AMENDMENT	09/01/2016	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 20	Minus	** 20	= 0	x $80 =	0
	Independent (37 CFR 1.16(h))	* 8	Minus	***8	= 0	x $420 =	0
	☐ Application Size Fee (37 CFR 1.16(s))						
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
						TOTAL ADD'L FEE	**0**

AMENDMENT		CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =	
	☐ Application Size Fee (37 CFR 1.16(s))						
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
						TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 13/666,680	Filing Date 11/01/2012	☐ To be Mailed

ENTITY: ☒ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED – PART I

FOR	NUMBER FILED (Column 1)	NUMBER EXTRA (Column 2)	RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).			
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL	

APPLICATION AS AMENDED – PART II

AMENDMENT	09/01/2016	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 20	Minus	** 20	= 0	x $80 =	0
	Independent (37 CFR 1.16(h))	* 8	Minus	***8	= 0	x $420 =	0
	☐ Application Size Fee (37 CFR 1.16(s))						
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
						TOTAL ADD'L FEE	**0**

AMENDMENT		CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =	
	☐ Application Size Fee (37 CFR 1.16(s))						
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
						TOTAL ADD'L FEE	

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*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

LIE
STEFANIE BRYCE

Substitute for form SB08 (Revised 07/09)				Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT *(Use as many sheets as necessary)*				Application Number	13/666,680
				Filing Date	11/01/2012
				First Named Inventor	Mehmet Oguz Bici
				Art Unit	2488
				Examiner Name	Clifford Hilaire
Sheet	*1*	of	1	Attorney Docket Number	042933/467264

OTHER DOCUMENTS

Examiner Initials*	Cite No.	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s) , volume-issue number(s), publisher, city and/or country where published.	English Language Translation Attached
	1	Office Action from Korean Patent Application No. 2014-7015093 dated August 22, 2016	YES

Examiner Signature		Date Considered	

**Examiner: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

CLT#36636444v1

Submitted September 2, 2016

Electronic Acknowledgement Receipt

EFS ID:	26823436
Application Number:	13666680
International Application Number:	
Confirmation Number:	4782
Title of Invention:	METHOD FOR CODING AND AN APPARATUS
First Named Inventor/Applicant Name:	Mehmet Oguz BICI
Customer Number:	10949
Filer:	Jonathan Abbott Thomas/Lisa Rone
Filer Authorized By:	Jonathan Abbott Thomas
Attorney Docket Number:	042933/467264
Receipt Date:	02-SEP-2016
Filing Date:	01-NOV-2012
Time Stamp:	11:41:02
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Non Patent Literature	467264-KR_OA-8-22-2016.PDF	1383740 98ef2a151da3eef0b2bc088fff08b988adb6fa8e	no	5

Warnings:

Information:

2		467264-IDS.pdf	136711 88a6dcf26fbf301e33c7fdc9ef77d92244b8090f	yes	2

Multipart Description/PDF files in .zip description

Document Description	Start	End
Transmittal Letter	1	1
Information Disclosure Statement (IDS) Form (SB08)	2	2

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New Applications Under 35 U.S.C. 111
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National Stage of an International Application under 35 U.S.C. 371
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New International Application Filed with the USPTO as a Receiving Office
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Attorney's Docket No. 042933/467264 PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re:	Mehmet Oguz Bici	Confirmation No.:	4782
Appl. No.:	13/666,680	Art Unit:	2488
Filed:	11/01/2012	Examiner:	Clifford Hilaire
For:	METHOD FOR CODING AND AN APPARATUS		

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

INFORMATION DISCLOSURE STATEMENT
CITATION UNDER 37 C.F.R. § 1.97

Attached is a list of documents on form SB08 along with a copy of any cited foreign patent documents and non-patent literature documents in accordance with 37 CFR 1.98(a)(2).

It is requested that the Examiner consider these documents and officially make them of record in accordance with the provisions of 37 C.F.R. § 1.97 and Section 609 of the MPEP. By identifying the listed documents, Applicant in no way makes any admission as to the prior art status of the listed documents, but is instead identifying the listed documents for the sake of full disclosure.

Applicant notes that each item of information listed on form SB08 was cited in a communication from a foreign patent office in a counterpart foreign application. In addition, the communication from the foreign patent office was not received by any individual designated by 37 CFR 1.56(c) more than thirty (30) days prior to the filing of this Information Disclosure Statement.

Respectfully submitted,

/Guy R. Gosnell/

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Fax Charlotte Office (704) 444-1111

Notice of References Cited	Application/Control No. 13/666,680	Applicant(s)/Patent Under Reexamination BICI ET AL.	
	Examiner NATHNAEL AYNALEM	Art Unit 2488	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-2011/0176013 A1	07-2011	Robertson; Mark	H04N5/145	348/208.4
*	B	US-2012/0230408 A1	09-2012	Zhou; Minhua	H04N19/105	375/240.15
*	C	US-2012/0269270 A1	10-2012	Chen; Ying	H04N19/597	375/240.16
*	D	US-2012/0257678 A1	10-2012	Zhou; Minhua	H04N19/436	375/240.16
*	E	US-2012/0300846 A1	11-2012	SUGIO; Toshiyasu	H04N19/521	375/240.16
*	F	US-2012/0320984 A1	12-2012	Zhou; Minhua	H04N19/50	375/240.16
*	G	US-2013/0003850 A1	01-2013	SUGIO; Toshiyasu	H04N19/105	375/240.16
*	H	US-2013/0004092 A1	01-2013	SASAI; Hisao	H04N19/70	382/233
*	I	US-2013/0070855 A1	03-2013	Zheng; Yunfei	H04N19/105	375/240.16
*	J	US-2013/0083853 A1	04-2013	Coban; Muhammed Zeyd	H04N19/563	375/240.16
*	K	US-2013/0272408 A1	10-2013	CHEN; Ying	H04N19/597	375/240.16
	L	US-				
	M	US-				

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Issue Classification	Application/Control No. 13666680	Applicant(s)/Patent Under Reexamination BICI ET AL.
	Examiner NATHNAEL AYNALEM	Art Unit 2488

CPC					
Symbol				Type	Version
H04N	19	/	00703	F	2013-01-01
H04N	19	/	52	I	2014-11-01
		/			
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Symbol				Type	Set	Ranking	Version
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/NATHNAEL AYNALEM/ Examiner.Art Unit 2488 (Assistant Examiner) (Date)	Total Claims Allowed: 30	
/SATH V PERUNGAVOOR/ Supervisory Patent Examiner.Art Unit 2488 09/26/2016 (Primary Examiner) (Date)	O.G. Print Claim(s) 1	O.G. Print Figure 1

U.S. Patent and Trademark Office Part of Paper No. 20160920

Issue Classification

Application/Control No.	Applicant(s)/Patent Under Reexamination
13666680	BICI ET AL.
Examiner	**Art Unit**
NATHNAEL AYNALEM	2488

US ORIGINAL CLASSIFICATION	
CLASS	SUBCLASS
375	240.16

INTERNATIONAL CLASSIFICATION					
CLAIMED					NON-CLAIMED
H	0	4	N	19 / 513 (2014.01.01)	
H	0	4	N	19 / 11 (2014.01.01)	

CROSS REFERENCE(S)

CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)				
375	240.12				

/NATHNAEL AYNALEM/ Examiner.Art Unit 2488 (Assistant Examiner)	(Date)	**Total Claims Allowed:** 30
/SATH V PERUNGAVOOR/ Supervisory Patent Examiner.Art Unit 2488 (Primary Examiner)	09/26/2016 (Date)	O.G. Print Claim(s): 1 O.G. Print Figure: 1

U.S. Patent and Trademark Office

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	NATHNAEL AYNALEM	2488

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
1	1	17	17												
2	2	18	18												
3	3		19												
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14	14	28	30												
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16	16	30	32												

/NATHNAEL AYNALEM/ Examiner.Art Unit 2488 (Assistant Examiner)	(Date)	**Total Claims Allowed:** 30	
/SATH V PERUNGAVOOR/ Supervisory Patent Examiner.Art Unit 2488 (Primary Examiner)	09/26/2016 (Date)	O.G. Print Claim(s) 1	O.G. Print Figure 1

U.S. Patent and Trademark Office Part of Paper No. 20160920

Aynalem, Nathnael

From: Gosnell, Guy <Guy.Gosnell@alston.com>
Sent: Saturday, September 24, 2016 10:50 AM
To: Aynalem, Nathnael
Subject: US Patent Application No. 13/666,680
Attachments: NC77198US Claims.docx

Hello Examiner Aynalem,

As we have not previously corresponded via email, please confirm receipt so that I know that the email was properly addressed.

To follow up on our conversation from yesterday evening, please find attached an amended set of claims. Claims 19 and 20 are canceled without prejudice to subsequent presentation in a divisional application. New dependent Claims 21-32 are added. The new dependent claims depend from one of independent apparatus Claims 15 or 16 and are mirror images to the dependent method claims. Applicant is amenable to the entry of the attached amendments via an Examiner's amendment so long as the amendments advance the application to allowance.

If you have any questions or need any further information, please let me know. I thank you for your attention to this matter.

Best regards,
Guy Gosnell
Reg. No. 34,610
(704) 444 1029

1. (Previously Presented) A method comprising:

receiving a block of pixels including a prediction unit;

determining a set of spatial motion vector prediction candidates for the block of pixels; the spatial motion vector prediction candidates being provided with motion information;

selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit, where the merge list is constructed based on the motion information of the spatial motion vector prediction candidates and is utilized to identify motion vector prediction candidates of which one spatial motion vector prediction candidate from the merge list is signaled as the motion information for the prediction unit;

determining a subset of spatial motion vector prediction candidates based on a location of the block associated with the first spatial motion vector prediction candidate;

comparing motion information of the first spatial motion vector prediction candidate with motion information of spatial motion vector prediction candidates in the determined subset of spatial motion vector prediction candidates without making a comparison of each possible candidate pair from the set of spatial motion vector prediction candidates, wherein comparing comprises performing an equivalence check or comparing a difference in motion information to a threshold or other similarity metric;

if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other, excluding the first spatial motion vector prediction candidate from the merge list; and

causing information identifying the one spatial motion vector prediction candidate from the merge list to be transmitted to a decoder or to be stored.

2. (Original) The method according to claim 1 comprising selecting spatial motion vector prediction candidates from the set of spatial motion vector prediction candidates as the potential spatial motion vector prediction candidate in a predetermined order.

3. (Original) The method according to claim 1, comprising comparing motion information of the potential spatial motion vector prediction candidate with motion information

of at most one other spatial motion vector prediction candidate of the set of spatial motion vector prediction candidates.

4. (Original) The method according to claim 1 comprising examining whether the received block of pixels is divided into a first prediction unit and a second prediction unit; and if so, excluding the potential spatial motion vector prediction candidate from the merge list if the prediction unit is the second prediction unit.

5. (Original) The method according to claim 1, further comprising

determining a maximum number of spatial motion vector prediction candidates to be included in a merge list; and

limiting the number of spatial motion vector prediction candidates in the merge list smaller or equal to the maximum number .

6. (Previously Presented) The method according to claim 5 comprising:

examining, if the number of spatial motion vector prediction candidates in the merge list smaller than the maximum number;

if so, examining whether the prediction unit to which the potential spatial motion vector prediction candidate belongs is available for motion prediction;

if so, performing at least one of the following:

for a potential spatial motion vector prediction candidate on a left side of the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled:

- the received block of pixels is vertically divided into a first prediction unit and a second prediction unit;
- the received block of pixels is horizontally divided into a first prediction unit and a second prediction unit, and if the prediction unit is the second prediction unit, and the potential spatial motion vector prediction candidate has essentially similar motion information than a spatial motion vector prediction candidate above the prediction unit;

for a potential spatial motion vector prediction candidate above the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled:

– the received block of pixels is horizontally divided into a first prediction unit and a second prediction unit, and the prediction unit is the second prediction unit;

– the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit;

for a potential spatial motion vector prediction candidate, which is on a right side of the potential spatial motion vector prediction candidate above the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate above the prediction unit;

for a potential spatial motion vector prediction candidate, which is below the potential spatial motion vector prediction candidate on the left side of the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit;

for a potential spatial motion vector prediction candidate cornerwise neighbouring the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled:

– all the other potential spatial motion vector prediction candidates have been included in the merge list;

– the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate above the prediction unit;

– the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit.

7. (Original) The method according to claim 1 further comprising including a temporal motion prediction candidate into the merge list.

8. (Original) The method according to claim 1 comprising selecting one motion vector prediction candidate from the merge list to represent a motion vector prediction for the block of pixels.

9. (Previously Presented) A method comprising:

receiving an encoded block of pixels including a prediction unit and information identifying a respective spatial motion vector prediction candidate from a merge list constructed by an encoder;

determining a set of spatial motion vector prediction candidates for the encoded block of pixels; the spatial motion vector prediction candidates being provided with motion information;

selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit, where the merge list is constructed based on the motion information of the spatial motion vector prediction candidates;

determining a subset of spatial motion vector prediction candidates based on the location of the block associated with the first spatial motion vector prediction candidate;

comparing motion information of the first spatial motion vector prediction candidate with motion information of another spatial motion vector prediction candidate of the set of spatial motion vector prediction candidates without making a comparison of each possible candidate pair from the set of spatial motion vector prediction candidates, wherein comparing comprises performing an equivalence check or comparing a difference in motion information to a threshold or other similarity metric;

if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other, excluding the first spatial motion vector prediction candidate from the merge list; and

selecting a spatial motion vector prediction candidate from the merge list for use in decoding the encoded block of pixels, wherein the spatial motion vector prediction candidate is selected from the merge list using the information that was received identifying a respective spatial motion vector prediction candidate.

10. (Original) The method according to claim 9 comprising comparing motion information of the potential spatial motion vector prediction candidate with motion information of at most one other spatial motion vector prediction candidate of the set of spatial motion vector prediction candidates.

11. (Original) The method according to claim 9 comprising examining whether the received encoded block of pixels is divided into a first prediction unit and a second prediction unit; and if so, excluding the potential spatial motion vector prediction candidate from the merge list if the prediction unit is the second prediction unit.

12. (Original) The method according to claim 9 further comprising

determining a maximum number of spatial motion vector prediction candidates to be included in a merge list; and

limiting the number of spatial motion vector prediction candidates in the merge list smaller or equal to the maximum number.

13. (Previously Presented) The method according to claim 12 comprising:

examining, if the number of spatial motion vector prediction candidates in the merge list smaller than the maximum number;

if so, examining whether the prediction unit to which the potential spatial motion vector prediction candidate belongs is available for motion prediction;

if so, performing at least one of the following:

for a potential spatial motion vector prediction candidate on a left side of the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled:

– the received encoded block of pixels is vertically divided into a first prediction unit and a second prediction unit;

– the received encoded block of pixels is horizontally divided into a first prediction unit and a second prediction unit, and if the prediction unit is the second prediction unit, and the potential spatial motion vector prediction candidate has essentially similar motion information than a spatial motion vector prediction candidate above the prediction unit;

for a potential spatial motion vector prediction candidate above the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled:

– the received encoded block of pixels is horizontally divided into a first prediction unit and a second prediction unit, and the prediction unit is the second prediction unit;

– the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit;

for a potential spatial motion vector prediction candidate, which is on a right side of the potential spatial motion vector prediction candidate above the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate above the prediction unit;

for a potential spatial motion vector prediction candidate, which is below the potential spatial motion vector prediction candidate on the left side of the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit; and

for a potential spatial motion vector prediction candidate cornerwise neighbouring the prediction unit, excluding the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled:

– all the other potential spatial motion vector prediction candidates have been included in the merge list;

– the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate above the prediction unit;

– the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit.

14. (Original) The method according to claim 9 comprising selecting one motion vector prediction candidate from the merge list to represent a motion vector prediction for the received encoded block of pixels.

15. (Previously Presented) An apparatus comprising a processor and a memory including computer program code, the memory and the computer program code configured to, with the processor, cause the apparatus to:

receive a block of pixels including a prediction unit;

determine a set of spatial motion vector prediction candidates for the block of pixels; the spatial motion vector prediction candidates being provided with motion information;

select a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit, where the merge list is constructed based on the motion information of the spatial motion vector prediction candidates and is utilized to identify motion vector prediction candidates of which one spatial motion vector prediction candidate from the merge list is signaled as the motion information for the prediction unit;

determine a subset of spatial motion vector-prediction candidates based on the location of the block associated with the first spatial motion vector prediction candidate;

compare motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates without making a comparison of each possible candidate pair from the set of spatial motion vector prediction candidates, wherein comparing comprises performing an equivalence check or comparing a difference in motion information to a threshold or other similarity metric;

if at least one the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other, exclude the first spatial motion vector prediction candidate from the merge list; and

cause information identifying the one spatial motion vector prediction candidate from the merge list to be transmitted to a decoder or to be stored.

16. (Previously Presented) An apparatus comprising a processor and a memory including computer program code, the memory and the computer program code configured to, with the processor, cause the apparatus to:

receive an encoded block of pixels including a prediction unit and information identifying a respective spatial motion vector prediction candidate from a merge list constructed by an encoder;

determine a set of spatial motion vector prediction candidates for the encoded block of pixels; the spatial motion vector prediction candidates being provided with motion information;

select a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit, where the merge list is constructed based on the motion information of the spatial motion vector prediction candidates;

determine a subset of spatial motion vector prediction candidates based on the location of the block associated with the first spatial motion vector prediction candidate;

compare motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates without making a comparison of each possible candidate pair from the set of spatial motion vector prediction candidates, wherein comparing comprises performing an equivalence check or comparing a difference in motion information to a threshold or other similarity metric;

exclude the first spatial motion vector prediction candidate from the merge list, if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other; and

select a spatial motion vector prediction candidate from the merge list for use in decoding the encoded block of pixels, wherein the spatial motion vector prediction candidate is selected from the merge list using the information that was received identifying a respective spatial motion vector prediction candidate.

17. (Previously Presented) A non-transitory computer readable medium having stored thereon a computer executable program code for use by an encoder, said program codes comprise instructions for use by an encoder, said program code comprises instructions for:

receiving a block of pixels including a prediction unit;

determining a set of spatial motion vector prediction candidates for the block of pixels; the spatial motion vector prediction candidates being provided with motion information;

selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit, where the merge list is constructed based on the motion information of the spatial motion vector prediction candidates and is utilized to identify motion vector prediction candidates of which one spatial motion vector prediction candidate from the merge list is signaled as the motion information for the prediction unit;

determining a subset of spatial motion vector prediction candidates based on the location of the block associated with the first spatial motion vector prediction candidate;

comparing motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates without making a comparison of each possible candidate pair from the set of spatial motion vector prediction candidates, wherein comparing comprises performing an equivalence check or comparing a difference in motion information to a threshold or other similarity metric;

if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other, excluding the first spatial motion vector prediction candidate from the merge list; and

causing information identifying the one spatial motion vector prediction candidate from the merge list to be transmitted to a decoder or to be stored.

18. (Previously Presented) A non-transitory computer readable medium having stored thereon a computer executable program code for use by an encoder, said program codes comprise instructions for use by an encoder, said program code comprises instructions for:

receiving an encoded block of pixels including a prediction unit and information identifying a respective spatial motion vector prediction candidate from a merge list constructed by an encoder;

determining a set of spatial motion vector prediction candidates for the encoded block of pixels; the spatial motion vector prediction candidates being provided with motion information;

selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as a potential spatial motion vector prediction candidate to be included in a merge list for the prediction unit, where the merge list is constructed based on the motion information of the spatial motion vector prediction candidates;

determining a subset of spatial motion vector prediction candidates based on the location of the block associated with the first spatial motion vector prediction candidate;

comparing motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates without making a comparison of each possible candidate pair from the set of spatial motion vector prediction candidates, wherein comparing comprises performing an equivalence check or comparing a difference in motion information to a threshold or other similarity metric;

if at least one of the comparisons indicates that the motion vector information of the spatial motion vector prediction candidates correspond with each other, excluding the first spatial motion vector prediction candidate from the merge list; and

selecting a spatial motion vector prediction candidate from the merge list for use in decoding the encoded block of pixels, wherein the spatial motion vector prediction candidate is selected from the merge list using the information that was received identifying a respective spatial motion vector prediction candidate.

19. (Canceled)

20. (Canceled)

21. (New) The apparatus according to claim 15 wherein the apparatus is further caused to select spatial motion vector prediction candidates from the set of spatial motion vector prediction candidates as the potential spatial motion vector prediction candidate in a predetermined order.

22. (New) The apparatus according to claim 15, wherein the apparatus is further caused to compare motion information of the potential spatial motion vector prediction candidate with motion information of at most one other spatial motion vector prediction candidate of the set of spatial motion vector prediction candidates.

23. (New) The apparatus according to claim 15 wherein the apparatus is further caused to examine whether the received block of pixels is divided into a first prediction unit and a second prediction unit; and if so, exclude the potential spatial motion vector prediction candidate from the merge list if the prediction unit is the second prediction unit.

24. (New) The apparatus according to claim 15, wherein the apparatus is further caused to:

determine a maximum number of spatial motion vector prediction candidates to be included in a merge list; and

limit the number of spatial motion vector prediction candidates in the merge list smaller or equal to the maximum number .

25. (New) The apparatus according to claim 24 wherein the apparatus is further caused to:

examine, if the number of spatial motion vector prediction candidates in the merge list smaller than the maximum number;

if so, examine whether the prediction unit to which the potential spatial motion vector prediction candidate belongs is available for motion prediction;

if so, perform at least one of the following:

for a potential spatial motion vector prediction candidate on a left side of the prediction unit, exclude the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled:

– the received block of pixels is vertically divided into a first prediction unit and a second prediction unit;

– the received block of pixels is horizontally divided into a first prediction unit and a second prediction unit, and if the prediction unit is the second prediction unit, and the potential spatial motion vector prediction candidate has essentially similar motion information than a spatial motion vector prediction candidate above the prediction unit;

for a potential spatial motion vector prediction candidate above the prediction unit, exclude the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled:

– the received block of pixels is horizontally divided into a first prediction unit and a second prediction unit, and the prediction unit is the second prediction unit;

– the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit;

for a potential spatial motion vector prediction candidate, which is on a right side of the potential spatial motion vector prediction candidate above the prediction unit, exclude the potential spatial motion vector prediction candidate from the merge list if the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate above the prediction unit;

for a potential spatial motion vector prediction candidate, which is below the potential spatial motion vector prediction candidate on the left side of the prediction unit, exclude the potential spatial motion vector prediction candidate from the merge list if the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit;

for a potential spatial motion vector prediction candidate cornerwise neighbouring the prediction unit, exclude the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled:

– all the other potential spatial motion vector prediction candidates have been included in the merge list;

– the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate above the prediction unit;

– the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit.

26. (New) The apparatus according to claim 15 wherein the apparatus is further caused to include a temporal motion prediction candidate into the merge list.

27. (New) The apparatus according to claim 15 wherein the apparatus is further caused to select one motion vector prediction candidate from the merge list to represent a motion vector prediction for the block of pixels.

28. (New) The apparatus according to claim 16 wherein the apparatus is further caused to compare motion information of the potential spatial motion vector prediction candidate with motion information of at most one other spatial motion vector prediction candidate of the set of spatial motion vector prediction candidates.

29. (New) The apparatus according to claim 16 wherein the apparatus is further caused to examine whether the received encoded block of pixels is divided into a first prediction unit and a second prediction unit; and if so, exclude the potential spatial motion vector prediction candidate from the merge list if the prediction unit is the second prediction unit.

30. (New) The apparatus according to claim 16 wherein the apparatus is further caused to:

determine a maximum number of spatial motion vector prediction candidates to be included in a merge list; and

limit the number of spatial motion vector prediction candidates in the merge list smaller or equal to the maximum number.

31. (New) The apparatus according to claim 30 wherein the apparatus is further caused to:

examine if the number of spatial motion vector prediction candidates in the merge list smaller than the maximum number;

if so, examine whether the prediction unit to which the potential spatial motion vector prediction candidate belongs is available for motion prediction;

if so, perform at least one of the following:

for a potential spatial motion vector prediction candidate on a left side of the prediction unit, exclude the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled:

- the received encoded block of pixels is vertically divided into a first prediction unit and a second prediction unit;
- the received encoded block of pixels is horizontally divided into a first prediction unit and a second prediction unit, and if the prediction unit is the second prediction unit, and the potential spatial motion vector prediction candidate has essentially similar motion information than a spatial motion vector prediction candidate above the prediction unit;

for a potential spatial motion vector prediction candidate above the prediction unit, exclude the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled:

- the received encoded block of pixels is horizontally divided into a first prediction unit and a second prediction unit, and the prediction unit is the second prediction unit;
- the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit;

for a potential spatial motion vector prediction candidate, which is on a right side of the potential spatial motion vector prediction candidate above the prediction unit, exclude the potential spatial motion vector prediction candidate from the merge list if the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate above the prediction unit;

for a potential spatial motion vector prediction candidate, which is below the potential spatial motion vector prediction candidate on the left side of the prediction unit, exclude the potential spatial motion vector prediction candidate from the merge list if the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit; and

for a potential spatial motion vector prediction candidate cornerwise neighbouring the prediction unit, exclude the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled:

– all the other potential spatial motion vector prediction candidates have been included in the merge list;

– the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate above the prediction unit;

– the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit.

32. (New) The apparatus according to claim 16 wherein the apparatus is further caused to select one motion vector prediction candidate from the merge list to represent a motion vector prediction for the received encoded block of pixels.

Examiner-Initiated Interview Summary	**Application No.** 13/666,680	**Applicant(s)** BICI ET AL.	
	Examiner NATHNAEL AYNALEM	**Art Unit** 2488	

All participants (applicant, applicant's representative, PTO personnel):

(1) *NATHNAEL AYNALEM*. (3)_____.

(2) *GUY GOSNELL*. (4)_____.

Date of Interview: *23 September 2016*.

Type: ☒ Telephonic ☐ Video Conference
☐ Personal [copy given to: ☐ applicant ☐ applicant's representative]

Exhibit shown or demonstration conducted: ☐ Yes ☒ No.
If Yes, brief description: _____.

Issues Discussed ☐101 ☒112 ☐102 ☐103 ☐Others
(For each of the checked box(es) above, please describe below the issue and detailed description of the discussion)

Claim(s) discussed: *19-32*.

Identification of prior art discussed: *N/A*.

Substance of Interview
(For each issue discussed, provide a detailed description and indicate if agreement was reached. Some topics may include: identification or clarification of a reference or a portion thereof, claim interpretation, proposed amendments, arguments of any applied references etc...)

Examiner inquired the applicant's representative if there is any corresponding structure in the specification of the current application for a means plus function limitations as recited in claims 19 and 20. Applicant's representative indicated that he believes that there is a support in the specification for the means plus function, however, in order to advance the prosecution of this application, applicants will cancel claims 19 and 20 and will file a divisional application. Furthermore, applicant's representative indicated that applicants would like to add a new dependent claims 21-32 depended from independent claims 15 and 16 .

Applicant recordation instructions: It is not necessary for applicant to provide a separate record of the substance of interview.

Examiner recordation instructions: Examiners must summarize the substance of any interview of record. A complete and proper recordation of the substance of an interview should include the items listed in MPEP 713.04 for complete and proper recordation including the identification of the general thrust of each argument or issue discussed, a general indication of any other pertinent matters discussed regarding patentability and the general results or outcome of the interview, to include an indication as to whether or not agreement was reached on the issues raised.

☐ Attachment

/NATHNAEL AYNALEM/
Examiner, Art Unit 2488

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NOTICE OF ALLOWANCE AND FEE(S) DUE

10949 7590 09/30/2016

Nokia Corporation and Alston & Bird LLP
c/o Alston & Bird LLP
Bank of America Plaza, 101 South Tryon Street
Suite 4000
Charlotte, NC 28280-4000

EXAMINER	
AYNALEM, NATHNAEL B	
ART UNIT	PAPER NUMBER
2488	

DATE MAILED: 09/30/2016

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/666,680	11/01/2012	Mehmet Oguz BICI	042933/467264	4782

TITLE OF INVENTION: METHOD FOR CODING AND AN APPARATUS

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$960	$0	$0	$960	12/30/2016

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail **Mail Stop ISSUE FEE**
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

10949 7590 09/30/2016

Nokia Corporation and Alston & Bird LLP
c/o Alston & Bird LLP
Bank of America Plaza, 101 South Tryon Street
Suite 4000
Charlotte, NC 28280-4000

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/666,680	11/01/2012	Mehmet Oguz BICI	042933/467264	4782

TITLE OF INVENTION: METHOD FOR CODING AND AN APPARATUS

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$960	$0	$0	$960	12/30/2016

EXAMINER	ART UNIT	CLASS-SUBCLASS
AYNALEM, NATHNAEL B	2488	375-240160

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).
   - ☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
   - ☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
   (1) The names of up to 3 registered patent attorneys or agents OR, alternatively,
   (2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.
   1________________
   2________________
   3________________

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ☐ Individual ☐ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:
- ☐ Issue Fee
- ☐ Publication Fee (No small entity discount permitted)
- ☐ Advance Order - # of Copies ______________

4b. Payment of Fee(s): **(Please first reapply any previously paid issue fee shown above)**
- ☐ A check is enclosed.
- ☐ Payment by credit card. Form PTO-2038 is attached.
- ☐ The director is hereby authorized to charge the required fee(s), any deficiency, or credits any overpayment, to Deposit Account Number _________ (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)
- ☐ Applicant certifying micro entity status. See 37 CFR 1.29 — NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.
- ☐ Applicant asserting small entity status. See 37 CFR 1.27 — NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.
- ☐ Applicant changing to regular undiscounted fee status. — NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature __________________ Date ______________

Typed or printed name __________________ Registration No. ______________

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/666,680	11/01/2012	Mehmet Oguz BICI	042933/467264	4782

10949 7590 09/30/2016

Nokia Corporation and Alston & Bird LLP
c/o Alston & Bird LLP
Bank of America Plaza, 101 South Tryon Street
Suite 4000
Charlotte, NC 28280-4000

EXAMINER	
AYNALEM, NATHNAEL B	
ART UNIT	**PAPER NUMBER**
2488	

DATE MAILED: 09/30/2016

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)

(Applications filed on or after May 29, 2000)

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Examiner-Initiated Interview Summary	Application No. 13/666,680	Applicant(s) BICI ET AL.	
	Examiner NATHNAEL AYNALEM	Art Unit 2488	

All participants (applicant, applicant's representative, PTO personnel):

(1) NATHNAEL AYNALEM. (3)_____.

(2) GUY GOSNELL. (4)_____.

Date of Interview: 23 September 2016.

Type: ☒ Telephonic ☐ Video Conference
☐ Personal [copy given to: ☐ applicant ☐ applicant's representative]

Exhibit shown or demonstration conducted: ☐ Yes ☒ No.
If Yes, brief description: _____.

Issues Discussed ☐101 ☒112 ☐102 ☐103 ☐Others
(For each of the checked box(es) above, please describe below the issue and detailed description of the discussion)

Claim(s) discussed: 19-32.

Identification of prior art discussed: N/A.

Substance of Interview
(For each issue discussed, provide a detailed description and indicate if agreement was reached. Some topics may include: identification or clarification of a reference or a portion thereof, claim interpretation, proposed amendments, arguments of any applied references etc...)

Examiner inquired the applicant's representative if there is any corresponding structure in the specification of the current application for a means plus function limitations as recited in claims 19 and 20. Applicant's representative indicated that he believes that there is a support in the specification for the means plus function, however, in order to advance the prosecution of this application, applicants will cancel claims 19 and 20 and will file a divisional application. Furthermore, applicant's representative indicated that applicants would like to add a new dependent claims 21-32 depended from independent claims 15 and 16 .

Applicant recordation instructions: It is not necessary for applicant to provide a separate record of the substance of interview.

Examiner recordation instructions: Examiners must summarize the substance of any interview of record. A complete and proper recordation of the substance of an interview should include the items listed in MPEP 713.04 for complete and proper recordation including the identification of the general thrust of each argument or issue discussed, a general indication of any other pertinent matters discussed regarding patentability and the general results or outcome of the interview, to include an indication as to whether or not agreement was reached on the issues raised.

☐ Attachment

/NATHNAEL AYNALEM/
Examiner, Art Unit 2488

Notice of Allowability	Application No. 13/666,680	Applicant(s) BICI ET AL.	
	Examiner NATHNAEL AYNALEM	Art Unit 2488	AIA (First Inventor to File) Status No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *amendment filed on 09/01/2016*.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on______.

2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

3. ☒ The allowed claim(s) is/are *1-18 and 21-32*. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   Certified copies:

   a) ☐ All b) ☐ Some *c) ☐ None of the:

   1. ☐ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. ______ .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.

   ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☒ Notice of References Cited (PTO-892)
2. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
4. ☒ Interview Summary (PTO-413), Paper No./Mail Date *20160923* .
5. ☒ Examiner's Amendment/Comment
6. ☒ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

/NATHNAEL AYNALEM/ Examiner, Art Unit 2488	/SATH V PERUNGAVOOR/ Supervisory Patent Examiner, Art Unit 2488

U.S. Patent and Trademark Office
PTOL-37 (Rev. 08-13) **Notice of Allowability** Part of Paper No./Mail Date 20160920

DETAILED ACTION

1. The present application is being examined under the pre-AIA first to invent provisions.

Continued Examination Under 37 CFR 1.114

2. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 09/01/2016 has been entered.

Response to Amendment/Argument

3. Applicants' amendment/argument with respect to pending claims 1-20 filed on September 01, 2016 have been fully considered. In view of the amendment of the claims, in view of the applicants' argument, and an Examiner's Amendment appearing below, the rejection of all pending claims has been withdrawn. Thus, the current application is in condition for allowance.

EXAMINER'S AMENDMENT

4. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in an interview with Guy Gosnell (Reg. No. 34, 610) on September 23, 2016.

Please amend claims 19-32 filed on 09/01/2016 as follows:

19. (Canceled)

20. (Canceled)

21. (New) The apparatus according to claim 15 wherein the apparatus is further caused to select spatial motion vector prediction candidates from the set of spatial motion vector prediction candidates as the potential spatial motion vector prediction candidate in a predetermined order.

22. (New) The apparatus according to claim 15, wherein the apparatus is further caused to compare motion information of the potential spatial motion vector prediction candidate with motion information of at most one other spatial motion vector prediction candidate of the set of spatial motion vector prediction candidates.

23. (New) The apparatus according to claim 15 wherein the apparatus is further caused to examine whether the received block of pixels is divided into a first prediction unit and a second prediction unit; and if so, exclude the potential spatial motion vector prediction candidate from the merge list if the prediction unit is the second prediction unit.

24. (New) The apparatus according to claim 15, wherein the apparatus is further caused to:

determine a maximum number of spatial motion vector prediction candidates to be included in a merge list; and limit the number of spatial motion vector prediction candidates in the merge list smaller or equal to the maximum number .

25. (New) The apparatus according to claim 24 wherein the apparatus is further caused to:

examine, if the number of spatial motion vector prediction candidates in the merge list smaller than the maximum number;

if so, examine whether the prediction unit to which the potential spatial motion vector prediction candidate belongs is available for motion prediction;

if so, perform at least one of the following:

for a potential spatial motion vector prediction candidate on a left side of the prediction unit, exclude the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled:

– the received block of pixels is vertically divided into a first prediction unit and a second prediction unit;

– the received block of pixels is horizontally divided into a first prediction unit and a second prediction unit, and if the prediction unit is the second prediction unit, and the potential spatial motion vector prediction candidate has essentially similar motion information than a spatial motion vector prediction candidate above the prediction unit;

for a potential spatial motion vector prediction candidate above the prediction unit, exclude the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled:

– the received block of pixels is horizontally divided into a first prediction unit and a second prediction unit, and the prediction unit is the second prediction unit;

– the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit;

for a potential spatial motion vector prediction candidate, which is on a right side of the potential spatial motion vector prediction candidate above the prediction unit, exclude the potential spatial motion vector prediction candidate from the merge list if the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate above the prediction unit;

for a potential spatial motion vector prediction candidate, which is below the potential spatial motion vector prediction candidate on the left side of the prediction unit, exclude the potential spatial motion vector prediction candidate from the merge list if the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit;

for a potential spatial motion vector prediction candidate cornerwise neighbouring the prediction unit, exclude the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled:

– all the other potential spatial motion vector prediction candidates have been included in the merge list;

– the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate above the prediction unit;

– the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit.

26. (New) The apparatus according to claim 15 wherein the apparatus is further caused to include a temporal motion prediction candidate into the merge list.

27. (New) The apparatus according to claim 15 wherein the apparatus is further caused to select one motion vector prediction candidate from the merge list to represent a motion vector prediction for the block of pixels.

28. (New) The apparatus according to claim 16 wherein the apparatus is further caused to compare motion information of the potential spatial motion vector prediction candidate with motion information of at most one other spatial motion vector prediction candidate of the set of spatial motion vector prediction candidates.

29. (New) The apparatus according to claim 16 wherein the apparatus is further caused to examine whether the received encoded block of pixels is divided into a first prediction unit and a second prediction unit; and if so, exclude the potential spatial motion vector prediction candidate from the merge list if the prediction unit is the second prediction unit.

30. (New) The apparatus according to claim 16 wherein the apparatus is further caused to:

determine a maximum number of spatial motion vector prediction candidates to be included in a merge list; and

limit the number of spatial motion vector prediction candidates in the merge list smaller or equal to the maximum number.

31. (New) The apparatus according to claim 30 wherein the apparatus is further caused to:

examine if the number of spatial motion vector prediction candidates in the merge list smaller than the maximum number;

if so, examine whether the prediction unit to which the potential spatial motion vector prediction candidate belongs is available for motion prediction;

if so, perform at least one of the following:

for a potential spatial motion vector prediction candidate on a left side of the prediction unit, exclude the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled:

– the received encoded block of pixels is vertically divided into a first prediction unit and a second prediction unit;

– the received encoded block of pixels is horizontally divided into a first prediction unit and a second prediction unit, and if the prediction unit is the second prediction unit, and the potential spatial motion vector prediction candidate has essentially similar motion information than a spatial motion vector prediction candidate above the prediction unit;

for a potential spatial motion vector prediction candidate above the prediction unit, exclude the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled:

– the received encoded block of pixels is horizontally divided into a first prediction unit and a second prediction unit, and the prediction unit is the second prediction unit;

– the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit;

for a potential spatial motion vector prediction candidate, which is on a right side of the potential spatial motion vector prediction candidate above the prediction unit, exclude the potential spatial motion vector prediction candidate from the merge list if the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate above the prediction unit;

for a potential spatial motion vector prediction candidate, which is below the potential spatial motion vector prediction candidate on the left side of the prediction unit, exclude the potential spatial motion vector prediction candidate from the merge list if the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit; and

for a potential spatial motion vector prediction candidate cornerwise neighbouring the prediction unit, exclude the potential spatial motion vector prediction candidate from the merge list if any of the following conditions are fulfilled:

– all the other potential spatial motion vector prediction candidates have been included in the merge list;

– the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate above the prediction unit;

– the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit.

32. (New) The apparatus according to claim 16 wherein the apparatus is further caused to select one motion vector prediction candidate from the merge list to represent a motion vector prediction for the received encoded block of pixels.

Allowable Subject Matter

5. Claims 1-18 and 21-32 are allowed.

6. The following is an examiner's statement of reasons for allowance: the amended claims are allowable due to applicants amending each of the independent claims 1, 9 and 15-18, and a persuasive argument by the applicants (Remarks dated 09/01/2016, pages 17-18). Specifically, the argument regarding the difference between the prior arts of record and the limitation "comparing motion information of the first spatial motion vector prediction candidate with motion information of spatial motion vector prediction candidates in the determined subset of spatial motion vector prediction candidates without making a comparison of each possible candidate pair from the set of spatial motion vector prediction candidates," as recited the independent claims.

Dependent claims 2-8, 10-14 and 21-32 are allowed by virtue of their dependency from allowed claims 1, 9 and 15-18.

7. The following prior arts, Robertson et al. (US 2011/0176013 A1), Zhou (Pub. No. US 2012/0230408 A1), Zhou et al. (US 2012/0257678 A1), Chen et al. (Pub. No. US 2012/0269270 A1), Sugio et al. (Pub. No. US 2012/0300846 A1), Zhou (Pub. No. US 2012/0320984 A1), Sugio et al. (Pub. No. US 2013/0003850 A1), Sasai et al. (Pub. No. US 2013/0004092 A1), Zheng et al. (Pub. No. US 2013/0070855 A1), Coban et al. (Pub. No. 2013/0083853 A1) and Chen et al. (Pub. No. US 2013/0272408 A1) as a relevant prior arts. However, the pertinent prior arts do not teach the above patentable feature of the independent claims 1, 9 and 15-18.

8. Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to NATHNAEL AYNALEM whose telephone number is (571)270-1482. The examiner can normally be reached on Monday-Friday 7:30 to 5:00 EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Sath V. Perungavoor can be reached on (571)272-7455. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/NATHNAEL AYNALEM/
Examiner, Art Unit 2488

/SATH V PERUNGAVOOR/

Supervisory Patent Examiner, Art Unit 2488

Search Notes	**Application/Control No.** 13666680	**Applicant(s)/Patent Under Reexamination** BICI ET AL.
	Examiner NATHNAEL AYNALEM	**Art Unit** 2488

CPC- SEARCHED

Symbol	Date	Examiner
H04N19/52; H04N19/513; H04N19/176; H04N19/61; H04N19/51; H04N19/597; H04N19/56; H04N19/139; H04N19/573; H04N19/521; H04N19/103; H04N19/30	9/7/2016	CH
H04N19/176 ; H04N19/52 ; H04N19/593 ; H04N19/105 ; H04N19/513 ; H04N19/139 ; H04N19/70 ; H04N19/503 ; H04N19/44 ; H04N19/463 ; H04N19/597 ; H04N19/61 ; H04N19/159 ; H04N19/51	9/20/2016	N.A.
H04N19/56 ; H04N19/107 ; H04N19/587 ; H04N19/174 ; H04N19/577; H04N19/00684 ; H04N19/00703 ; H04N19/147 ; H04N19/30 ; H04N19/105 ; H04N19/11 ; H04N19/119 ; H04N19/187 ; H04N19/58	9/20/2016	N.A.

CPC COMBINATION SETS - SEARCHED

Symbol	Date	Examiner

US CLASSIFICATION SEARCHED

Class	Subclass	Date	Examiner
375	240	9/7/2016	CH
375	240.01-240.29	9/27/2016	N.A.

SEARCH NOTES

Search Notes	Date	Examiner
See Attached EAST Search History Document	9/7/2016	CH
IEEEXplore Search	9/7/2016	CH
Google Scholar	9/7/2016	CH
East keyword search	9/20/2016	N.A.
Assignee search	9/20/2016	N.A.
Inventor's name search	9/20/2016	N.A.

/NATHNAEL AYNALEM/ Examiner.Art Unit 2488	

INTERFERENCE SEARCH

US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner
375	*	9/7/2016	CH
	General Interference Search of the claims (USPGPUB,USPAT)	9/20/2016	N.A.

/NATHNAEL AYNALEM/ Examiner.Art Unit 2488	

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L4	2798	(spatial or intra) with predict$3 with candidate$1	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 17:53
L5	559	(spatial or intra) with predict$3 with candidate$1 with list	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 17:55
L6	15357	(subset or sub$set) with candidate$1	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 17:57
L7	5	5 same 6	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 17:58
L8	33	(spatial or intra) with predict$3 with candidate$1 with list with (exclud$3 or without or eliminat$3)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 18:02
L9	580	(compar$3 or evaluat$3 or verif$7 or check$3 or search$3) with (spatial or intra) with predict$3 with candidate$1	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 18:17
L10	48	(spatial or intra) with predict$3 with candidate$1 with list with (exclud$3 or without or eliminat$3 or skip$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 18:18
L11	8	9 same 10	US-PGPUB;	OR	ON	2016/09/20

			USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			18:18
L12	5	11 AND ((H04N19/52 OR H04N19/00684 OR H04N19/00703 OR H04N19/147 OR H04N19/30 OR H04N19/597 OR H04N19/105 OR H04N19/11 OR H04N19/119 OR H04N19/174 OR H04N19/176 OR H04N19/187 OR H04N19/513 OR H04N19/58 OR H04N19/70).CPC. OR (375/240.01-240.29).CCLS.)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 18:19
L13	7278	merg$3 near3 list	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 18:20
L14	292	5 and 13	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 18:20
L15	280	14 AND ((H04N19/176 OR H04N19/52 OR H04N19/593 OR H04N19/105 OR H04N19/513 OR H04N19/139 OR H04N19/70 OR H04N19/503 OR H04N19/44 OR H04N19/463 OR H04N19/597 OR H04N19/61 OR H04N19/159 OR H04N19/51 OR H04N19/56 OR H04N19/107 OR H04N19/587 OR H04N19/174 OR H04N19/577).CPC.)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 18:23
L16	722	(compar$3 or evaluat$3 or verif$7 or check$3 or search$3 or differenc$2) with (spatial or intra) with predict$3 with candidate$1	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 18:24
L17	8	10 same 16	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 18:25
L18	44	10 AND ((H04N19/176 OR H04N19/52 OR H04N19/593 OR H04N19/105 OR H04N19/513 OR H04N19/139 OR H04N19/70 OR H04N19/503 OR H04N19/44 OR H04N19/463 OR H04N19/597 OR H04N19/61 OR H04N19/159 OR H04N19/51 OR H04N19/56 OR H04N19/107 OR H04N19/587 OR H04N19/174 OR	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 18:26

		H04N19/577).CPC.)				
L19	736	(compar$3 or evaluat$3 or verif$7 or check$3 or search$3 or differenc$2 or examin$3) with (spatial or intra) with predict$3 with candidate$1	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 18:28
L20	18	(spatial or intra) with predict$3 with candidate$1 with list with (exclud$3 or without or eliminat$3) with merg$3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 18:29
L21	4	19 same 20	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 18:29
L22	4	19 and 20	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 18:29
L23	43381	(intra or spatial or spatio adj1 temporal or inter) near4 predict$3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 19:14
L24	407	13 same 23	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 19:14
L25	1072	(motion or vector$1 or mv) with merg$3 with list	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 19:16
L27	323	24 same 25	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 19:16
L28	3255	(compar$3 or evaluat$3 or verif$7 or check$3 or search$3 or differenc$2 or examin$3) with (spatial or intra) with predict$3 with (motion or vector or mv)	US-PGPUB; USPAT; USOCR; FPRS; EPO;	OR	ON	2016/09/20 19:17

			JPO; DERWENT; IBM_TDB			
L29	74	27 and 28	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 19:17
L30	73	29 AND ((H04N19/176 OR H04N19/52 OR H04N19/593 OR H04N19/105 OR H04N19/513 OR H04N19/139 OR H04N19/70 OR H04N19/503 OR H04N19/44 OR H04N19/463 OR H04N19/597 OR H04N19/61 OR H04N19/159 OR H04N19/51 OR H04N19/56 OR H04N19/107 OR H04N19/587 OR H04N19/174 OR H04N19/577).CPC.)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 19:17
L31	73	30 AND ((H04N19/52 OR H04N19/00684 OR H04N19/00703 OR H04N19/147 OR H04N19/30 OR H04N19/597 OR H04N19/105 OR H04N19/11 OR H04N19/119 OR H04N19/174 OR H04N19/176 OR H04N19/187 OR H04N19/513 OR H04N19/58 OR H04N19/70).CPC. OR (375/240.01-240.29).CCLS.)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 19:18
L32	29910	(motion or vector$1 or mv) with list	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 19:20
L33	112	28 same 32	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 19:20
L34	5698	candidate$1 with list with (exclud$3 or without or eliminat$3 or remov$3)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 19:59
L35	259	25 and 34	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 19:59
L36	152	25 same 34	US-PGPUB; USPAT; USOCR; FPRS; EPO;	OR	ON	2016/09/20 20:00

			JPO; DERWENT; IBM_TDB			
L38	227453	(compar$3 or evaluat$3 or verif$7 or check$3 or search$3 or differenc$2 or examin$3) with predict$3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 20:03
L39	6	36 same 38	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 20:03
L40	126	36 and 38	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 20:03
L42	40	(BICI near3 (Mehmet Oguz)).in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 20:44
L44	36069	(intra or inter) near3 predict$3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 20:45
L45	13	42 and 44	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 20:46
L47	431	(LAINEMA near2 Jani).in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 20:47
L48	88	44 and 47	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 20:47
L49	11	34 and 48	US-PGPUB; USPAT;	OR	ON	2016/09/20 20:47

			USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			
L50	306	(UGUR near3 Kemal).in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 20:48
L51	12	34 and 50	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 20:49
L52	61847	(nokia).as.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 20:50
L53	70	34 and 52	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 20:50
L55	15	44 and 53	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/09/20 20:50

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L57	21002	((block or macroblock or picture or image) with (predict$3 or pu)).clm.	US-PGPUB; USPAT	OR	ON	2016/09/20 20:54
L58	266	((spatial or intra) with (mv or motion adj1 vector$1) with candidate).clm.	US-PGPUB; USPAT	OR	ON	2016/09/20 20:55
L59	818	(candidat$1 with merg$3).clm.	US-PGPUB; USPAT	OR	ON	2016/09/20 20:56
L60	739	((compar$3 or evaluat$3 or verif$7 or check$3 or search$3 or differenc$2 or examin$3) with predict$3 with candidat$1).clm.	US-PGPUB; USPAT	OR	ON	2016/09/20 20:57
L61	668	(candidate$1 with list with (exclud$3 or without or eliminat$3 or remov$3)).clm.	US-PGPUB;	OR	ON	2016/09/20 20:58

			USPAT			
L62	200	57 and 58	US-PGPUB; USPAT	OR	ON	2016/09/20 20:58
L63	2	59 and 60 and 61	US-PGPUB; USPAT	OR	ON	2016/09/20 20:59
L64	11	60 and 61	US-PGPUB; USPAT	OR	ON	2016/09/20 21:02
L65	1	62 and 64	US-PGPUB; USPAT	OR	ON	2016/09/20 21:02

9/20/2016 9:04:11 PM
C:\Users\naynalem\Documents\EAST\Workspaces\13666680.wsp

Substitute for form SB08 (Revised 07/09) **INFORMATION DISCLOSURE STATEMENT BY APPLICANT** *(Use as many sheets as necessary)*		**Complete if Known**	
		Application Number	13/666,680
		Filing Date	11/01/2012
		First Named Inventor	Mehmet Oguz Bici
		Art Unit	2488
		Examiner Name	Nathnael B. Aynalem
Sheet *1*	of 1	Attorney Docket Number	042933/467264

OTHER DOCUMENTS

Examiner Initials*	Cite No.	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s) , volume-issue number(s), publisher, city and/or country where published.	English Language Translation Attached
	1	Office Action for Canadian Application No. 2,854,495 dated September 6, 2016	

Examiner Signature		Date Considered	

**Examiner: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

CLT#36702952v1

Submitted October 3, 2016

Electronic Acknowledgement Receipt	
EFS ID:	27105559
Application Number:	13666680
International Application Number:	
Confirmation Number:	4782
Title of Invention:	METHOD FOR CODING AND AN APPARATUS
First Named Inventor/Applicant Name:	Mehmet Oguz BICI
Customer Number:	10949
Filer:	Jonathan Abbott Thomas/Lisa Rone
Filer Authorized By:	Jonathan Abbott Thomas
Attorney Docket Number:	042933/467264
Receipt Date:	03-OCT-2016
Filing Date:	01-NOV-2012
Time Stamp:	15:37:37
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$180
RAM confirmation Number	100416INTEFSW00002032160605
Deposit Account	
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		467264-IDS.pdf	134631 9e00d74392be2af6e529f8b7a6f01d521f2bfdd2	yes	2

Multipart Description/PDF files in .zip description

Document Description	Start	End
Transmittal Letter	1	1
Information Disclosure Statement (IDS) Form (SB08)	2	2

Warnings:

Information:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
2	Non Patent Literature	467264-CA_OA-9-6-2016.pdf	1555512 026af6deaa910c802d0a6ec18e2093aa844cb910	no	4

Warnings:

Information:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
3	Fee Worksheet (SB06)	fee-info.pdf	30676 67dba1ce2c4a20026c45c1fa1126ad60f5133300	no	2

Warnings:

Information:

Total Files Size (in bytes): 1720819

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

<u>New Applications Under 35 U.S.C. 111</u>
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

<u>National Stage of an International Application under 35 U.S.C. 371</u>
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

<u>New International Application Filed with the USPTO as a Receiving Office</u>
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re:	Mehmet Oguz Bici	Confirmation No.:	4782
Appl. No.:	13/666,680	Group Art Unit:	2488
Filed:	11/01/2012	Examiner:	Nathnael B. Aynalem
For:	METHOD FOR CODING AND AN APPARATUS		

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

INFORMATION DISCLOSURE STATEMENT
UNDER 37 C.F.R. § 1.97(d)

This Information Disclosure Statement is being filed after a Final Office Action under 37 C.F.R. § 1.113 or a Notice of Allowance under 37 C.F.R. § 1.311, but before payment of the Issue Fee. The Final Office Action or Notice of Allowance was mailed on September 30, 2016.

Attached is a list of documents on form PTO-1449 along with any cited foreign patent documents and non-patent literature documents in accordance with 37 CFR 1.98(a)(2). Also enclosed is a translation or a concise explanation of each non-English language document.

By identifying the listed documents, Applicant in no way makes any admission as to the prior art status of the listed documents, but is instead identifying the listed documents for the sake of full disclosure.

In accordance with the requirements of 37 C.F.R. § 1.97(d)(2), the following statement as specified in 37 C.F.R. § 1.97(e) is made:

Each item of information contained in this statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three (3) months prior to the filing of this statement. In this regard, Applicant notes that the communication from the foreign patent office was not received by any individual designated by 37 CFR 1.56(c) more than thirty (30) days prior to the filing of this Information Disclosure Statement.

The $180.00 fee specified in 37 C.F.R. § 1.17(p) is being paid at the time of e-filing. The Commissioner is authorized to charge any additional fee, or credit any refund, to our Deposit Account No. 16-0605.

Respectfully submitted,

/Guy R. Gosnell/

Guy R. Gosnell
Registration No. 34,610

CUSTOMER NO. 10949
ALSTON & BIRD LLP
Bank of America Plaza
101 South Tryon Street, Suite 4000
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Electronic Patent Application Fee Transmittal

Application Number:	13666680
Filing Date:	01-Nov-2012
Title of Invention:	METHOD FOR CODING AND AN APPARATUS
First Named Inventor/Applicant Name:	Mehmet Oguz BICI
Filer:	Jonathan Abbott Thomas/Lisa Rone
Attorney Docket Number:	042933/467264

Filed as Large Entity

Filing Fees for **Utility under 35 USC 111(a)**

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
Submission- Information Disclosure Stmt	1806	1	180	180
	Total in USD ($)			**180**

Substitute for form SB08 (Revised 07/09)				Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT *(Use as many sheets as necessary)*				Application Number	13/666,680
				Filing Date	11/01/2012
				First Named Inventor	Mehmet Oguz Bici
				Art Unit	2488
				Examiner Name	Nathnael B. Aynalem
Sheet	*1*	of	1	Attorney Docket Number	042933/467264

OTHER DOCUMENTS

Examiner Initials*	Cite No.	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s) , volume-issue number(s), publisher, city and/or country where published.	English Language Translation Attached
/N.A./	1	Office Action for Canadian Application No. 2,854,495 dated September 6, 2016	

Examiner Signature	/Nathnael Aynalem/	Date Considered	10/08/2016

**Examiner: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

CLT#36702952v1

Submitted October 3, 2016

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /N.A./

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/666,680	11/01/2012	Mehmet Oguz BICI	042933/467264	4782

10949 7590 10/19/2016

Nokia Corporation and Alston & Bird LLP
c/o Alston & Bird LLP
Bank of America Plaza, 101 South Tryon Street
Suite 4000
Charlotte, NC 28280-4000

EXAMINER	
AYNALEM, NATHNAEL B	

ART UNIT	PAPER NUMBER
2488	

NOTIFICATION DATE	DELIVERY MODE
10/19/2016	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

usptomail@alston.com

Supplemental Notice of Allowability	Application No. 13/666,680	Applicant(s) BICI ET AL.	
	Examiner NATHNAEL AYNALEM	Art Unit 2488	AIA (First Inventor to File) Status No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *Information Disclosure Statement filed on 10/03/2016*.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on______.
2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.
3. ☒ The allowed claim(s) is/are *1-18 and 21-32*. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.
4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   Certified copies:

   a) ☐ All b) ☐ Some *c) ☐ None of the:

   1. ☐ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. ______ .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.

   ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☒ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date 10/03/2016
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
5. ☐ Examiner's Amendment/Comment
6. ☐ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

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(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
22 September 2011 (22.09.2011)

PCT

(10) International Publication Number
WO 2011/115659 A1

(51) International Patent Classification:
H04N 7/26 (2006.01) *H04N 7/50* (2006.01)
H04N 7/36 (2006.01)

(21) International Application Number:
PCT/US2011/000421

(22) International Filing Date:
3 March 2011 (03.03.2011)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
61/314,506 16 March 2010 (16.03.2010) US

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(81) **Designated States** *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) **Designated States** *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ,

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(54) **Title**: METHODS AND APPARATUS FOR IMPLICIT ADAPTIVE MOTION VECTOR PREDICTOR SELECTION FOR VIDEO ENCODING AND DECODING

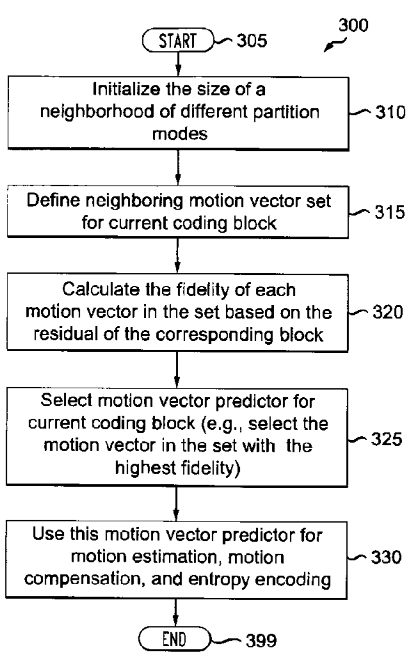

FIG. 3

(57) **Abstract**: Methods and apparatus are provided for implicit adaptive motion vector predictor selection for video encoding and decoding. The method encodes an image block using implicit adaptive motion vector predictor selection. The motion vector for encoding the block is predicted by defining (315) a set of motion vector predictor candidates for the block based on a plurality of spatio-temporal neighboring motion vectors; and then selecting (325) from the set a particular motion vector predictor candidate as the motion vector for encoding the bloc. The selection is made responsive to respective values for a fidelity of the spatio-temporal neighboring motion vectors (320).

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TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*

— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

METHODS AND APPARATUS FOR IMPLICIT ADAPTIVE MOTION VECTOR PREDICTOR SELECTION FOR VIDEO ENCODING AND DECODING

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims the benefit of U.S. Provisional Application Serial No. 61/314,506, filed March 16, 2010, which is incorporated by reference herein in its entirety.

TECHNICAL FIELD

The present principles relate generally to video encoding and decoding and, more particularly, to methods and apparatus for implicit adaptive motion vector predictor selection for video encoding and decoding.

BACKGROUND

Motion estimation and compensation are widely used in video compression to leverage and make use of the temporal redundancy inherent between images of a video sequence. Motion information is usually represented by a displacement format with a motion vector and corresponding reference frame index to indicate the correspondence of a current coding block in the reference frame buffer. Such motion information is transmitted or otherwise conveyed to a decoder as overhead. Obviously, the goal in compression is to convey information for as little cost as possible, while still maintaining a desired objective and subjective quality of images.

In the state of the art video coding standard, namely the International Organization for Standardization/International Electrotechnical Commission (ISO/IEC) Moving Picture Experts Group-4 (MPEG-4) Part 10 Advanced Video Coding (AVC) Standard/International Telecommunication Union, Telecommunication Sector (ITU-T) H.264 Recommendation (hereinafter the "MPEG-4 AVC Standard"), a motion vector is predicted by the median of its spatial causal neighboring motion vectors. This approach is very simple and effective when the motion field is relatively smooth and the neighboring motion vectors have high fidelities. However, when the motion field tends to be complicated, this approach may not work well by only selecting the median value of the neighboring motion vectors. Furthermore, there could be many low fidelity motion vectors surrounding a current coding block. These factors may cause a degradation of the quality of a motion vector predictor.

A technique known as motion vector competition (MVComp) is described in a first prior art approach. In MVComp, the procedure for motion vector predictor selection is incorporated within the rate-distortion optimization of a coding block. As a resulting output, MVComp explicitly transmits (or otherwise conveys, e.g., embedded on a media) the best motion vector predictor index to the decoder. In MVComp, a coding block has a set of motion vector predictors. The best motion vector predictor will be selected based on the rate-distortion (RD) optimization. The index of the motion vector predictor in the set will be explicitly transmitted to the decoder if the set has more than one candidate. The process is highly optimized because each of the motion vector predictors will be checked and compared with other motion vector predictors. The set can include motion vectors which come from both spatial and temporal causal neighboring blocks. Given a motion vector predictor set, this approach can also find the best predictor in the set in the rate-distortion sense. However, the complexity is very high at the encoder as it will take each predictor into the mode decision loop for each coding block. Another shortcoming is the overhead (e.g., the index of the motion vector predictor in the set) and can make this approach costly and inefficient especially for the low bitrate applications.

SUMMARY

These and other drawbacks and disadvantages of the prior art are addressed by the present principles, which are directed to methods and apparatus for implicit adaptive motion vector predictor selection for video encoding and decoding.

According to an aspect of the present principles, there is provided an apparatus. The apparatus includes a video encoder for encoding at least a block in a picture using implicit adaptive motion vector predictor selection. A motion vector for encoding the block is predicted by defining a set of motion vector predictor candidates for the block based on a plurality of spatio-temporal neighboring motion vectors, and selecting from the set a particular motion vector predictor candidate as the motion vector for encoding the block responsive to respective values for a fidelity of the spatio-temporal neighboring motion vectors.

According to another aspect of the present principles, there is provided a method in a video encoder. The method includes encoding at least a block in a picture using implicit adaptive motion vector predictor selection. A motion vector for encoding the block is predicted by defining a set of motion vector predictor candidates for the block based on a plurality of spatio-temporal neighboring motion vectors, and selecting from the set a particular motion vector predictor candidate as the motion vector for encoding the block responsive to respective values for a fidelity of the spatio-temporal neighboring motion vectors.

According to yet another aspect of the present principles, there is provided an apparatus. The apparatus includes a video decoder for decoding at least a block in a picture using implicit adaptive motion vector predictor selection. A motion vector for decoding the block is predicted by defining a set of motion vector predictor candidates for the block based on a plurality of spatio-temporal neighboring motion vectors, and selecting from the set a particular motion vector predictor candidate as the motion vector for decoding the block responsive to respective values for a fidelity of the spatio-temporal neighboring motion vectors.

According to still another aspect of the present principles, there is provided a method in a video decoder. The method includes decoding at least a block in a picture using implicit adaptive motion vector predictor selection. A motion vector for decoding the block is predicted by defining a set of motion vector predictor candidates for the block based on a plurality of spatio-temporal neighboring motion vectors, and selecting from the set a particular motion vector predictor candidate as the motion vector for decoding the block responsive to respective values for a fidelity of the spatio-temporal neighboring motion vectors.

These and other aspects, features and advantages of the present principles will become apparent from the following detailed description of exemplary embodiments, which is to be read in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

The present principles may be better understood in accordance with the following exemplary figures, in which:

FIG. 1 is a block diagram showing an exemplary video encoder to which the present principles may be applied, in accordance with an embodiment of the present principles;

FIG. 2 is a block diagram showing an exemplary video decoder to which the present principles may be applied, in accordance with an embodiment of the present principles;

FIG. 3 is a flow diagram showing an exemplary method for implicit adaptive motion vector prediction selection in a video encoder, in accordance with an embodiment of the present principles;

FIG. 4 is a flow diagram showing an exemplary method for implicit adaptive motion vector prediction selection in a video decoder, in accordance with an embodiment of the present principles;

FIG. 5 is a flow diagram showing another exemplary method for implicit adaptive motion vector predictor selection in a video encoder, in accordance with an embodiment of the present principles;

FIG. 6 is a flow diagram showing another exemplary method for implicit adaptive motion vector predictor selection in a video decoder, in accordance with an embodiment of the present principles;

FIG. 7 is a flow diagram showing yet another exemplary method for implicit adaptive motion vector predictor selection in a video encoder, in accordance with an embodiment of the present principles; and

FIG. 8 is a flow diagram showing yet another exemplary method for implicit adaptive motion vector predictor selection in a video decoder, in accordance with an embodiment of the present principles.

DETAILED DESCRIPTION

The present principles are directed to methods and apparatus for implicit adaptive motion vector predictor selection for video encoding and decoding.

The present description illustrates the present principles. It will thus be appreciated that those skilled in the art will be able to devise various arrangements that, although not explicitly described or shown herein, embody the present principles and are included within its spirit and scope.

All examples and conditional language recited herein are intended for pedagogical purposes to aid the reader in understanding the present principles and the concepts contributed by the inventor(s) to furthering the art, and are to be construed as being without limitation to such specifically recited examples and conditions.

Moreover, all statements herein reciting principles, aspects, and embodiments of the present principles, as well as specific examples thereof, are intended to encompass both structural and functional equivalents thereof. Additionally, it is intended that such equivalents include both currently known equivalents as well as equivalents developed in the future, i.e., any elements developed that perform the same function, regardless of structure.

Thus, for example, it will be appreciated by those skilled in the art that the block diagrams presented herein represent conceptual views of illustrative circuitry embodying the present principles. Similarly, it will be appreciated that any flow charts, flow diagrams, state transition diagrams, pseudocode, and the like represent various processes which may be substantially represented in computer readable media and so executed by a computer or processor, whether or not such computer or processor is explicitly shown.

The functions of the various elements shown in the figures may be provided through the use of dedicated hardware as well as hardware capable of executing software in association with appropriate software. When provided by a processor, the functions may be provided by a single dedicated processor, by a single shared processor, or by a plurality of individual processors, some of which may be shared. Moreover, explicit use of the term "processor" or "controller" should not be construed to refer exclusively to hardware capable of executing software, and may implicitly include, without limitation, digital signal processor ("DSP") hardware, read-only memory ("ROM") for storing software, random access memory ("RAM"), and non-volatile storage.

Other hardware, conventional and/or custom, may also be included. Similarly, any switches shown in the figures are conceptual only. Their function may be carried out through the operation of program logic, through dedicated logic, through the interaction of program control and dedicated logic, or even manually, the particular technique being selectable by the implementer as more specifically understood from the context.

In the claims hereof, any element expressed as a means for performing a specified function is intended to encompass any way of performing that function including, for example, a) a combination of circuit elements that performs that function or b) software in any form, including, therefore, firmware, microcode or the like, combined with appropriate circuitry for executing that software to perform the function. The present principles as defined by such claims reside in the fact that the functionalities provided by the various recited means are combined and brought together in the manner which the claims call for. It is thus regarded that any means that can provide those functionalities are equivalent to those shown herein.

Reference in the specification to "one embodiment" or "an embodiment" of the present principles, as well as other variations thereof, means that a particular feature, structure, characteristic, and so forth described in connection with the embodiment is included in at least one embodiment of the present principles. Thus, the appearances of the phrase "in one embodiment" or "in an embodiment", as well any other variations, appearing in various places throughout the specification are not necessarily all referring to the same embodiment.

It is to be appreciated that the use of any of the following "/", "and/or", and "at least one of", for example, in the cases of "A/B", "A and/or B" and "at least one of A and B", is intended to encompass the selection of the first listed option (A) only, or the selection of the second listed option (B) only, or the selection of both options (A and B). As a further example, in the cases of "A, B, and/or C" and "at least one of A, B, and C", such phrasing is intended to encompass the selection of the first listed option (A) only, or the selection of the second listed option (B) only, or the selection of the third listed option (C) only, or the selection of the first and the second listed options (A and B) only, or the selection of the first and third listed options (A and C) only, or the selection of the second and third listed options (B and C) only, or the selection of all three options (A and B and C). This may be extended, as readily apparent by one of ordinary skill in this and related arts, for as many items listed.

Moreover, for purposes of illustration and description, examples are described herein in the context of improvements over the MPEG-4 AVC Standard, using the MPEG-4 AVC Standard as the baseline for our description and explaining the improvements and extensions beyond the MPEG-4 AVC Standard. However, it is to be appreciated that the present principles are not limited solely to the MPEG-4 AVC Standard and/or extensions thereof. Given the teachings of the present principles provided herein, one of ordinary skill in this and related arts would readily understand that the present principles are equally applicable and would provide at least similar benefits when applied to extensions of other standards, or when applied and/or incorporated within standards not yet developed. It is to be further appreciated that the present principles also apply to video encoders and video decoders that do not conform to standards, but rather confirm to proprietary definitions.

Also, as used herein, the words "picture" and "image" are used interchangeably and refer to a still image or a picture from a video sequence. As is known, a picture may be a frame or a field.

Turning to FIG. 1, an exemplary video encoder to which the present principles may be applied is indicated generally by the reference numeral 100. The video encoder 100 includes a frame ordering buffer 110 having an output in signal communication with a non-inverting input of a combiner 185. An output of the combiner 185 is connected in signal communication with a first input of a transformer and quantizer 125. An output of the transformer and quantizer 125 is connected in signal communication with a first input of an entropy coder 145 and a first input of an inverse transformer and inverse quantizer 150. An output of the entropy coder 145 is connected in signal communication with a first non-inverting input of a combiner 190. An output of the combiner 190 is connected in signal communication with a first input of an output buffer 135.

A first output of an encoder controller 105 is connected in signal communication with a second input of the frame ordering buffer 110, a second input of the inverse transformer and inverse quantizer 150, an input of a picture-type decision module 115, a first input of a macroblock-type (MB-type) decision module 120, a second input of an intra prediction module 160, a second input of a deblocking filter 165, a first input of a motion compensator 170, a first input of a motion estimator 175, and a second input of a reference picture buffer 180.

A second output of the encoder controller 105 is connected in signal communication with a first input of a Supplemental Enhancement Information (SEI) inserter 130, a second input of the transformer and quantizer 125, a second input of the entropy coder 145, a second input of the output buffer 135, and an input of the Sequence Parameter Set (SPS) and Picture Parameter Set (PPS) inserter 140.

An output of the SEI inserter 130 is connected in signal communication with a second non-inverting input of the combiner 190.

A first output of the picture-type decision module 115 is connected in signal communication with a third input of the frame ordering buffer 110. A second output of the picture-type decision module 115 is connected in signal communication with a second input of a macroblock-type decision module 120.

An output of the Sequence Parameter Set (SPS) and Picture Parameter Set (PPS) inserter 140 is connected in signal communication with a third non-inverting input of the combiner 190.

An output of the inverse quantizer and inverse transformer 150 is connected in signal communication with a first non-inverting input of a combiner 119. An output of the combiner 119 is connected in signal communication with a first input of the intra prediction module 160 and a first input of the deblocking filter 165. An output of the deblocking filter 165 is connected in signal communication with a first input of a reference picture buffer 180.

An output of the reference picture buffer 180 is connected in signal communication with a second input of the motion estimator 175 and a third input of the motion compensator 170. A first output of the motion estimator 175 is connected in signal communication with a second input of the motion compensator 170. A second output of the motion estimator 175 is connected in signal communication with a third input of the entropy coder 145.

An output of the motion compensator 170 is connected in signal communication with a first input of a switch 197. An output of the intra prediction module 160 is connected in signal communication with a second input of the switch 197. An output of the macroblock-type decision module 120 is connected in signal communication with a third input of the switch 197. The third input of the switch 197 determines whether or not the "data" input of the switch (as compared to the control input, i.e., the third input) is to be provided by the motion compensator 170 or the intra prediction module 160. The output of the switch 197 is connected in signal communication with a second non-inverting input of the combiner 119 and an inverting input of the combiner 185.

A first input of the frame ordering buffer 110 and an input of the encoder controller 105 are available as inputs of the encoder 100, for receiving an input picture. Moreover, a second input of the Supplemental Enhancement Information (SEI) inserter 130 is available as an input of the encoder 100, for receiving metadata. An output of the output buffer 135 is available as an output of the encoder 100, for outputting a bitstream.

Turning to FIG. 2, an exemplary video decoder to which the present principles may be applied is indicated generally by the reference numeral 200. The video decoder 200 includes an input buffer 210 having an output connected in signal communication with a first input of an entropy decoder 245. A first output of the entropy decoder 245 is connected in signal communication with a first input of an inverse transformer and inverse quantizer 250. An output of the inverse transformer and inverse quantizer 250 is connected in signal communication with a second non-inverting input of a combiner 225. An output of the combiner 225 is connected in signal communication with a second input of a deblocking filter 265 and a first input of an intra prediction module 260. A second output of the deblocking filter 265 is connected in signal communication with a first input of a reference picture buffer 280. An output of the reference picture buffer 280 is connected in signal communication with a second input of a motion compensator 270.

A second output of the entropy decoder 245 is connected in signal communication with a third input of the motion compensator 270, a first input of the deblocking filter 265, and a third input of the intra predictor 260. A third output of the entropy decoder 245 is connected in signal communication with an input of a decoder controller 205. A first output of the decoder controller 205 is connected in signal communication with a second input of the entropy decoder 245. A second output of the decoder controller 205 is connected in signal communication with a second input of the inverse transformer and inverse quantizer 250. A third output of the decoder controller 205 is connected in signal communication with a third input of the deblocking filter 265. A fourth output of the decoder controller 205 is connected in signal communication with a second input of the intra prediction module 260, a first input of the motion compensator 270, and a second input of the reference picture buffer 280.

An output of the motion compensator 270 is connected in signal communication with a first input of a switch 297. An output of the intra prediction module 260 is connected in signal communication with a second input of the switch 297. An output of the switch 297 is connected in signal communication with a first non-inverting input of the combiner 225.

An input of the input buffer 210 is available as an input of the decoder 200, for receiving an input bitstream. A first output of the deblocking filter 265 is available as an output of the decoder 200, for outputting an output picture.

As noted above, the present principles are directed to methods and apparatus for implicit adaptive motion vector predictor selection for video encoding and decoding. In accordance with an embodiment of the present principles, a motion vector is predicted by one of its spatio-temporal neighboring motion vector. The selection is based on the motion compensation error of the corresponding motion vector candidate, which is available at both the encoder and decoder. Therefore, the selection is based on implicit (derived) data already available at the encoder and decoder without the need for side or additional information being sent from the encoder to the decoder. Therefore, using the present principles, there is no additional cost or overhead for motion vector predictor selection and, yet, the present principles still achieve very accurate prediction performance. A motion vector is derived at the decoder by exploiting the correlation among its spatio-temporal neighboring motion vectors and their prediction confidence. The prediction confidence can be a function of an estimated motion compensation error, motion vector magnitude, reference index, or other parameter available and related to motion information.

In accordance with the present principles, we exploit the correlation among neighboring motion vectors by defining a causal local neighborhood for each coding block.

The neighborhood includes causal spatio-temporal neighboring blocks that are coded as inter-coded blocks. Since these blocks are already decoded, the motion vectors are known at both the encoder and decoder. These motion vectors form the motion vector candidate set. The next question is how to select motion vector predictors for the coding block within the candidate set.

In accordance with the present principles, we consider the fidelity of each candidate in the set. The fidelity is defined as the motion compensation error caused by using the motion vector to compensate the corresponding block. For example, considering a block B_i in the neighborhood, block B_i has motion vector MV_i available at both the encoder and decoder. The motion compensation error E_i of B_i caused by using MV_i can be estimated by the residual information of B_i. Thus, the fidelity of MV_i can be defined as a function of E_i as follows:

$$F(i) = f(E_i)$$

The function should be a decreasing function of E_i, which means that a large motion compensation error results in a low fidelity. Each motion vector in the candidate set has a fidelity value, which implicitly provides side information for our motion vector predictor selection.

After obtaining the fidelity values of the candidates, the selection process is made. The actual parameter or parameters used to make the selection can be from a variety of parameters. For example, in an embodiment, we can select the motion vector in the set which has the highest fidelity as the motion vector predictor. In another embodiment, we can use the weighted median value of the motion vectors in the set as the motion vector predictor. In an embodiment, the weights can be a function of the fidelity value. In an embodiment, we can also use weighted averaging or other functions that take into account the fidelity information in order to derive the motion vector predictor. Embodiments are presented which illustrate these varieties.

Since all information used in the selection and the calculation of the fidelity value is available at both the encoder and decoder, no overhead needs to be sent, which makes the present principles promising in both low and high bit rate applications. Compared to the median approach in the MPEG-4 AVC Standard, the present principles take into account the fidelity of the neighboring motion vectors, which may be suitable for the relatively complicated motion field cases with only a very minor increase in complexity.

Embodiment 1:

In Embodiment 1, the motion vector predictor selection is based on the prior information provided by the fidelity values of the neighboring candidates. The motion vector predictor of the current coding block is the motion vector in the set which has the highest fidelity.

Turning to FIG. 3, an exemplary method for implicit adaptive motion vector prediction selection in a video encoder is indicated generally by the reference numeral 300. The method 300 includes a start block 305 that passes control to a function block 310. The function block 310 initializes the size of a neighborhood of different partition modes, and passes control to a function block 315. The function block 315 defines the neighboring motion vector set for the current coding block, and passes control to a function block 320. The function block 320 calculates the fidelity of each motion vector in the set based on the residual of the corresponding block, and passes control to a function block 325. The function block 325 selects the motion vector predictor for the current coding block (e.g., selecting the motion vector in the set with the highest fidelity), and passes control to a function block 330. The function block 330 uses this motion vector predictor for motion estimation, motion compensation, and entropy encoding, and passes control to an end block 399.

Turning to FIG. 4, an exemplary method for implicit adaptive motion vector prediction selection in a video decoder is indicated generally by the reference numeral 400. The method 400 includes a start block 405 that passes control to a function block 410. The function block 410 parses an input bitstream, and passes control to a function block 415. The function block 415 initializes the size of a neighborhood of different partition modes, and passes control to a function block 420. The function block 420 defines the neighboring motion vector set for the current coding block, and passes control to a function block 425. The function block 425 calculates the fidelity of each motion vector in the set based on the residual of the corresponding block, and passes control to a function block 430. The function block 430 selects the motion vector predictor for the current coding block (e.g., selecting the motion vector in the set with the highest fidelity), and passes control to a function block 435. The function block 435 decodes the motion vector difference, calculates the motion vector by using the motion vector predictor, and passes control to an end block 499.

Embodiment 2:

In Embodiment 2, the fidelity values of the motion vector candidates are used for a weighted median filter to derive the motion vector predictor. The weights in the weighted median filter indicate the number of repetitions of a value within the filter support. The filter support here is the neighborhood that includes all the motion vector candidates of a block. If the weight of a motion vector is n, then the motion vector will be duplicated n times when being filtered by a median filter. In Embodiment 2, the weights are linked with the fidelity by a mapping function, which maps the fidelity to the number of repetitions of a motion vector. Then the output of the weighted median filter is taken as the motion vector predictor of the current coding block.

Turning to FIG. 5, another exemplary method for implicit adaptive motion vector predictor selection in a video encoder is indicated generally by the reference numeral 500. The method 500 includes a start block 505 that passes control to a function block 510. The function block 510 initializes the size of a neighborhood of different partition modes, and passes control to a function block 515. The function block 515 defines the neighboring motion vector set for the current coding block, and passes control to a function block 520. The function block 520 calculates the fidelity of each motion vector in the set based on the residual of the corresponding block, and passes control to a function block 525. The function block 525 maps the fidelity to the weight of the median filter, and passes control to a function block 530. The function block 530 applies the weighted median filter to the motion vector predictor candidate set to obtain the motion vector predictor of the current coding block, and passes control to a function block 535. The function block 535 uses the motion vector predictor for motion estimation, motion compensation, and entropy encoding, and passes control to an end block 599.

Turning to FIG. 6, another exemplary method for implicit adaptive motion vector predictor selection in a video decoder is indicated generally by the reference numeral 600. The method 600 includes a start block 605 that passes control to a function block 610. The function block 610 parses an input bitstream, and passes control to a function block 615. The function block 615 initializes the size of a neighborhood of different partition modes, and passes control to a function block 620. The function block 620 defines the neighboring motion vector set for the current coding block, and passes control to a function block 625. The function block 625 calculates the fidelity of each motion vector in the set based on the residual of the corresponding block, and passes control to a function block 630. The function block 630 maps the fidelity to the weight of the median filter, and passes control to a function block 635. The function block 635 applies the weighted median filter to the motion vector predictor candidate set to obtain the motion vector predictor of the current coding block, and passes control to a function block 640. The function block 640 decodes the motion vector difference, calculates the motion vector by using the motion vector predictor, and passes control to an end block 699.

Embodiment 3:

In Embodiment 3, the implicit motion vector predictor selection can be combined with the explicit approach. The fidelities of neighboring motion vectors are generated and compared with a pre-defined threshold. If all fidelities are lower than the threshold, the explicit signaling approach is used for selecting the motion vector predictors based on the rate distortion optimization. Otherwise, the implicit signaling approach is used.

Turning to FIG. 7, yet another exemplary method for implicit adaptive motion vector predictor selection in a video encoder is indicated generally by the reference numeral 700. The method 700 includes a start block 705 that passes control to a function block 710. The function block 710 initializes the size of a neighborhood of different partition modes, and passes control to a function block 715. The function block 715 defines the neighboring motion vector set for the current coding block, and passes control to a function block 720. The function block 720 calculates the fidelity of each motion vector in the set based on the residual of the corresponding block, and passes control to a decision block 725. The decision block 725 determines whether or not all fidelities are smaller than a threshold. If so, then control is passed to a function block 730. Otherwise, control is passed to a function block 740. The function block 730 uses the explicit motion vector predictor signaling approach based on rate distortion optimization, and passes control to a function block 735. The function block 740 uses the implicit motion vector predictor selection approach based on fidelity, and passes control to the function block 735. The function block 735 uses this motion vector predictor for motion estimation, motion compensation, and entropy encoding, and passes control to an end block 799.

Turning to FIG. 8, yet another exemplary method for implicit adaptive motion vector predictor selection in a video decoder is indicated generally by the reference numeral 800. The method 800 includes a start block 805 that passes control to a function block 810. The function block 810 parses an input bitstream, and passes control to a function block 815. The function block 815 initializes the size of a neighborhood of different partition modes, and passes control to a function block 820. The function block 820 defines the neighboring motion vector set for the current coding block, and passes control to a function block 825. The function block 825 calculates the fidelity of each motion vector in the set based on the residual of the corresponding block, and passes control to a decision block 830. The decision block 830 determines whether or not all fidelities are smaller than a threshold. If so, then control is passed to a function block 835. Otherwise, control is passed to a function block 840. The function block 835 decodes the motion vector index, and passes control to a function block 840. The function block 845 uses the implicit motion vector predictor selection approach based on fidelity, and passes control to the function block 840. The function block 840 decodes the motion vector difference, calculates the motion vector by using the motion vector predictor, and passes control to an end block 899.

Syntax

TABLE 1 shows exemplary slice header syntax, in accordance with an embodiment of the present principles.

TABLE 1

slice_header( ) {	**Descriptor**
...	
use_implicit_mvp_signaling	u(1)
...	
}	
macroblock(){	
if (use_implicit_mvp_signaling){	
...	
if (all fidelities < threshold){	
mvp_index	u(v)
}	
...	
}	
...	
}	

The semantics of the syntax elements of TABLE 1 are as follows:

use_implicit_mvp_signaling specifies whether the implicit motion vector predictor selection is used or not. use_implicit_mvp_signaling equal to 1 means the implicit motion vector prediction selection is used; use_implicit_mvp_signaling equal to 0 means it is not used.

mvp_index specifies the index of the motion vector that is selected as motion vector predictor in the candidate set.

A description will now be given of some of the many attendant advantages/features of the present invention, some of which have been mentioned above. For example, one advantage/feature is an apparatus having a video encoder for encoding at least a block in a picture using implicit adaptive motion vector predictor selection, wherein a motion vector for encoding the block is predicted by defining a set of motion vector predictor candidates for the block based on a plurality of spatio-temporal neighboring motion vectors, and selecting from the set a particular motion vector predictor candidate as the motion vector for encoding the block responsive to respective values for a fidelity of the spatio-temporal neighboring motion vectors.

Another advantage/feature is the apparatus having the video encoder as described above, wherein the fidelity is a function of at least one of the motion compensation error, a motion vector magnitude, a reference index, and other motion related information which is available at both the encoder and the corresponding decoder.

Yet another advantage/feature is the apparatus having the video encoder as described above, wherein the particular motion vector predictor candidate selected as the motion vector for encoding the block has a highest fidelity from the motion vector predictor candidates in the set.

Still another advantage/feature is the apparatus having the video encoder as described above, wherein the respective values for the fidelity of the spatio-temporal neighboring motion vectors are used for a weighted median filter to derive the particular motion vector predictor candidate selected as the motion vector for encoding the block.

Moreover, another advantage/feature is the apparatus having the video encoder as described above, wherein the implicit adaptive motion vector predictor selection is combined with explicit signaling of motion vector predictors in a hybrid scenario.

Further, another advantage/feature is the apparatus having the video encoder wherein the implicit adaptive motion vector predictor selection is combined with explicit signaling of motion vector predictors in a hybrid scenario as described above, wherein a decision of whether to use the implicit adaptive motion vector predictor selection or the explicit signaling of motion vector predictors for the block is determined responsive to an evaluation of fidelity values.

Also, another advantage/feature is the apparatus having the video encoder wherein the implicit adaptive motion vector predictor selection is combined with explicit signaling of motion vector predictors in a hybrid scenario as described above, wherein the explicit signaling of motion vector predictors is used at a slice level, and the decision of whether to use the implicit adaptive motion vector predictor selection or the explicit signaling of motion vector predictors for the block is made at a block level.

These and other features and advantages of the present principles may be readily ascertained by one of ordinary skill in the pertinent art based on the teachings herein. It is to be understood that the teachings of the present principles may be implemented in various forms of hardware, software, firmware, special purpose processors, or combinations thereof.

Most preferably, the teachings of the present principles are implemented as a combination of hardware and software. Moreover, the software may be implemented as an application program tangibly embodied on a program storage unit. The application program may be uploaded to, and executed by, a machine comprising any suitable architecture. Preferably, the machine is implemented on a computer platform having hardware such as one or more central processing units ("CPU"), a random access memory ("RAM"), and input/output ("I/O") interfaces. The computer platform may also include an operating system and microinstruction code. The various processes and functions described herein may be either part of the microinstruction code or part of the application program, or any combination thereof, which may be executed by a CPU. In addition, various other peripheral units may be connected to the computer platform such as an additional data storage unit and a printing unit.

It is to be further understood that, because some of the constituent system components and methods depicted in the accompanying drawings are preferably implemented in software, the actual connections between the system components or the process function blocks may differ depending upon the manner in which the present principles are programmed. Given the teachings herein, one of ordinary skill in the pertinent art will be able to contemplate these and similar implementations or configurations of the present principles.

Although the illustrative embodiments have been described herein with reference to the accompanying drawings, it is to be understood that the present principles is not limited to those precise embodiments, and that various changes and modifications may be effected therein by one of ordinary skill in the pertinent art without departing from the scope or spirit of the present principles. All such changes and modifications are intended to be included within the scope of the present principles as set forth in the appended claims.

CLAIMS:

1. An apparatus, comprising:

a video encoder (100) for encoding an image block using implicit adaptive motion vector predictor selection, wherein a motion vector for encoding the block is predicted by defining a set of motion vector predictor candidates for the block based on a plurality of spatio-temporal neighboring motion vectors, and selecting from the set a particular motion vector predictor candidate as the motion vector for encoding the block responsive to respective values for a fidelity of the spatio-temporal neighboring motion vectors.

2. The apparatus of claim 1, wherein the fidelity is a function of at least one of: motion compensation error, motion vector magnitude, and a reference index, which is available at both the encoder and corresponding decoder.

3. The apparatus of claim 1, wherein the particular motion vector predictor candidate selected as the motion vector for encoding the block has a highest fidelity from the motion vector predictor candidates in the set.

4. The apparatus of claim 1, wherein the respective values for the fidelity of the spatio-temporal neighboring motion vectors are used for a weighted median filter to derive the particular motion vector predictor candidate selected as the motion vector for encoding the block.

5. The apparatus of claim 1, wherein the implicit adaptive motion vector predictor selection is combined with explicit signaling of motion vector predictors in a hybrid scenario.

6. The apparatus of claim 5, wherein a decision of whether to use the implicit adaptive motion vector predictor selection or the explicit signaling of motion vector predictors for the block is determined responsive to an evaluation of fidelity values.

7. The apparatus of claim 5, wherein the explicit signaling of motion vector predictors is used at a slice level, and the decision of whether to use the implicit adaptive motion vector predictor selection or the explicit signaling of motion vector predictors for the block is made at a block level.

8. In a video encoder, a method, comprising:

encoding an image block using implicit adaptive motion vector predictor selection, wherein a motion vector for encoding the block is predicted by defining (315, 515, 715) a set of motion vector predictor candidates for the block based on a plurality of spatio-temporal neighboring motion vectors, and selecting (325, 530, 740) from the set a particular motion vector predictor candidate as the motion vector for encoding the block responsive to respective values for a fidelity of the spatio-temporal neighboring motion vectors (320, 520, 720).

9. The method of claim 8, wherein the fidelity is a function of at least one of: motion compensation error, motion vector magnitude, and a reference index, which is available at both the encoder and corresponding decoder (320, 520, 720).

10. The method of claim 8, wherein the particular motion vector predictor candidate selected as the motion vector for encoding the block has a highest fidelity from the motion vector predictor candidates in the set (325).

11. The method of claim 8, wherein the respective values for the fidelity of the spatio-temporal neighboring motion vectors are used for a weighted median filter to derive the particular motion vector predictor candidate selected as the motion vector for encoding the block (525, 530).

12. The method of claim 8, wherein the implicit adaptive motion vector predictor selection is combined with explicit signaling of motion vector predictors in a hybrid scenario (700).

13. The method of claim 12, wherein a decision of whether to use the implicit adaptive motion vector predictor selection or the explicit signaling of motion vector predictors for the block is determined responsive to an evaluation of fidelity values (725).

14. The method of claim 12, wherein the explicit signaling of motion vector predictors is used at a slice level, and the decision of whether to use the implicit adaptive motion vector predictor selection or the explicit signaling of motion vector predictors for the block is made at a block level (700).

15. An apparatus, comprising:

a video decoder (200) for decoding an image block using implicit adaptive motion vector predictor selection, wherein a motion vector for decoding the block is predicted by defining a set of motion vector predictor candidates for the block based on a plurality of spatio-temporal neighboring motion vectors, and selecting from the set a particular motion vector predictor candidate as the motion vector for decoding the block responsive to respective values for a fidelity of the spatio-temporal neighboring motion vectors.

16. The apparatus of claim 15, wherein the fidelity is a function of at least one of: motion compensation error, motion vector magnitude, and a reference index, which is available at both the decoder and corresponding encoder.

17. The apparatus of claim 15, wherein the particular motion vector predictor candidate selected as the motion vector for decoding the block has a highest fidelity from the motion vector predictor candidates in the set.

18. The apparatus of claim 15, wherein the respective values for the fidelity of the spatio-temporal neighboring motion vectors are used for a weighted median filter to derive the particular motion vector predictor candidate selected as the motion vector for decoding the block.

19. The apparatus of claim 15, wherein the implicit adaptive motion vector predictor selection is combined with explicit signaling of motion vector predictors in a hybrid scenario.

20. The apparatus of claim 19, wherein a decision of whether to use the implicit adaptive motion vector predictor selection or the explicit signaling of motion vector predictors for the block is determined responsive to an evaluation of fidelity values.

21. The apparatus of claim 19, wherein the explicit signaling of motion vector predictors is used at a slice level, and the decision of whether to use the implicit adaptive motion vector predictor selection or the explicit signaling of motion vector predictors for the block is made at a block level.

22. In a video decoder, a method, comprising:

decoding an image block using implicit adaptive motion vector predictor selection, wherein a motion vector for decoding the block is predicted by defining (420, 620, 820) a set of motion vector predictor candidates for the block based on a plurality of spatio-temporal neighboring motion vectors, and selecting (430, 635, 845) from the set a particular motion vector predictor candidate as the motion vector for decoding the block responsive to respective values for a fidelity of the spatio-temporal neighboring motion vectors (425, 625, 825).

23. The method of claim 22, wherein the fidelity is a function of at least one of: motion compensation error, motion vector magnitude, and a reference index, which is available at both the decoder and corresponding encoder (425, 625, 825).

24. The method of claim 22, wherein the particular motion vector predictor candidate selected as the motion vector for decoding the block has a highest fidelity from the motion vector predictor candidates in the set (430).

25. The method of claim 22, wherein the respective values for the fidelity of the spatio-temporal neighboring motion vectors are used for a weighted median filter to derive the particular motion vector predictor candidate selected as the motion vector for decoding the block (630, 635).

26. The method of claim 22, wherein the implicit adaptive motion vector predictor selection is combined with explicit signaling of motion vector predictors in a hybrid scenario (800).

27. The method of claim 26, wherein a decision of whether to use the implicit adaptive motion vector predictor selection or the explicit signaling of motion vector predictors for the block is determined responsive to an evaluation of fidelity values (830).

28. The method of claim 26, wherein the explicit signaling of motion vector predictors is used at a slice level, and the decision of whether to use the implicit adaptive motion vector predictor selection or the explicit signaling of motion vector predictors for the block is made at a block level (800).

29. A computer readable non-transitory storage media having video signal data encoded thereupon, comprising:

compressed data for an image block encoded using implicit adaptive motion vector predictor selection, wherein a motion vector for encoding the block is predicted by defining a set of motion vector predictor candidates for the block based on a plurality of spatio-temporal neighboring motion vectors, selecting from the set a particular motion vector predictor candidate as the motion vector for encoding the block based on a motion compensation error of the particular motion vector predictor candidate, the motion compensation error being available at the video encoder and a corresponding decoder.

1/8

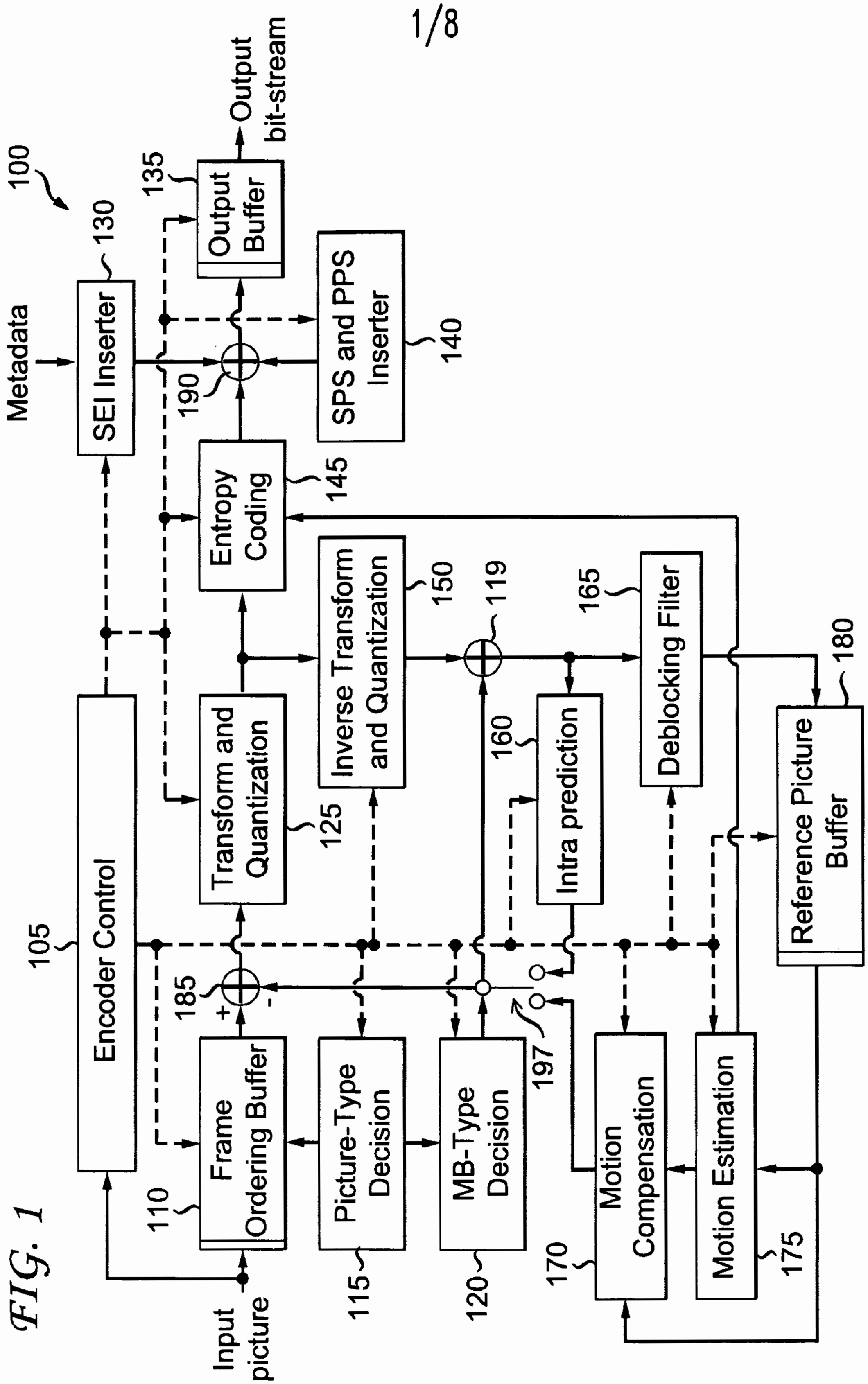

100
Metadata
SEI Inserter
130
135
Output Buffer
Output bit-stream
SPS and PPS Inserter
140
190
Entropy Coding
145
Encoder Control
105
Transform and Quantization
125
Inverse Transform and Quantization
150
119
165
Deblocking Filter
160
Intra prediction
180
Reference Picture Buffer
185
+
-
197
Frame Ordering Buffer
110
Picture-Type Decision
115
MB-Type Decision
120
Motion Compensation
170
Motion Estimation
175
Input picture

FIG. 1

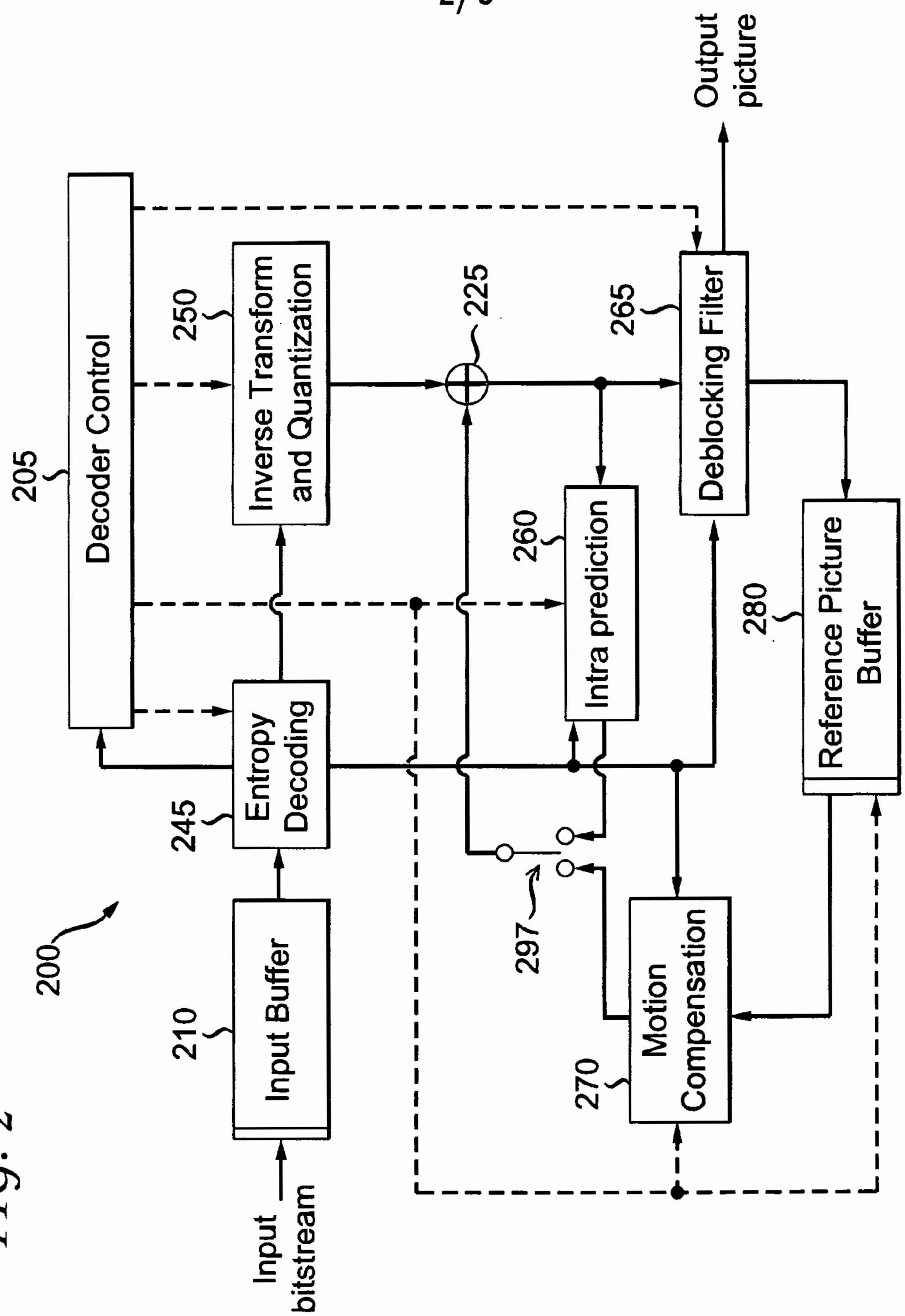

200
Input bitstream
Input Buffer
210
Entropy Decoding
245
Decoder Control
205
Inverse Transform and Quantization
250
225
Intra prediction
260
Deblocking Filter
265
Output picture
Motion Compensation
270
297
Reference Picture Buffer
280

FIG. 2

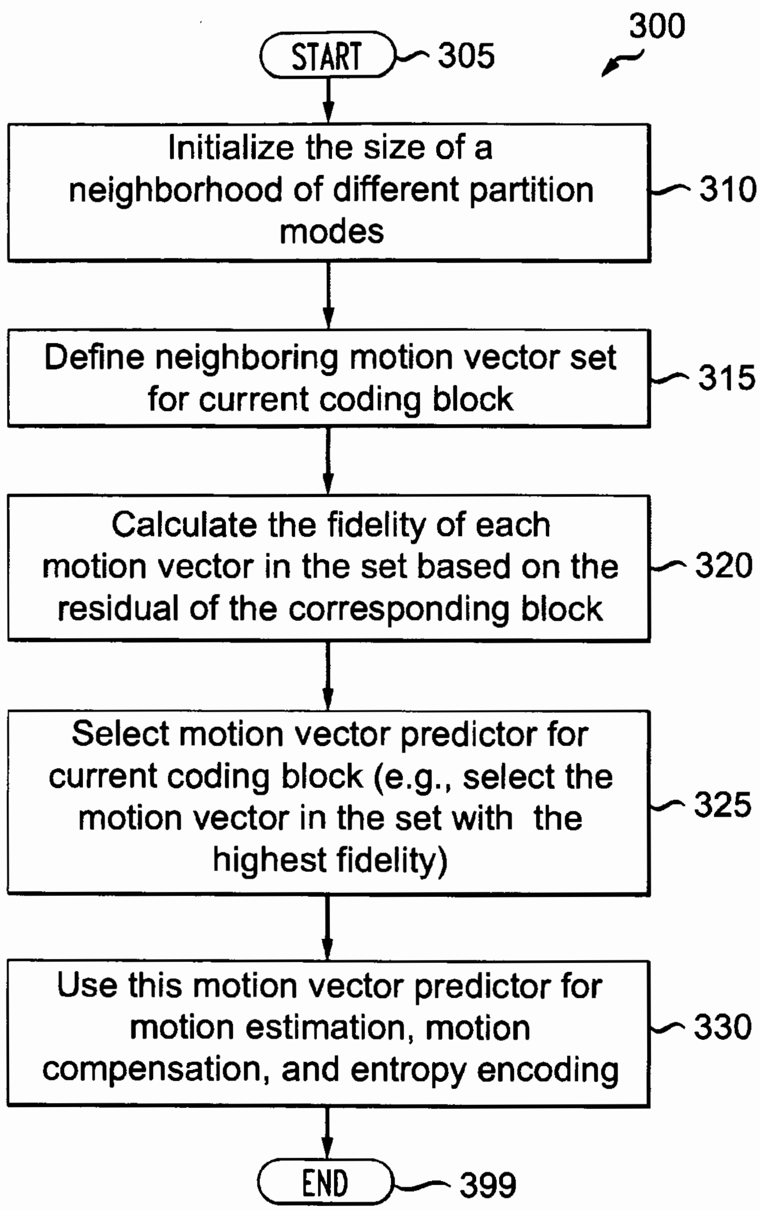
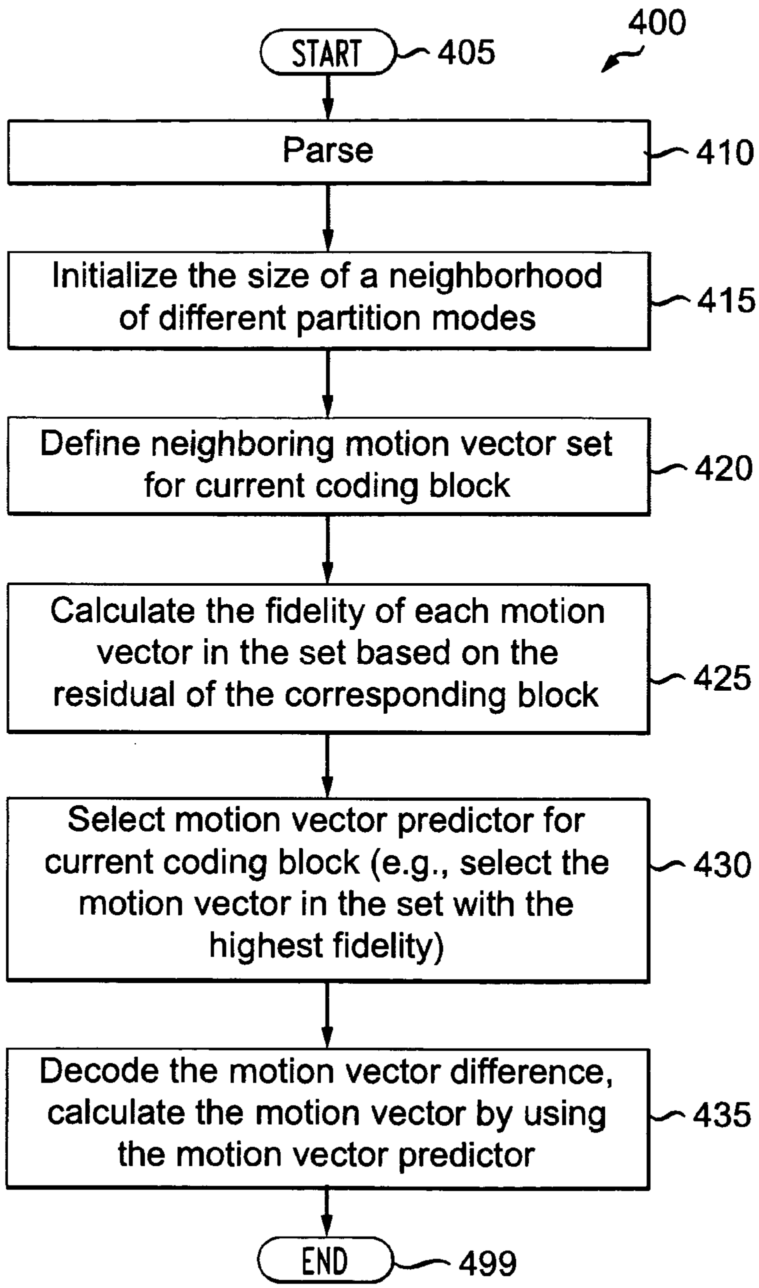

300
START
305
Initialize the size of a neighborhood of different partition modes
310
Define neighboring motion vector set for current coding block
315
Calculate the fidelity of each motion vector in the set based on the residual of the corresponding block
320
Select motion vector predictor for current coding block (e.g., select the motion vector in the set with the highest fidelity)
325
Use this motion vector predictor for motion estimation, motion compensation, and entropy encoding
330
END
399

FIG. 3



400
START
405
Parse
410
Initialize the size of a neighborhood of different partition modes
415
Define neighboring motion vector set for current coding block
420
Calculate the fidelity of each motion vector in the set based on the residual of the corresponding block
425
Select motion vector predictor for current coding block (e.g., select the motion vector in the set with the highest fidelity)
430
Decode the motion vector difference, calculate the motion vector by using the motion vector predictor
435
END
499

FIG. 4

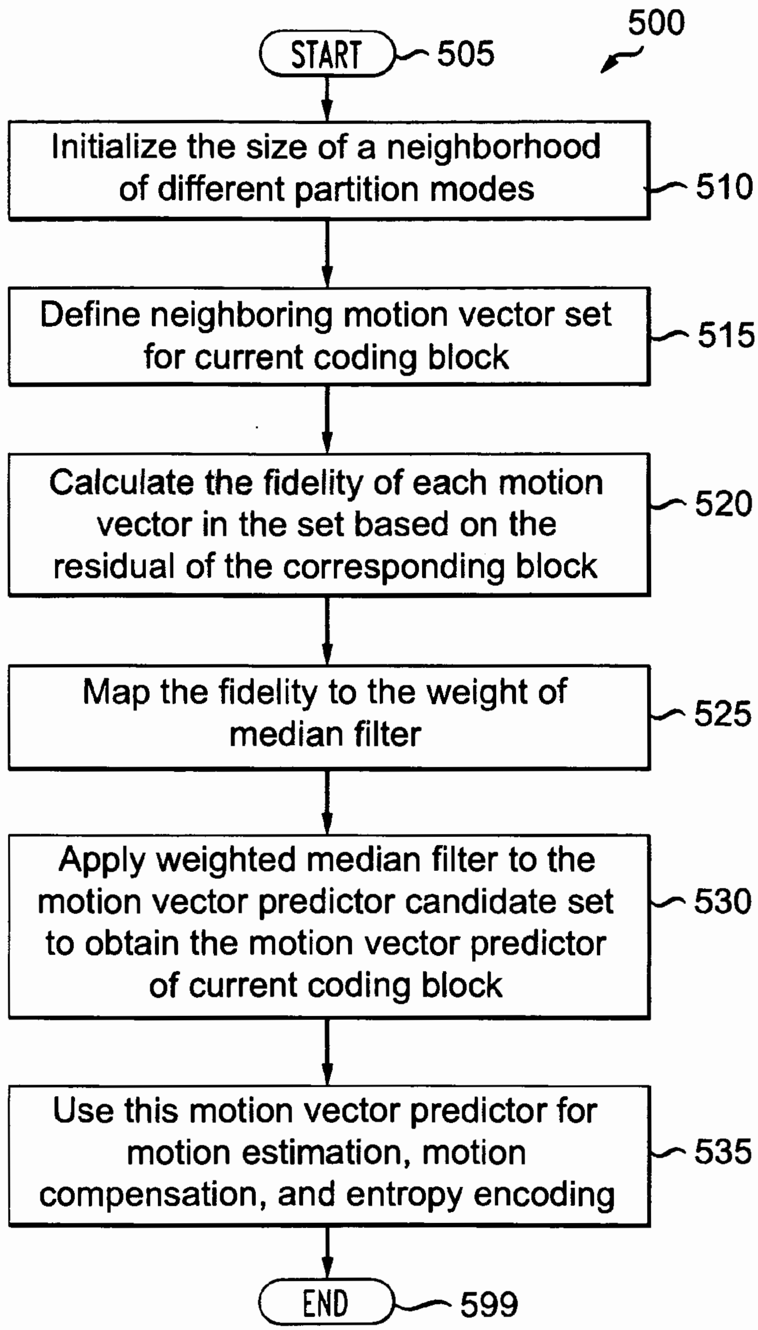

500
START
505
Initialize the size of a neighborhood of different partition modes
510
Define neighboring motion vector set for current coding block
515
Calculate the fidelity of each motion vector in the set based on the residual of the corresponding block
520
Map the fidelity to the weight of median filter
525
Apply weighted median filter to the motion vector predictor candidate set to obtain the motion vector predictor of current coding block
530
Use this motion vector predictor for motion estimation, motion compensation, and entropy encoding
535
END
599

FIG. 5

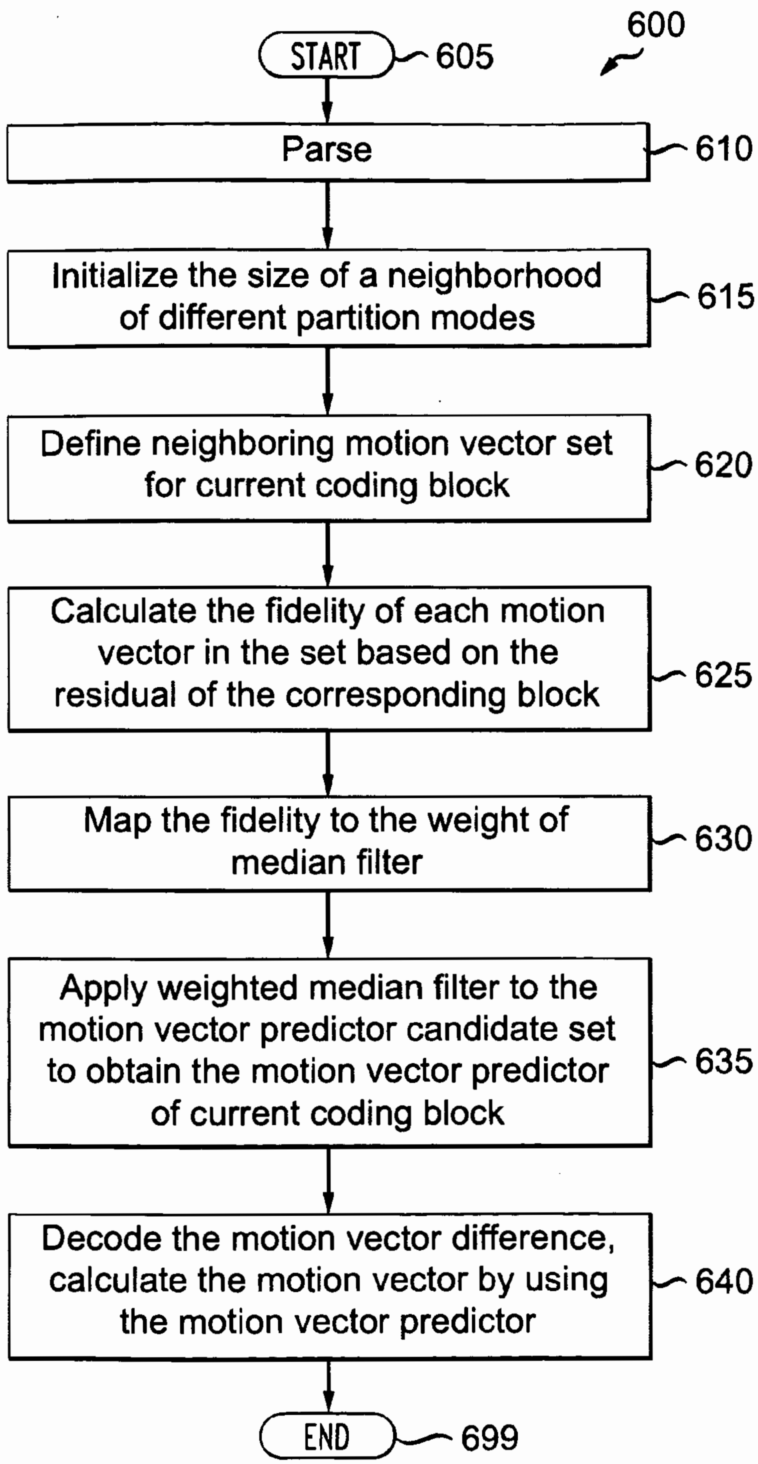
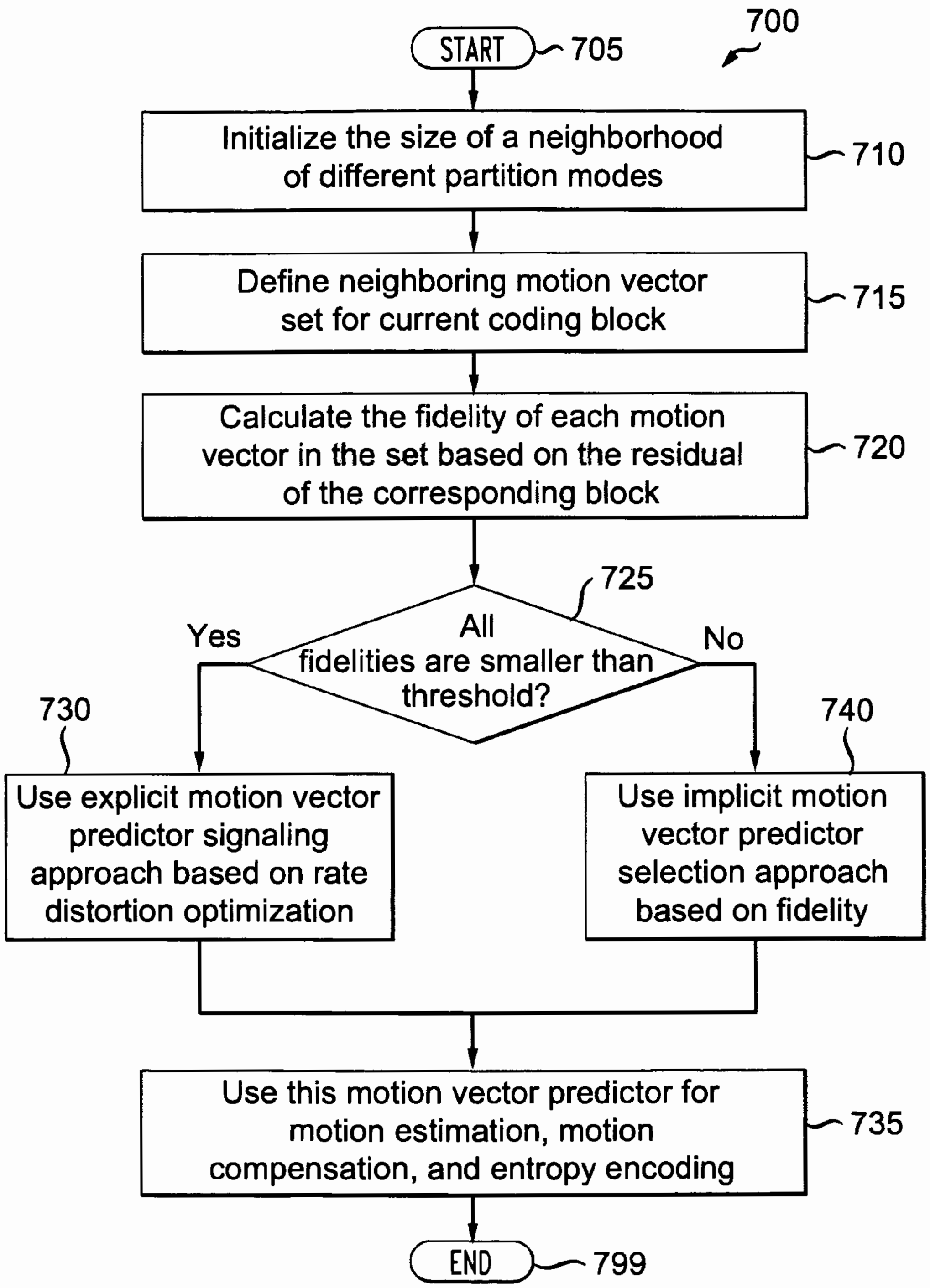

600
START
605
Parse
610
Initialize the size of a neighborhood of different partition modes
615
Define neighboring motion vector set for current coding block
620
Calculate the fidelity of each motion vector in the set based on the residual of the corresponding block
625
Map the fidelity to the weight of median filter
630
Apply weighted median filter to the motion vector predictor candidate set to obtain the motion vector predictor of current coding block
635
Decode the motion vector difference, calculate the motion vector by using the motion vector predictor
640
END
699

FIG. 6



700
START
705
Initialize the size of a neighborhood of different partition modes
710
Define neighboring motion vector set for current coding block
715
Calculate the fidelity of each motion vector in the set based on the residual of the corresponding block
720
725
All fidelities are smaller than threshold?
Yes
No
730
Use explicit motion vector predictor signaling approach based on rate distortion optimization
740
Use implicit motion vector predictor selection approach based on fidelity
Use this motion vector predictor for motion estimation, motion compensation, and entropy encoding
735
END
799

FIG. 7

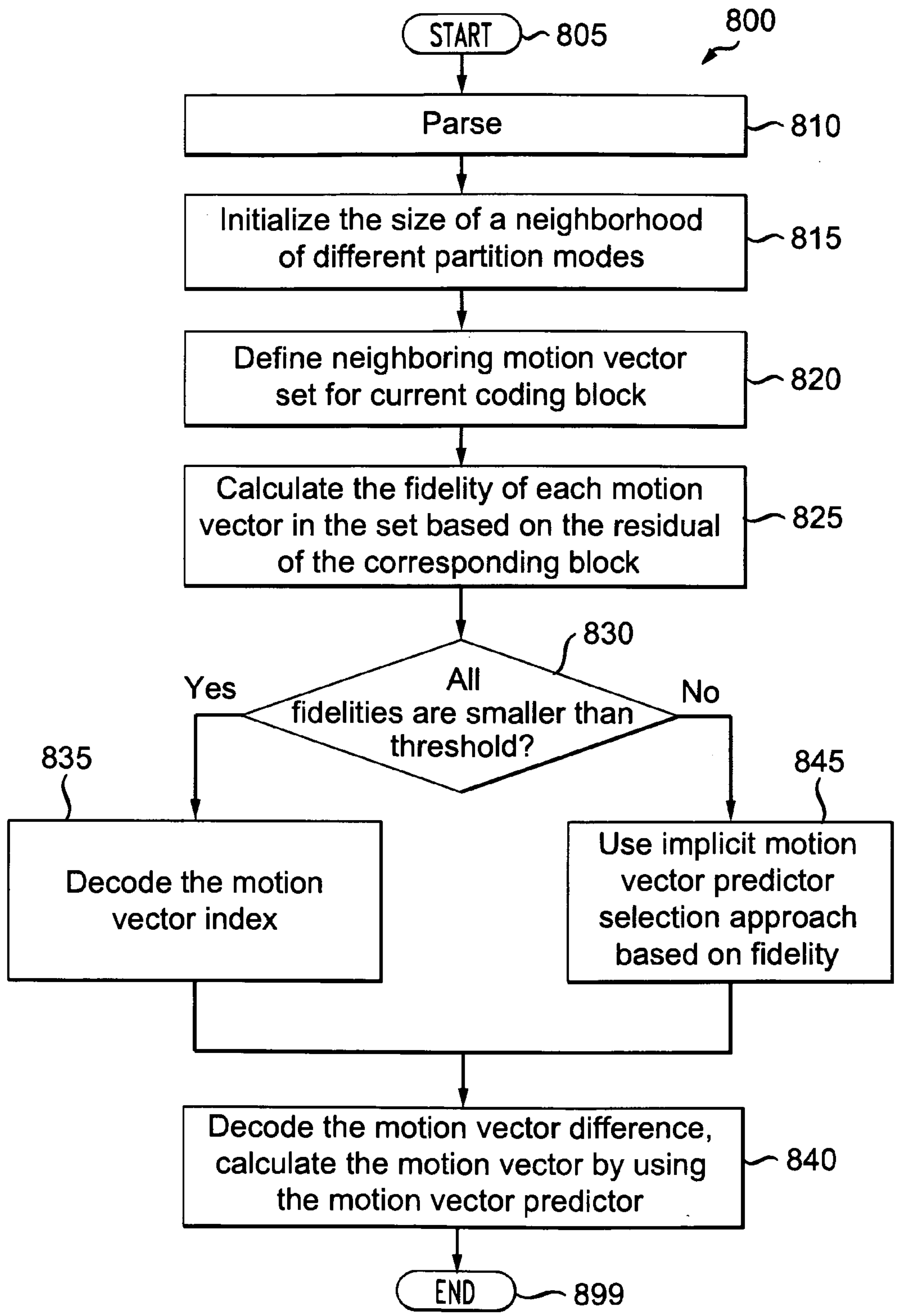

START
805
800
Parse
810
Initialize the size of a neighborhood of different partition modes
815
Define neighboring motion vector set for current coding block
820
Calculate the fidelity of each motion vector in the set based on the residual of the corresponding block
825
830
All fidelities are smaller than threshold?
Yes
No
835
Decode the motion vector index
845
Use implicit motion vector predictor selection approach based on fidelity
Decode the motion vector difference, calculate the motion vector by using the motion vector predictor
840
END
899

FIG. 8

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2011/000421

A. CLASSIFICATION OF SUBJECT MATTER
INV. H04N7/26 H04N7/36 H04N7/50
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H04N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, INSPEC, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JINGJING DAI ET AL: "An efficient motion vector coding algorithm based on adaptive motion vector prediction", 90. MPEG MEETING; 26-10-2009 - 30-10-2009; XIAN; (MOTION PICTURE EXPERT GROUP OR ISO/IEC JTC1/SC29/WG11),, 23 October 2009 (2009-10-23), XP030045452, the whole document -----	1-3, 8-10, 15-17, 22-24,29
X	WO 2009/115901 A2 (NOKIA CORP [FI]; HALLAPURO ANTTI OLLI [FI]; UGUR KEMAI [FI]; LAINEMA J) 24 September 2009 (2009-09-24) abstract page 3, lines 12-18,33-34 page 8, lines 13-23 page 9, lines 10-22,31-32 ----- -/--	1,2,5-9, 12-16, 19-23, 26-28

[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
17 August 2011	24/08/2011

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Santos Luque, Rocio

Form PCT/ISA/210 (second sheet) (April 2005)

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2008/247465 A1 (XIN ET AL) 9 October 2008 (2008-10-09) paragraphs [0017] - [0018], [0021], [0033] - [0039] -----	1,4,8, 11,15, 18,22,25
A	US 2004/252764 A1 (HUR ET AL) 16 December 2004 (2004-12-16) abstract paragraphs [0018] - [0025], [0082] - [0085] -----	1,4,8, 11,15, 18,22,25
A	LAROCHE G ET AL: "RD Optimized Coding for Motion Vector Predictor Selection", IEEE TRANSACTIONS ON CIRCUITS AND SYSTEMS FOR VIDEO TECHNOLOGY, IEEE SERVICE CENTER, PISCATAWAY, NJ, US, vol. 18, no. 9, 1 September 2008 (2008-09-01), pages 1247-1257, XP011231739, ISSN: 1051-8215, DOI: 10.1109/TCSVT.2008.928882 the whole document -----	1-29

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2011/000421

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2009115901 A2	24-09-2009	EP 2266318 A2	29-12-2010
		US 2009304084 A1	10-12-2009
US 2008247465 A1	09-10-2008	JP 2008259174 A	23-10-2008
US 2004252764 A1	16-12-2004	JP 2005012798 A	13-01-2005
		KR 20040108053 A	23-12-2004

Form PCT/ISA/210 (patent family annex) (April 2005)

Substitute for form SB08 (Revised 07/09) **INFORMATION DISCLOSURE STATEMENT BY APPLICANT** *(Use as many sheets as necessary)*	Complete if Known	
	Application Number	13/666,680
	Filing Date	November 1, 2012
	First Named Inventor	Bici et al.
	Art Unit	2488
	Examiner Name	N. B. Aynalem
Sheet 1 of 1	Attorney Docket Number	042933/467264

U. S. PATENT DOCUMENTS

Examiner Initials*	Cite No.	Document Number Number - Kind Code (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages of Relevant Figures Appear

FOREIGN PATENT DOCUMENTS

Examiner Initials	Cite No.	Foreign Patent Document Country Code - Number Kind Code (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	English Language Translation Attached
	1	WO 2011 115659 A1	09-22-2011	Thomson Licensing		

OTHER DOCUMENTS

Examiner Initials*	Cite No.	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	English Language Translation Attached
	2	Office Action for Chinese Application No. 2012800657775 dated October 9, 2016	Yes

Examiner Signature		Date Considered	

*Examiner: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. LEGAL02/36819290v1

Submitted November 23, 2016

Electronic Acknowledgement Receipt

EFS ID:	27608249
Application Number:	13666680
International Application Number:	
Confirmation Number:	4782
Title of Invention:	METHOD FOR CODING AND AN APPARATUS
First Named Inventor/Applicant Name:	Mehmet Oguz BICI
Customer Number:	10949
Filer:	Christopher Jason Gegg/Joyce Smith
Filer Authorized By:	Christopher Jason Gegg
Attorney Docket Number:	042933/467264
Receipt Date:	23-NOV-2016
Filing Date:	01-NOV-2012
Time Stamp:	17:20:53
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$180
RAM confirmation Number	112516INTEFSW00006268160605
Deposit Account	
Authorized User	

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		IDS467264.PDF	120349 b845ae209454b044d98594509813707f2049057f	yes	2

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Transmittal Letter	1	1
	Information Disclosure Statement (IDS) Form (SB08)	2	2

Warnings:

Information:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
2	Foreign Reference	467264_WO2011115659A1.pdf	2509710 d4823bdcdd669fa523163e7b121a7c735a7273fe	no	35

Warnings:

Information:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
3	Non Patent Literature	467264_CNOA.PDF	808176 c1c45dbc009990c5360d598d0cc49f2d4bb59439	no	13

Warnings:

Information:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
4	Fee Worksheet (SB06)	fee-info.pdf	30777 055efd02c01f163e02f2bc505e958676c3b5611c	no	2

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New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

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If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Attorney's Docket No. 042933/467264

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re:	Bici et al.	Confirmation No.:	4782
Appl. No.:	13/666,680	Group Art Unit:	2488
Filed:	November 1, 2012	Examiner:	N. B. Aynalem
For:	METHOD FOR CODING AND AN APPARATUS		

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT UNDER 37 C.F.R. § 1.97(d)

This Information Disclosure Statement is being filed after a Notice of Allowance under 37 C.F.R. § 1.311, but before payment of the Issue Fee. The Notice of Allowance was mailed on October 19, 2016.

Attached is a list of documents on form SB08 along with any cited foreign patent documents and non-patent literature documents in accordance with 37 CFR 1.98(a)(2). Also enclosed is a translation or a concise explanation of each non-English language document.

By identifying the listed documents, Applicant in no way makes any admission as to the prior art status of the listed documents, but is instead identifying the listed documents for the sake of full disclosure.

In accordance with the requirements of 37 C.F.R. § 1.97(d)(2), the following statement as specified in 37 C.F.R. § 1.97(e) is made:

Each item of information contained in this statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three (3) months prior to the filing of this statement.

The $180.00 fee specified in 37 C.F.R. § 1.17(p) is being paid at the time of e-filing. The Commissioner is authorized to charge any additional fee, or credit any refund, to our Deposit Account No. 16-0605.

Respectfully submitted,

Guy R. Gosnell
Registration No. 34,610

CUSTOMER NO. 10949
ALSTON & BIRD LLP
Bank of America Plaza
101 South Tryon Street, Suite 4000
Charlotte, NC 28280-4000
Tel Charlotte Office (704) 444-1000
Fax Charlotte Office (704) 444-1111
#36819315v1

Electronic Patent Application Fee Transmittal

Application Number:	13666680
Filing Date:	01-Nov-2012
Title of Invention:	METHOD FOR CODING AND AN APPARATUS
First Named Inventor/Applicant Name:	Mehmet Oguz BICI
Filer:	Christopher Jason Gegg/Joyce Smith
Attorney Docket Number:	042933/467264

Filed as Large Entity

Filing Fees for **Utility under 35 USC 111(a)**

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
Submission- Information Disclosure Stmt	1806	1	180	180
		Total in USD ($)		**180**

Substitute for form SB08 (Revised 07/09)	Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT *(Use as many sheets as necessary)*	Application Number	13/666,680
	Filing Date	November 1, 2012
	First Named Inventor	Bici et al.
	Art Unit	2488
	Examiner Name	N. B. Aynalem
Sheet 1 of 1	Attorney Docket Number	042933/467264

U. S. PATENT DOCUMENTS

Examiner Initials*	Cite No.	Document Number Number - Kind Code (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages of Relevant Figures Appear

FOREIGN PATENT DOCUMENTS

Examiner Initials	Cite No.	Foreign Patent Document Country Code - Number Kind Code (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	English Language Translation Attached
/N.B.A/	1	WO 2011 115659 A1	09-22-2011	Thomson Licensing		

OTHER DOCUMENTS

Examiner Initials*	Cite No.	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	English Language Translation Attached
/N.B.A/	2	Office Action for Chinese Application No. 2012800657775 dated October 9, 2016	Yes

Examiner Signature	/NATHNAEL B AYNALEM/	Date Considered	12/12/2016

*Examiner: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. LEGAL02/36819290v1

Submitted November 23, 2016

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/666,680	11/01/2012	Mehmet Oguz BICI	042933/467264	4782

10949 7590 12/20/2016

Nokia Corporation and Alston & Bird LLP
c/o Alston & Bird LLP
Bank of America Plaza, 101 South Tryon Street
Suite 4000
Charlotte, NC 28280-4000

EXAMINER	
AYNALEM, NATHNAEL B	

ART UNIT	PAPER NUMBER
2488	

NOTIFICATION DATE	DELIVERY MODE
12/20/2016	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

usptomail@alston.com

PTOL-90A (Rev. 04/07)

Supplemental Notice of Allowability	Application No. 13/666,680	Applicant(s) BICI ET AL.	
	Examiner NATHNAEL AYNALEM	Art Unit 2488	AIA (First Inventor to File) Status No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *Information Disclosure Statement filed on 11/23/2016*.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on______.
2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.
3. ☒ The allowed claim(s) is/are *1-18 and 21-32*. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.
4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   Certified copies:

   a) ☐ All b) ☐ Some *c) ☐ None of the:
   1. ☐ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☒ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date 11/23/2016
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
5. ☐ Examiner's Amendment/Comment
6. ☐ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

/NATHNAEL AYNALEM/
Examiner, Art Unit 2488

Substitute for form SB08 (Revised 07/09)				Complete if Known	
				Application Number	13/666,680
				Filing Date	11/01/2012
INFORMATION DISCLOSURE STATEMENT BY APPLICANT *(Use as many sheets as necessary)*				First Named Inventor	Mehmet Oguz Bici
				Art Unit	2488
				Examiner Name	Clifford Hilaire
Sheet	*1*	of	1	Attorney Docket Number	042933/467264

OTHER DOCUMENTS

Examiner Initials*	Cite No.	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s) , volume-issue number(s), publisher, city and/or country where published.	English Language Translation Attached
/N.B.A/	1	Office Action from corresponding Canadian Patent Application No. 2,854,495, dated October 7, 2015	YES

Examiner Signature	/NATHNAEL B AYNALEM/	Date Considered	12/21/2016

**Examiner: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

CLT#36219768v1

Submitted February 26, 2016

Substitute for form SB08 (Revised 07/09) **INFORMATION DISCLOSURE STATEMENT BY APPLICANT** *(Use as many sheets as necessary)*				**Complete if Known**	
				Application Number	13/666,680
				Filing Date	11/01/2012
				First Named Inventor	Mehmet Oguz Bici
				Art Unit	2488
				Examiner Name	Clifford Hilaire
Sheet	1	of	1	Attorney Docket Number	042933/467264

OTHER DOCUMENTS

Examiner Initials*	Cite No.	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s) , volume-issue number(s), publisher, city and/or country where published.	English Language Translation Attached
/N.B.A/	1	Office Action from Korean Patent Application No. 2014-7015093 dated August 22, 2016	YES

Examiner Signature	/NATHNAEL B AYNALEM/	Date Considered	12/21/2016

**Examiner: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

CLT#36636444v1

Submitted September 2, 2016

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.H/

Substitute for form SB08 (Revised 07/09) **INFORMATION DISCLOSURE STATEMENT BY APPLICANT** *(Use as many sheets as necessary)*	**Complete if Known**	
	Application Number	13/666,680
	Filing Date	November 1, 2012
	First Named Inventor	Bici et al.
	Art Unit	2488
	Examiner Name	Clifford Hilaire
Sheet *1* of *1*	Attorney Docket Number	042933/467264

OTHER DOCUMENTS

Examiner Initials*	Cite No.	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s) , volume-issue number(s), publisher, city and/or country where published.	English Language Translation Attached
/N.B.A/	1	Extended European Search Report for corresponding European Application No. 12845839.5 dated March 21, 2016, 10 pages	
/N.B.A/	2	**Nakamura, H. et al.**, *Unification of derivation process for merge mode and MVP*, Joint Collaborative Team on Video Coding (JCT-VC) of ITU-T SG16 WP3 and ISO/IEC JTC1/SC29/WG11, 6th Meeting; Torino, IT, 14-22 July, 2011; Document JCTVC-F419; URL: http://wftp3.itu.int/AV-ARCH/JCTVC-SITE/2011_07_F_Torino/, 10 pages	
/N.B.A/	3	**Zheng, Y. et al**., *Merge Candidate Selection in 2NxN, Nx2N, and NxN Mode*, Joint Collaborative Team on Video Coding (JCT-VC) of ITU-T SG16 WP3 and ISO/IEC JTC1/SC29/WG11, 6th Meeting, Torino, IT, 14-22 July, 2011; Document JCTVC-F302, 6 pages	
/N.B.A/	4	**Bross, B. et al.**, *Core Experiment 9: MV Coding and Skip/Merge Operations*, Joint Collaborative Team on Video Coding (JCT-VC) of ITU-T SG16 WP3 and ISO/IEC JTC1/SC29/WG11, 6th Meeting, Torino, IT, 14-22 July, 2011; Document JCTVC-F909, 13 pages	
/N.B.A/	5	**Jeon, Y. et al**., *On MVP list pruning process*, Joint Collaborative Team on Video Coding (JCT-VC) of ITU-T SG16 WP3 and ISO/IEC JTC1/SC29/WG11, 6th Meeting, Torino, IT, 14-22 July, 2011, Document JCTVC-F105, 7 pages	
/N.B.A/	6	**Bici, O. et al.**, *Non-CE13: Simplification of merge mode*, Joint Collaborative Team on Video Coding (JCT-VC) of ITU-T SG16 WP3 and ISO/IEC JTC1/SC29/WG11, 7th Meeting: Geneva, CH, 21-30 November, 2011, Document JCTVC-G593; URL: HTTP://WFTP3.ITU.INT/AV-ARCH/JCTVC-SITE/, 13 pages	

Examiner Signature	/NATHNAEL B AYNALEM/	Date Considered	12/21/2016

*Examiner: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. LEGAL02/32811780v3

Submitted April 25, 2016

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.H/

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/666,680	11/01/2012	Mehmet Oguz BICI	042933/467264	4782

10949 7590 12/27/2016
Nokia Corporation and Alston & Bird LLP
c/o Alston & Bird LLP
Bank of America Plaza, 101 South Tryon Street
Suite 4000
Charlotte, NC 28280-4000

EXAMINER	
AYNALEM, NATHNAEL B	

ART UNIT	PAPER NUMBER
2488	

NOTIFICATION DATE	DELIVERY MODE
12/27/2016	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

usptomail@alston.com

PTOL-90A (Rev. 04/07)

Supplemental Notice of Allowability	**Application No.** 13/666,680	**Applicant(s)** BICI ET AL.	
	Examiner NATHNAEL AYNALEM	**Art Unit** 2488	**AIA (First Inventor to File) Status** No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *application filed on 11/01/2012*.
   - ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on______.
2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.
3. ☒ The allowed claim(s) is/are *1-18 and 21-32*. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.
4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   Certified copies:

   a) ☐ All b) ☐ Some *c) ☐ None of the:
   1. ☐ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   - ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)
1. ☐ Notice of References Cited (PTO-892)
2. ☒ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date See Continuation Sheet
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
5. ☐ Examiner's Amendment/Comment
6. ☐ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

/NATHNAEL AYNALEM/
Examiner, Art Unit 2488

Continuation of Attachment(s) 2. Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date: 2/26/2016;4/25/2016;9/2/2016.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail **Mail Stop ISSUE FEE**
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

10949 7590 09/30/2016
Nokia Corporation and Alston & Bird LLP
c/o Alston & Bird LLP
Bank of America Plaza, 101 South Tryon Street
Suite 4000
Charlotte, NC 28280-4000

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)

(Signature)

(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/666,680	11/01/2012	Mehmet Oguz BICI	042933/467264	4782

TITLE OF INVENTION: METHOD FOR CODING AND AN APPARATUS

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$960	$0	$0	$960	12/30/2016

EXAMINER	ART UNIT	CLASS-SUBCLASS
AYNALEM, NATHNAEL B	2488	375-240160

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).
   - ☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
   - ☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
   (1) The names of up to 3 registered patent attorneys or agents OR, alternatively,
   (2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.
   1 Alston & Bird LLP
   2
   3

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE: Nokia Technologies Oy

(B) RESIDENCE: (CITY and STATE OR COUNTRY): Espoo, Finland

Please check the appropriate assignee category or categories (will not be printed on the patent) : ☐ Individual ☒ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:
- ☒ Issue Fee
- ☐ Publication Fee (No small entity discount permitted)
- ☐ Advance Order - # of Copies ____________

4b. Payment of Fee(s): **(Please first reapply any previously paid issue fee shown above)**
- ☐ A check is enclosed.
- ☐ Payment by credit card. Form PTO-2038 is attached.
- ☒ The director is hereby authorized to charge the required fee(s), any deficiency, or credits any overpayment, to Deposit Account Number 16-0605 (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)
- ☐ Applicant certifying micro entity status. See 37 CFR 1.29 — NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.
- ☐ Applicant asserting small entity status. See 37 CFR 1.27 — NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.
- ☐ Applicant changing to regular undiscounted fee status. — NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature ____________ Date December 29, 2016

Typed or printed name Guy R. Gosnell Registration No. 34,610

Electronic Acknowledgement Receipt

EFS ID:	27927497
Application Number:	13666680
International Application Number:	
Confirmation Number:	4782
Title of Invention:	METHOD FOR CODING AND AN APPARATUS
First Named Inventor/Applicant Name:	Mehmet Oguz BICI
Customer Number:	10949
Filer:	Christopher Jason Gegg/Joyce Smith
Filer Authorized By:	Christopher Jason Gegg
Attorney Docket Number:	042933/467264
Receipt Date:	29-DEC-2016
Filing Date:	01-NOV-2012
Time Stamp:	13:11:07
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$960
RAM confirmation Number	122916INTEFSW00014176160605
Deposit Account	
Authorized User	

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Issue Fee Payment (PTO-85B)	ISSUEFEE467264.PDF	102442 65282791946e16d72d1808df53bc83dd3a33c817	no	1
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	30855 f76e07a1b0914739f7d9ba2745db1d44e95681de	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	133297		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Electronic Patent Application Fee Transmittal

Application Number:	13666680
Filing Date:	01-Nov-2012
Title of Invention:	METHOD FOR CODING AND AN APPARATUS
First Named Inventor/Applicant Name:	Mehmet Oguz BICI
Filer:	Christopher Jason Gegg/Joyce Smith
Attorney Docket Number:	042933/467264

Filed as Large Entity

Filing Fees for **Utility under 35 USC 111(a)**

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
UTILITY APPL ISSUE FEE	1501	1	960	960

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		**960**

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**		
	Application Number	13666680
	Filing Date	2012-11-01
	First Named Inventor	Mehmet Oguz BICI
	Art Unit	2631
	Examiner Name	TBD
	Attorney Docket Number	NC77198US-NP

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code1	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					

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U.S.PATENT APPLICATION PUBLICATIONS Remove

Examiner Initial*	Cite No	Publication Number	Kind Code1	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
Change(s) applied to document, /L.H./ 1/3/2017	1	20120307905	A1	2012-12-06	~~Sunyeon et al.~~ Kim et al.	
	2	20110170602	A1	2011-07-14	~~Tammy et al.~~ Lee et al.	

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Examiner Initial*	Cite No	Foreign Document Number3	Country Code2 i	Kind Code4	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T5
	1	2011062392	WO	A2	2011-05-26	SK Telecom Co. Ltd. et al.		☐

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ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /CH/

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
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Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/666,680	02/14/2017	9571833	042933/467264	4782

10949 7590 01/25/2017

Nokia Corporation and Alston & Bird LLP
c/o Alston & Bird LLP
Bank of America Plaza, 101 South Tryon Street
Suite 4000
Charlotte, NC 28280-4000

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment is 711 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site http://pair.uspto.gov for additional applicants):

Mehmet Oguz BICI, Tampere, FINLAND;
Nokia Technologies Oy, Espoo, FINLAND;
Jani LAINEMA, Tampere, FINLAND;
Kemal UGUR, Tampere, FINLAND;

IR103 (Rev. 10/09)

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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www.uspto.gov

APPLICATION NUMBER	PATENT NUMBER	GROUP ART UNIT	REQUEST ID
13/666,680	9571833	2488	46786

PAIR Correspondence Address/Fee Address Change

The following fields have been changed to Customer Number 00197 on 09/06/2017 via Private PAIR in view of the certification copied below that authorized the change.

- Maintenance Fee Address

The address for Customer Number 00197 is:
00197
CPA GLOBAL LIMITED
2318 Mill Road 12th Floor
ALEXANDRIA, VA 22314

I certify, in accordance with 37 CFR 1.4(d)(4) that I am:

An attorney or Agent of Record registered to practice before the Patent and Trademark Office who has been given power of attorney in this application

Signature:	/Guy R. Gosnell/
Name:	Guy R. Gosnell
Registration Number:	34610

Attorney's Docket No. 042933/467264 PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re:	Mehmet Oguz Bici	Confirmation No. 4782
Appl. No.:	13/666,680	Patent No.: 9,571,833
Filed:	November 1, 2012	Issue Date: February 14, 2017
For:	METHOD FOR CODING AND AN APPARATUS	

Certificate of Correction Branch
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

REQUEST FOR CERTIFICATE OF CORRECTION

On behalf of the Applicant and Assignee of the above-referenced patent, Nokia Technologies Oy, it is hereby requested that the Office issue a Certificate of Correction in order to make a correction to Claim 9 as set forth in the attached Certificate of Correction. Specifically, the requested correction brings the wording of Claim 9 consistent with corresponding independent Claims 1, 15, 16, 17 and 18.

The required Certificate of Correction fee of $150 is being paid during e-filing concurrently herewith.

Respectfully submitted,

/Guy R. Gosnell/

Guy R. Gosnell
Registration No. 34,610

ALSTON & BIRD LLP
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Fax Charlotte Office (704) 444-1111
LEGAL02/38421324v1

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 9,571,833 B2 Page 1 of 1

APPLICATION NO. : 13/666,680

ISSUE DATE : February 14, 2017

INVENTOR(S) : Bici et al.

It is certified that an error appears or errors appear in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In the claims:

Column 33,
Line 56, "set" should read --subset--.

MAILING ADDRESS OF SENDER

ALSTON & BIRD LLP
Bank of America Plaza
101 South Tryon Street, Suite 4000
Charlotte, NC 28280-4000
Tel Charlotte Office (704) 444-1000

Electronic Acknowledgement Receipt

EFS ID:	33854474
Application Number:	13666680
International Application Number:	
Confirmation Number:	4782
Title of Invention:	METHOD FOR CODING AND AN APPARATUS
First Named Inventor/Applicant Name:	Mehmet Oguz BICI
Customer Number:	10949
Filer:	Guy Randall Gosnell/Kim Shaul
Filer Authorized By:	Guy Randall Gosnell
Attorney Docket Number:	042933/467264
Receipt Date:	27-SEP-2018
Filing Date:	01-NOV-2012
Time Stamp:	18:13:52
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$150
RAM confirmation Number	092818INTEFSW00005658160605
Deposit Account	
Authorized User	

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Request for Certificate of Correction	467264CertCorr.pdf	25125 37a5125c542e55e231a2bdd4cf3cb8e9755 8576c	no	2

Warnings:

Information:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
2	Fee Worksheet (SB06)	fee-info.pdf	30382 8f7054e7fe1d5735f8fa94c5479a75400dab 72e6	no	2

Warnings:

Information:

Total Files Size (in bytes):	55507

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

<u>New Applications Under 35 U.S.C. 111</u>
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.
<u>National Stage of an International Application under 35 U.S.C. 371</u>
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.
<u>New International Application Filed with the USPTO as a Receiving Office</u>
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Electronic Patent Application Fee Transmittal

Application Number:	13666680
Filing Date:	01-Nov-2012
Title of Invention:	METHOD FOR CODING AND AN APPARATUS
First Named Inventor/Applicant Name:	Mehmet Oguz BICI
Filer:	Guy Randall Gosnell/Kim Shaul
Attorney Docket Number:	042933/467264

Filed as Large Entity

Filing Fees for **Utility under 35 USC 111(a)**

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
CERTIFICATE OF CORRECTION	1811	1	150	150

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		**150**

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 9,571,833 B2
APPLICATION NO. : 13/666680
DATED : February 14, 2017
INVENTOR(S) : Bici et al.

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In the Claims

Column 33,
Line 56, “set” should read --subset--.

Signed and Sealed this
Twenty-third Day of October, 2018

Andrei Iancu
Director of the United States Patent and Trademark Office