

Declaration of Dan Schonfeld in Support of Petition for *Inter Partes* Review of
U.S. Patent No. 11,252,325

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SAMSUNG ELECTRONICS CO., LTD. and
SAMSUNG ELECTRONICS AMERICA, INC.,

Petitioners,

v.

SNAPAID, LTD.
Patent Owner

U.S. PATENT NO. 11,252,325

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Inventor: Ishay Sivan

Title: Real Time Assessment of Picture Quality

Case IPR2025-TBD

**DECLARATION OF DAN SCHONFELD IN SUPPORT OF PETITION
FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 11,252,352 UNDER
35 U.S.C. § 312 AND 37 C.F.R. § 42.104**

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LIST OF EXHIBITS¹

Exhibit No.	Description
1001	U.S. Patent No. 11,252,325
1002	<i>Curriculum Vitae</i> of Dan Schonfeld
1003	Declaration of Dan Schonfeld in support of <i>Inter Partes</i> Review
1004	U.S. Patent No. 8,508,622 (“Anon”)
1005	U.S. Pat. App. Pub. No. 2010/0149361 (“Takeuchi”)
1006	U.S. Pat. App. Pub. No. 2004/0012682 (“Kosaka”)
1007	U.S. Pat. App. Pub. 2010/0246939A1 (“Aisaka”)
1008	U.S. Pat. App. Pub. No. 2002/0110286 (“Cheatle”)
1009	U.S. Pat. App. Pub. 2009/0296989 (“Ramesh”)
1010	U.S. Pat. App. Pub. 2012/0201427A1 (“Jasinski”)
1011	U.S. Patent No. 8,009,198 (“Alhadeff”)
1012	U.S. Pat. App. Pub. 2012/0105662A1 (“Staudacher”)
1013	Excerpts from Hector Garcia-Molina et al., “DATABASE SYSTEMS The Complete Book,” 2009 (“Garcia-Molina”)
1014	File History of U.S. Patent No. 11,252,325
1015	U.S. Pat. App. Pub. No. 2005/0270381 (“Owens”)
1016	Che-Hua Yeh et al., “Personalized Photograph Ranking and Selection System,” 2010 (“Yeh”)
1017	Claudio S.V.C. Cavalcanti, et al., “A Survey on Automatic Techniques for Enhancement and Analysis of Digital Photography,” 2013 (“Cavalcanti 2013”)

¹ Unless otherwise specified, citations are to the original page, column, and line numbers in exhibits, and all emphasis is added unless otherwise noted.

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I, Dan Schonfeld, hereby certify as follows:

I. ASSIGNMENT

1. I have been retained as a technical expert on behalf of Petitioners Samsung Electronics Co., Ltd. and Samsung Electronics America, Inc. (“Samsung” or “Petitioners”) to offer technical opinions regarding whether claims 1-20 (the “Challenged Claims”) of U.S. Patent No. 11,252,325 (“the ’325 patent”) (EX1001) would have been invalid to one of ordinary skill in the art as of October 23, 2012 in connection with the above-captioned Petition for *Inter Partes* Review (“IPR”).

2. For the purposes of this Declaration, I have been asked to assume that the priority date of the alleged invention recited in the ’325 patent is at the earliest October 23, 2012 (hereinafter, the “Priority Date”).

3. I am not currently, and never have been, an employee of Samsung, nor do I have any financial interest therein. I received no compensation for this Declaration beyond my normal hourly compensation for time actually spent analyzing the ’325 patent, the prior art cited below, and any related issues. My compensation is not dependent on the outcome of any IPR or other proceeding involving the ’325 patent.

4. In forming the opinions expressed in this Declaration, I have also relied on my academic and professional experience. I also considered the viewpoint of a person having ordinary skill in the art as of the Priority Date. I also relied on

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the '325 patent and its file history, the references cited in the Petition and in this Declaration, as well as on the exhibits in the exhibit list above.

II. BACKGROUND AND QUALIFICATIONS

5. My qualifications for forming the opinions set forth in this Declaration are summarized here and include my educational background, career history, publications, and other relevant qualifications. My full *curriculum vitae* is attached as EX1002 to this Declaration, and includes my detailed employment background, professional experience, and list of publications.

6. I received my B.S. degree in Electrical Engineering and Computer Science from the University of California, Berkeley, California, in 1986 with a concentration on Computer Engineering / Systems Engineering. I received my M.S. degree in Electrical and Computer Engineering from The Johns Hopkins University, Baltimore, Maryland, in 1988, with a concentration on Speech Processing / Biomedical Signal Processing. I received my Ph.D. degree in Electrical and Computer Engineering from The Johns Hopkins University, Baltimore, Maryland, in 1990, with a concentration on Nonlinear Signal Processing / Image Analysis.

7. In August 1990, I joined the Department of Electrical Engineering and Computer Science at the University of Illinois, Chicago, Illinois, where I am a Professor Emeritus in the Departments of Electrical and Computer Engineering, Computer Science, and Biomedical Engineering. Before I joined the University of

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Illinois Chicago, I served as an instructor in the Department of Electrical and
Computer Engineering at The Johns Hopkins University, Baltimore, Maryland.

8. At the University of Illinois Chicago, I have served as the Director of
the University-Industry Engineering Research Center (UIERC), formerly the
Manufacturing Research Center (MRC). I am also Co-Director of the Multimedia
Communications Laboratory (MCL) and a member of the Signal and Image
Research Laboratory (SIRL).

9. Over the past few decades, I have also served as a visiting professor in
(a) the Advanced Analytics Institute (AAI) at the University of Technology, Sydney,
Australia, (b) the Department of Information Engineering and Computer Science
("DISI") at the University of Trento, Italy, (c) the School of Computer Engineering
at the Nanyang Technological University, Singapore, and (d) the Department of
Electrical Engineering—Systems at Tel-Aviv University, Israel.

10. I have been elected Fellow of the Institute of Electrical and Electronics
Engineers ("IEEE") "for contributions to image and video analysis" as well as
Fellow of the International Society for Optics and Photonics ("SPIE") "for specific
achievements in morphological image processing and video analysis." I have also
been elected University Scholar of the University of Illinois. A complete list of my
publications, professional activities, and honors that I have received is fully set forth
in my *curriculum vitae*, attached hereto as EX1002.

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11. I have previously served as Editor-in-Chief and Deputy Editor-in-Chief of the IEEE Transactions on Circuits and Systems for Video Technology. I have also previously served as Area Editor for special issues of the IEEE Signal Processing Magazine. I have served as Associate Editor of the IEEE Transactions on Image Processing (on image and video storage, retrieval and analysis), Associate Editor of the IEEE Transactions on Circuits and Systems for Video Technology (on video analysis), Associate Editor of the IEEE Transactions on Signal Processing (on multidimensional signal processing and multimedia signal processing), and Associate Editor of the IEEE Transactions on Image Processing (on nonlinear filtering). I have also served on the editorial board of the IEEE Signal Processing Magazine, EURASIP Journal of Image and Video Processing, Research Letters in Signal Processing, and Bentham Science Publishers, Ltd.'s "Recent Patents on Computer Science" and "Recent Patents on Electrical Engineering" publications. I have served as guest editor of numerous special issues in various journal publications in the area of multimedia systems.

12. I have previously served on the Conference Board of the IEEE Signal Processing Society. I have previously served as Technical Program Chair of the IEEE International Conference on Acoustics, Speech, and Signal Processing ("ICASSP") 2018 as well as Program Chair of the IEEE Conference on Visual Communications and Image Processing ("VCIP") 2015. I have also previously

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served as General Co-Chair of the Workshop on Big Data in 3D Computer Vision 2013 and the IEEE International Conference on Multimedia and Expo (“ICME”) 2012. I have served as Chair of the IEEE Workshop on Video Mining 2008 and the SPIE Conference on Visual Communications and Image Processing 2007. I have also served on the organizing committees of various conferences, including the IEEE International Conference on Image Processing 1998, 2012, and 2020, the IEEE/SPIE International Conference on Visual Communications and Image Processing (VCIP) 2010, 2017, and the IEEE Workshop on Nonlinear Signal and Image Processing (NSIP) 1997. I was an organizer of the Thematic Symposium on Multimedia Search and Retrieval at the IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP) 2009.

13. I have authored and co-authored over 250 technical papers for various journals and conferences. I was the author of a book chapter, entitled: “Image and video communication networks,” and later editions entitled: “Video communication networks.” I was co-author (with Carlo Giulietti and Rashid Ansari) of a paper that won the Best Paper Award at the ACM Multimedia Workshop on Advanced Video Streaming Techniques for Peer-to-Peer Networks and Social Networking 2010. I was also co-author (with Junlan Yang) of a paper that won the Best Student Paper Award at the IEEE International Conference on Image Processing 2007. I was also co-author (with Wei Qu) of a paper that won the Best Student Paper Award at the

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IEEE International Conference on Image Processing 2006. I was also co-author (with Nidhal Bouaynaya) of a paper that won the Best Student Paper Award in Visual Communications and Image Processing 2006. In addition, many of my publications relate to the broad topic of multimedia systems, which includes audio, image, and video processing. My publications in the area of multimedia systems date back to 1988. A list of my publications within the past ten years is included in EX1002.

14. I have been selected to be the keynote speaker at the IEEE International Conference on Computer, Electrical and Communication Engineering (ICCECE), Kolkata, India, in 2023. I was also the keynote speaker at the N-Brain Alliance Launch & Product Release Conference and the Think for Education Conference (TEC) AI+Education, both held in Beijing, China, in 2018. I was also the keynote speaker at the International Conference on Wireless Communications and Signal Processing (WCSP), Yangzhou, China, in 2016, and the International Conference on Intelligent Control and Information Processing (ICICIP) and International Conference on Brain Inspired Cognitive Systems (BICS), Beijing, China, in 2013. Further, I was a plenary speaker at the IEEE/IET International Conference on Audio, Language and Image Processing (ICALIP), Shanghai, China, in 2010, and at the IEEE International Conference on Advanced Video and Signal Based Surveillance (AVSS), Genoa, Italy, in 2009. I was also a plenary speaker at the INPT/ASME

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International Conference on Communications, Signals, and Systems (ICCSS), Rabat
Morocco, in 1995 and 2001.

15. I have served as Representative of Regions 1-6 (North America) on the Chapters Committee of the IEEE Signal Processing Society. I have also served as Chairman of the IEEE Signal Processing Chicago Chapter. I have also served on the IEEE Image, Video, and Multidimensional Signal Processing (IVMSP) Technical Committee, formerly the IEEE Image and Multidimensional Signal Processing (IMDSP) Technical Committee, Visual Signal Processing and Communications (VSPC) Technical Committee, IEEE Signal and Image Processing in Medicine Technical Committee, and the IEEE Multimedia Communications Technical Committee. I currently serve on the American National Standards Institute (ANSI) / Underwriters Laboratory (UL) Standards Technical Panel (“STP”) on Multimedia Systems.

16. I have also taught various courses that relate to multimedia systems. For example, since the late 1990s, I have introduced and taught an advanced undergraduate-level / first-year graduate-level course on multimedia systems (originally called multimedia communication networks), which focuses on audio, image, and video processing and communications.

17. I have also served as a consultant in various engagements related to multimedia systems. For example, over the past decade, I have served as an expert

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witness in several cases related to multimedia systems. In 1997, I served as a consultant for Prairiecomm Corp. where, among other tasks, I developed and deployed multimedia systems. Since 2002, I have also served as a member of the American National Standards Institute (ANSI) / Underwriters Laboratory (UL) Standards Technical Panel (STP) on various standards related to multimedia systems.

18. Additional details of my education and work experience, professional activities, awards and honors, and publications that may be relevant to opinions I have formed are set forth in my *curriculum vitae*, which is attached as EX1002 to this Declaration. Additionally, I have consulted for several companies in the area of signal processing and multimedia systems.

III. UNDERSTANDING OF PATENT LAW

19. I am not an attorney, and I do not offer any legal opinions herein. In order to conduct my analysis, I have been provided by attorneys with an understanding of the patent law issues relevant to the analysis. My understanding of these issues is as follows.

20. I understand that patent claims are to be construed as they would have been understood by a person of ordinary skill in the art (“POSITA”) as of the time of invention. I further understand that in this proceeding, terms are to be given their

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plain and ordinary meaning as understood by a POSITA, and that this standard would also apply in District Court litigation.

21. I understand that in a petition for *inter partes* review, claims are construed under the case *Phillips v. AWH Corp.*, 415 F.3d 1303, decided by the Federal Circuit in 2005, as I note further below in Section VII.

22. I understand that in a petition for *inter partes* review, claims are unpatentable if they are anticipated or obvious. I have been informed that anticipation requires all of a claim's elements to be disclosed expressly or inherently (*i.e.*, necessarily present in the reference) in a single prior art reference, and moreover to be arranged in that reference as they are arranged in the claim. I have been informed that obviousness requires only for the invention to have been obvious at the time of invention from the perspective of a POSITA.

23. I understand that in an IPR proceeding, the Board may only consider anticipation or obviousness based on prior printed publications or prior patents and patent applications. I understand that publications are prior art under § 102(a) if they were known or used by others in the U.S., or patented or published anywhere, prior to the date of invention of the '325 patent. I understand that publications are prior art under § 102(b) if they were patented or published anywhere, or in public use, on sale, or offered for sale in this country, more than one year prior to the earliest U.S. filing date of the '325 patent. I understand that a patent or patent application is prior

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art under § 102(e) if it has an effective filing date that is prior to the date of invention of the '325 patent.

24. I have been informed and understand that the subject matter of a patent claim is obvious if the differences between the subject matter of the claim 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 the subject matter pertains. I have also been informed that the framework for determining obviousness involves considering the following factors: (i) the scope and content of the prior art; (ii) the differences between the prior art and the claimed subject matter; (iii) the level of ordinary skill in the art; and (iv) any objective evidence of non-obviousness.

25. I further understand that a claim can be found obvious if it unites old elements with no change to their respective functions or alters prior art by mere substitution of one element for another known in the field, with that combination yielding predictable results. I have been informed that common sense should guide such combinations, and there is no rigid requirement for a teaching, suggestion, or motivation to combine. I understand that when a product is available, design incentives and other market forces can prompt variations of it, either in the same field or different one. Additionally, I understand that if a POSITA can implement a predictable variation, obviousness likely bars patentability, and that if a technique

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has been used to improve one device, and a POSITA would have recognized that the technique would improve similar devices in the same way, use of the technique is obvious. I further understand that a claim may be obvious if common sense directs one to combine multiple prior art references or add missing features to reproduce the alleged invention recited in the claims.

26. I also understand the following rationale may support a finding of obviousness:

- a. Combining prior art elements according to known methods to yield predictable results;
- b. Simple substitution of one known element for another to obtain predictable results;
- c. User of known technique to improve similar devices (methods, or products) in the same way;
- d. Applying a known technique to a known device (method, or product) ready for improvement to yield predictable results;
- e. “Obvious to try” — choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success;
- f. Known work in one field of endeavor may prompt variations of it for use in either the same field or a different one based on design

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incentives or other market forces if the variations are predictable to one of ordinary skill in the art;

g. Some teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill to modify the prior art reference or to combine prior art reference teachings to arrive at the claimed invention.

27. I also understand that it is impermissible to use the claimed invention itself as a blueprint for piecing together elements in the art, or in other words, to use hindsight reconstruction to pick and choose among disclosures in the prior art to reconstruct the claimed invention.

28. I understand that so-called “secondary considerations of nonobviousness” are to be considered in an obviousness analysis. I understand that such an analysis helps to prevent the forbidden use of hindsight in determining whether a patent claim is obvious. I understand that secondary considerations of non-obviousness include, among others: (a) a long-felt but unresolved need for the invention; (b) commercial success of the invention; (c) copying of the invention; (d) praise and recognition of the invention by others; (e) licensing of the rights to the invention; and (f) unexpected results.

29. In rendering my opinions, I followed these guidelines.

IV. SUMMARY OF OPINIONS

30. It is my opinion that each and every Challenged Claim of the '325 patent would have been obvious to a person of ordinary skill in the art ("POSITA") as of the Priority Date in view of the knowledge of a POSITA and prior art cited and in this Declaration.

31. It is my opinion that claims 1-4 and 7-10 are obvious in view of Anon (EX1004), Takeuchi (EX1005), Kosaka (EX1006), Aisaka (EX1007), Jasinski (EX1010), and Garcia-Molina (EX1013) (Ground 1A).

32. It is my opinion that claims 11, 14-17, and 20 are obvious in view of Anon (EX1004), Takeuchi (EX1005), Aisaka (EX1007), Jasinski (EX1010), and Cheatle (EX1008) (Ground 1B).

33. It is my opinion that claim 5 is obvious in view of Anon (EX1004), Takeuchi (EX1005), Kosaka (EX1006), Aisaka (EX1007), Jasinski (EX1010), Garcia-Molina (EX1013), and Cheatle (EX1008) (Ground 1C).

34. It is my opinion that claim 6 is obvious in view of Anon (EX1004), Takeuchi (EX1005), Kosaka (EX1006), Aisaka (EX1007), Jasinski (EX1010), Garcia-Molina (EX1013), and Ramesh (EX1009) (Ground 1D).

35. It is my opinion that claim 12 is obvious in view of Anon (EX1004), Takeuchi (EX1007), Aisaka (EX1007), Jasinski (EX1010), Cheatle (EX1008), and Alhadeh (EX1011) (Ground 1E).

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36. It is my opinion that claim 13 is obvious in view of Anon (EX1004), Takeuchi (EX1005), Aisaka (EX1007), Jasinski (EX1010), Cheatle (EX1008), and Ramesh (EX1009) (Ground 1F).

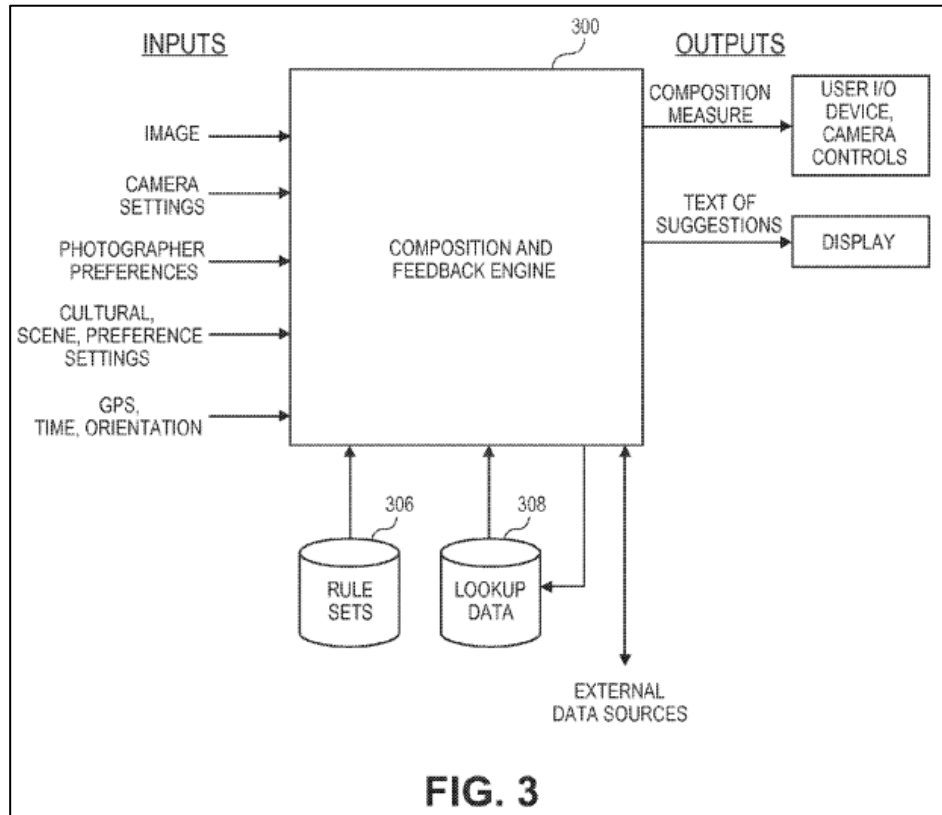
37. It is my opinion that claim 18 is obvious in view of Anon (EX1004), Takeuchi (EX1007), Aisaka (EX1007), Jasinski (EX1010), Cheatle (EX1008), and Garcia-Molina (EX1013) (Ground 1G).

38. It is my opinion that claim 19 is obvious in view of Anon (EX1004), Takeuchi (EX1007), Aisaka (EX1007), Jasinski (EX1010), Cheatle (EX1008), and Staudacher (EX1012) (Ground 1H).

V. OVERVIEW OF THE PRIOR ART

A. Anon

39. Anon discloses “[a]n image capturing device” that can “determine a plurality of image-based characteristics for a proposed image,” including “a likely quality of a composition and/or recommendations for improvement usable while the image or video is being taken.” EX1004, Abstract, 2:64-3:1. Anon explains that “the photographer is provided with real time feedback as to composition and recommendations, or can be provided with such feedback after the fact.” *Id.*, 3:22-26. Anon’s system is illustrated below:



40. Anon has a composition and feedback engine that performs its evaluation using a “weighted, combination of parameters.” *Id.*, 8:32-35. Anon’s composition and feedback engine 300 can make use of inputs from the image capturing device, such as the image itself, the device settings, and metadata, combine it with rule sets 306 and lookup data 308, and output suggestions to the user of the camera to improve image quality. For example, one of those suggestions is taking the photograph at a different location.

B. Takeuchi

41. Takeuchi discloses an “image evaluation apparatus and camera which are capable of evaluating an image which is comprehensively good.” EX1005,

Abstract. As part of that image evaluation, Takeuchi teaches the use of background focus/blur analysis. *See e.g., id.*, ¶¶ [142-145] and [291]. Takeuchi also teaches using a “total evaluation result” for an image using a weighted combination of different quality evaluation methods. *Id.*, ¶ [0269].

C. Aisaka

42. Aisaka discusses an apparatus that evaluates, processes, and selects images based on subject sharpness and quality, using multiple feature maps—such as luminance, color, edge, face, and motion information—combined into a subject map via weighted addition. Aisaka teaches the use of deep learning, specifically “neural-network-based learning,” in this process, increasing reliability and adaptability. Further, “the weight being used to generate a subject map for specifying a region of a subject on an image” is learned by “extracting a feature value of a feature of the region of the subject from a learning image that includes the subject and that is used for the learning, and generating an information map representing the feature value in each region of the learning image.” EX1007, ¶¶ [0014] and [0020]. Aisaka’s system further involves “performing weighted addition of, using the weight, the plurality of information maps representing the feature value of the feature, which are different from each other,” and “calculating an amount of change by which the weight is to be changed using the subject map and an image label that is determined in advance and that represents the region of the subject in

the learning image; and updating means for adding the amount of change to the weight and updating the weight.” *Id.*, ¶¶ [0014], [0021], and [0022].

VI. THE '325 PATENT

A. Claims

43. The '325 patent, titled “Real Time Assessment of Picture Quality,” discloses a method and system for assessing picture quality in camera devices from a stream of images. EX1001, Abstract, claims 1, 11. The disclosed methods and devices determine several quality indicators (QIs) for the images. *Id.* at 2:24-41. These QIs are then used to determine the “total” quality of captured images and image stills from videos, as well as to generate real-time suggestions for improving photo quality. *Id.* at 3:22-27.

44. The '325 patent has 20 claims of which claims 1 and 11 are independent claims. The two independent claims are directed to methods for estimating image quality. Dependent claims 2-10 and 12-20 further specify the calculation of image quality, including what variables may be considered and what those variables are responsive to, as well as providing specificity on the quality indicators used to determine image quality.

45. Independent claim 1 of the '325 patent claims a method of estimating an image’s quality from a stream of images. Claim 1 is reproduced below:

A method for estimating quality of at least one image from
a stream of images, for use with a device that comprises in

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a single enclosure a digital camera module or functionality that comprises at least one optical lens for focusing received light from a scene and an image sensor coupled to at least one optical lens for capturing an image of the scene; a motion or location sensor for sensing the device motion; and a processor coupled to the image sensor and to the digital camera for receiving data therefrom, the method by the processor comprising use of at least one value and weight;

obtaining a first value (QI1) responsive to the device motion from at least one motion or location sensor;

estimating a first weight (c1) associated with the first;

obtaining a second value (QI2), where value is a measurement of under or over exposure of at least one of a part of image or face exposure;

estimating a second weight (c2) associated with the second value;

analyzing the captured image for detecting or recognizing zero or more faces in the picture, calculates properties of at least one of said faces if exist, where said properties are at least one of: looking at camera, smiling, crying, face detection quality, face exposure or subject movement to obtain a third value (QI3);

estimating a third weight (c3) associated with the third value;

obtaining a fo[u]rth value (QI4) responsive to obstruction of at least one optical lens; and

estimating a fo[u]rth weight (c4) associated with the fo[u]rth value;

wherein at least one of the values QI1, QI2, QI3, QI4 or the weights c1, c2, c3, c4 are calculated based on an

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artificial neural network employing deep learning
algorithm

to select, based on values QI1, QI2, QI3, QI4 and weights
c1, c2, c3, c4, at least one appropriate suggestion from a
pre-stored table of suggestions of how a user of the system
may cause at least on[e] said value to be above or below a
threshold and to present said appropriate suggestion to the
user.

EX1001, claim 1.

46. Independent claim 11 of the '325 patent claims a method of estimating
an image's quality from a stream of images. Claim 11 is reproduced below:

11. A method for estimating quality of at least one image
from a stream of images, for use with a device that
comprises in a single enclosure a digital camera module or
functionality that comprises at least one optical lens for
focusing received light from a scene and an image sensor
coupled to at least one optical lens for capturing an image
of the scene; at least one motion or location sensor for
sensing the device motion; and a processor coupled to the
image sensor and to the digital camera for receiving data
therefrom, the method by the processor comprising use of
at least one value and weight;

obtaining a first value (QI1) responsive to the device
motion from at least one motion or location sensor;

estimating a first weight (c1) associated with the first;

obtaining a second value (QI2) value is a combination of
at least one of: digital camera exposure, lens focus, under
or over exposure of the image or its part or face exposure;

estimating a second weight (c2) associated with the second
value;

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analyzing the captured image via deep learning algorithms for detecting or recognizing one or more objects in, or one or more characteristics of the image or at least one of object characteristics to obtain a third value (QI3) associated with the analysis; and

analyzing the captured image for detecting or recognizing zero or more faces in the picture, calculates properties of at least one of said faces, where said properties are at least one of: looking at camera, smiling, crying, face detection quality, face exposure or subject movement to obtain a fo[u]rth value (QI4);

where the fo[u]rth value (QI4) may be based on the recognition value of at least one of said faces as a known face or unknown face, based on a pre-stored list of configured faces;

estimating a fo[u]rth weight (c4) associated with the fo[u]rth value;

calculating a total quality value according to, or based on values QI1, QI2, QI3, QI4 and weights c1, c2, c3, c4 and previous values QI1, QI2, QI3, QI4 and previous weights c1, c2, c3, c4 in the image stream; and

selecting by said processor at least one image from the plurality of images at least partly on said total quality value.

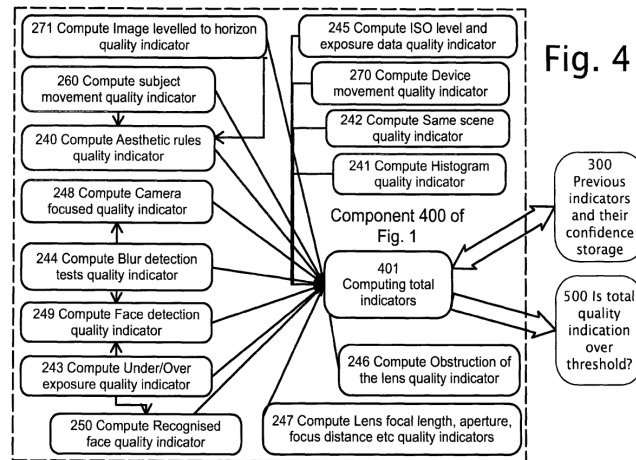
EX1001, claim 11.

B. Specification

47. The '325 patent, entitled "Real Time Assessment of Picture Quality," describes a method and system for real-time assessment of picture quality in camera devices. EX1001, Abstract. To assess the "total" quality of captured images, the

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'325 patent determines quality indicators (QIs) using various sensors, such as accelerometers and lens modules. *Id.* at 2:24-41. The process of combining these QIs is illustrated in Figure 4:



Id., Fig. 4. Based on the QIs, the system provides real-time feedback and suggestions to users for improving photo quality. *Id.* at 3:22-27.

48. As the '325 patent admits, “[p]rior art has used certain independent quality indicators” and “quantif[ed] the quality by means of a total quality indicator.” EX1001, 2:42-62. The '325 patent distinguishes its invention by stating that in the '325 patent, “the weight of one indicator will take into account data from other quality indicators.” *Id.* at 2:63-3:1. But QI weights that respond to other QIs are unrelated to most of the Challenged Claims, and were also known in the prior art. *See* Section **Error! Reference source not found.** below.

C. Prosecution History

49. The prosecution of the '325 patent was minimal. I understand that in prosecution, no prior art reference was substantively discussed, nor were any claims rejected. The Examiner's Reasons for Allowance state that the prior art fails to teach the whole of claim 1, and is silent with respect to independent claim 11. EX1014, 27. Further, the prior art references discussed herein were not considered during prosecution.

D. Person of Ordinary Skill in the Art

50. I understand that there are multiple factors relevant to determining the level of a person having ordinary skill in the pertinent art, including the educational level of active workers in the field at the time of the alleged invention, the sophistication of the technology, the type of problems encountered in the art, and prior art solutions to those problems. In determining the characteristics of a hypothetical person of ordinary skill in the art of the '325 patent as of the Priority Date, I considered factors such as the type of problems encountered in this field, the swiftness with which innovations were made, the sophistication of the technology involved, and the educational background that would be necessary to understand the '325 patent. Finally, I placed myself back in the relevant period of time and considered the state of the art and the level of skill of those working in this field at those times.

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51. In my opinion, taking all of the factors into account, a person of ordinary skill in the art related to the '325 patent as of the Priority Date would have had a bachelor's degree in electrical engineering, computer engineering, computer science, or a related field, and at least two years of experience with image processing and analysis. Individuals with different education and experience could still be of ordinary skill in the art if additional experience compensates for a deficit in their education, and vice versa.

52. I also note that my opinions provided in this Declaration would not change in view of any minor modifications to this level of skill.

VII. CLAIM CONSTRUCTION

53. I understand that for the purposes of this *inter partes* review, claims are to be construed under the so-called *Phillips* standard, under which claim terms are given their ordinary and customary meaning as would be understood by a person of ordinary skill in the art in light of the specification and prosecution history, unless the inventor has set forth a special meaning for a term. I have been asked to assume that there is no need to construe any claim terms for my Declaration and that all that the claim terms of the Challenged Claims should be understood according to their plain and ordinary meaning from the perspective of a POSITA as of the Priority Date. I reserve the right to respond to claim construction positions as necessary in

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the future, should they be raised by Patent Owner SnapAid, Ltd. (“SnapAid” or “Patent Owner”).

VIII. SPECIFIC GROUNDS FOR PETITION UNDER 37 C.F.R. § 42.104(B)

54. In this section, I discuss the ’325 patent, the prior art, and why the prior art renders the ’325 patent obvious.

A. Ground 1A: Claims 1-4 and 7-10 are Obvious in View of Anon, Takeuchi, Kosaka, Aisaka, Jasinski, and Garcia-Molina

1. Independent Claim 1

- i. *[1.pre.] “A method for estimating quality of at least one image from a stream of images, for use with a device that comprises in a single enclosure a digital camera module or functionality that comprises at least one optical lens for focusing received light from a scene and an image sensor coupled to at least one optical lens for capturing an image of the scene; a motion or location sensor for sensing the device motion; and a processor coupled to the image sensor and to the digital camera for receiving data therefrom, the method by the processor comprising use of at least one value and weight.”*

55. Anon discloses the preamble. In particular, Anon discloses a method for estimating image quality of at least one image from a plurality of images by analyzing several characteristics of the image, computing a composition measure (an image quality measure) based on data including those characteristics, and providing suggestions to a user in real time. See EX1004, 2:64-3:1 (“An improved composition and recommendation method and apparatus are described herein. Using

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this, a photographer (or videographer) is provided signals or indications of a likely quality of a composition and/or recommendations for improvement usable while the image or video is being taken.”); *see also id.*, 2:9-15, 2:16-28, 2:32-38, 3:14-26. Anon also discloses analyzing a “plurality of images” with the invention. *Id.*, 10:8-26 (“engine might provide a filter to provide suggestions for images from a large body of images that are the more aesthetic images”), 2:45-48 (“plurality of images”), 3:2-10 (“what is explained about a photographer using a camera to capture a photograph can equally apply, unless otherwise indicated, to a videographer using a video camera to capture a video sequence, or possibly also 3D photography and 3d videography”), cl. 10 (“determining a respective plurality of image-based characteristics using the processor in response to the plurality of images”). In my opinion, a POSITA would have found it obvious in light of these disclosures that Anon’s device comprises a *method for estimating quality of at least one image from a plurality of images*.

56. Anon discloses “[a]n image capturing device includ[ing] an image sensing device, a processor, and a memory,” as well as “lens 102” and “CCD 104” (an image sensor) via which light creates a “digital, electronically readable image[.]” *Id.*, Abstract, 1:59-2:8; 5:54-56. Anon further discloses “[c]amera 100 [] equipped with a processor 106 ... and a composition and feedback engine (‘engine’) 108.” *Id.*, 5:56-59. In my opinion, a POSITA would have found it obvious in light of these

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disclosures that Anon’s device *comprises at least one optical lens for focusing received light from a scene and an image sensor coupled to the optical lens for capturing an image of the scene.*

57. Moreover, Anon describes that its disclosed device contains its modules in a single unit, noting that “[i]n a typical operation, the photographer uses a device that is either a camera (e.g., point-and-shoot, DSLR, SLR) or a multi-purpose device that includes a camera (such as a mobile telephone with a camera)[.]” *Id.*, 3:14-17; *see also id.*, 3:17-19 (“The photographer uses a device ... to stage a shot ... and then capturing the image.”). In my opinion and in light of this discussion, a POSITA would have found it obvious that the camera components are housed *in a single enclosure* in Anon’s invention, which would have been standard as of the Priority Date. *See, e.g., id.*, Fig. 1, 3:11-14.

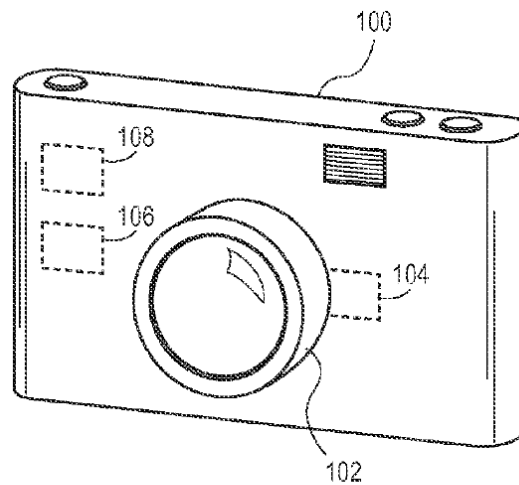


FIG. 1

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58. Finally, Anon describes the use of motion sensors (e.g., an “accelerometer for orientation”). *Id.*, 4:24-33 (“Camera-specific external inputs might include the camera's current geographic location, time of day, orientation and the like.”); *see also id.*, 7:4-7. In my opinion, a POSITA would have found it obvious in light of these disclosures that Anon’s device comprises *a motion sensor for sensing the device motion; wherein the motion sensor consists of, or comprises, an accelerometer.*

59. Anon further describes the use of “[e]ngine 108” that “might be coupled to processor 106 to alter how processor 106 manages its inputs and provide outputs for the photographer,” and which “could be implemented as ... software elements executed on **a processor**” *Id.*, 5:62-64, 6:33-41. A POSITA would have found it obvious that engine 108, which includes images as inputs, may be coupled to processor 106, CCD 104 and camera 100. The inputs of this engine are illustrated in Figure 3 below:

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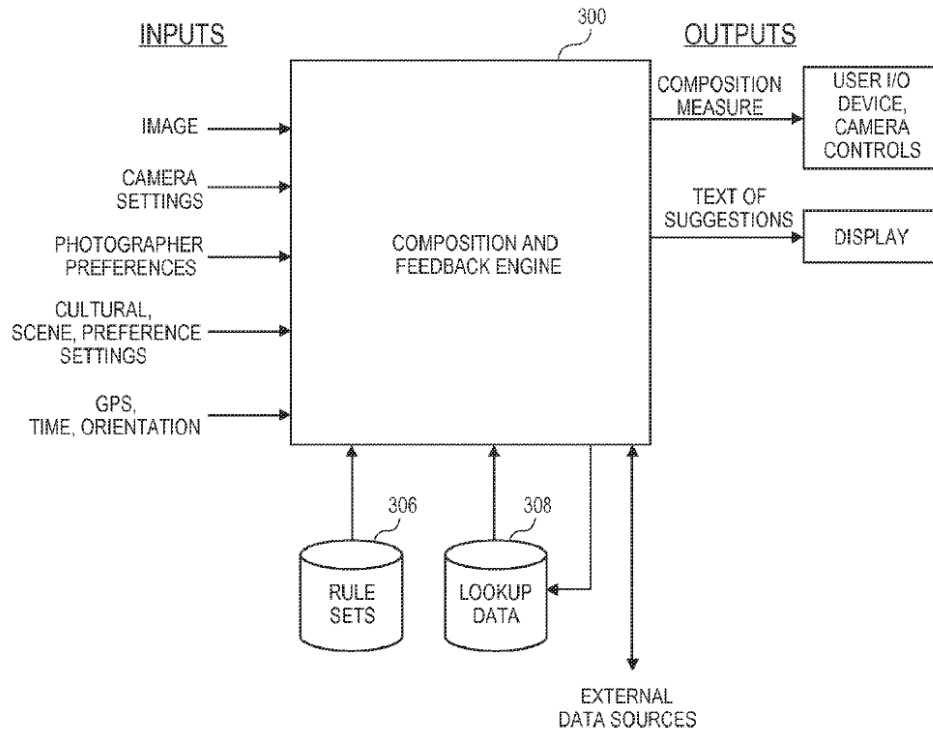


FIG. 3

In my opinion, a POSITA would have found it obvious in light of these disclosures that Anon's device comprises *a processor coupled to at least one image sensor and to the digital camera for receiving data therefrom.*

60. Furthermore, Anon's device renders obvious that engine 108 performs a method comprising *use of at least one value and weight* as described in detail in the elements below.

61. Moreover, Anon discloses that its quality of a composition method is for an image or "video," which a POSITA would have found obvious to be encompassed by a stream of images. *See, e.g., EX1004, 2:64-3:1* ("An improved composition and recommendation method and apparatus are described herein. Using

this, a photographer (or videographer) is provided signals or indications of a likely quality of a composition and/or recommendations for improvement usable while the image or video is being taken.”). In my opinion, a POSITA would have found it obvious in light of these disclosures that Anon’s device *comprises method for estimating a quality of at least one image from a stream of images.*

- ii. [1.a] “obtaining a first value (QII) responsive to the device motion from at least one motion or location sensor”

62. Anon teaches that its engine has inputs including camera settings, photographer preferences, various settings for cultural preferences, scene preferences and the like, location, time, and orientation inputs. EX1004, Fig. 3, 4:24-34, 7:4-29. Parameters “such as the orientation of the camera, where the camera is focused-upon, where within the scene is a face recognized, and the like” (*id.*, 8:28-31) as well as “[c]amera-specific external inputs” like “the camera’s current geographic location, time of day, orientation and the like” (*id.*, 4:24-26) determine how the image quality is judged. For example, Anon describes the use of the location sensor: “if the engine is aware of the camera location and has access to a data set of rules (e.g., ‘when located at the GPS coordinates of the front of Cinderella’s Castle™ in Disneyland, suggest centering on the castle rather than rule of thirds’).” *Id.*, 5:3-7. It would have been obvious to a POSITA that such “GPS coordinates” are a *first value*, as they include longitude and latitude coordinate

values. The same is true of motion sensors, which Anon notes “can provide the engine with inputs as to how the camera is moving” (*id.*, 10:26-35) and which Anon describes the use of: “it might be a preference when a subject is moving quickly in a scene to frame more of the scene in front of the subject than in back of the subject and this could be suggested by the engine to a videographer.” *Id.*, 10:31-35.

iii. [1.b] “*estimating a first weight (c1) associated with the first value*”

63. Anon describes determining a plurality of image-based characteristics (*i.e.*, QIs) for an image and using them to “compute a composition measure for the proposed image and the given settings ***that depends from at least two of*** the plurality of image-based characteristics of the proposed image.” *See* EX1004, 1:64-67. It would thus have been obvious to a POSITA that this computation does not use merely one of the image-based characteristics, but multiple (“at least two”) of them, each of which may contribute differently to the composition measure.

64. Anon’s engine further uses both intrinsic characteristics (*e.g.*, color, focus, brightness, energy) and external characteristics (*e.g.*, geographic location, time of day, user preferences, cultural rules) to determine image composition, noting that the invention “will consider more than one independent value for some characteristic of an image and provide recommendations that might not be optimal for one characteristic versus another characteristic”. EX1004, 5:26-30. A POSITA would therefore have found it obvious that Anon’s system weighs different

characteristics differently, given that it considers what would be optimal for a particular characteristic and makes tradeoffs between what is optimal for one characteristic and what improves the image composition.

65. As such, and given Anon’s disclosure of location and motion variables (see Section VIII.A.1.ii above), it would have been obvious to a POSITA that such variables would also have variable weights in Anon’s engine. See EX1004, 10:27-47 (motion is an “optimized” characteristic).

66. To the extent “estimating” is narrowly construed to require a real-time and context-dependent determination of a value’s weight, this is disclosed by Anon. EX1004, 3:53-4:3 (“***Other inputs might include an indication of where in the image the subject is (e.g., find faces and draw a rectangle around the most prominent face in the image, find an object with a defined border that has a color distribution that is wildly different from the histogram of the rest of the image, as might be the case when photographing a red and yellow bird with a background of green and brown of the surrounding trees). This input can be used to influence how various characteristics are weighted.***”). And to the extent Anon is found not to disclose this element, Jasinski remedies this. For instance, Jasinski dynamically calculates weights for each region of an image, and then recalculates for every image or sequence such that the system can adapt to changing scene conditions. See, e.g., EX1010, ¶¶ [0119]-[0122]. Jasinski states that “[t]he weighting coefficients w_i can

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be determined using any method known in the art. In a preferred embodiment, the weighting coefficients w_i are determined to be representative of the estimated relative importance of the image regions to a user.” *Id.*, ¶ [0120]. Moreover, various of the attributes disclosed by Jasinski may be considered in the determination of importance (*i.e.*, weight) of other attributes, such as image detail, scene brightness, region position, important features in a region, and confidence. *Id.*, ¶¶ [0120], [0121] (“image regions 365 with high levels of image detail can be weighted more highly than image regions 365 with lower levels of image detail”), [0114] (“local scene brightness level can also be an indication of the suitability of an image region... the choice of image regions with a higher local brightness level avoids areas where low signal-to-noise can interfere with the calculation of accurate motion velocities”), [0120] (“image regions 365 in a face zone or an autofocus zone can be weighted more heavily than other image regions 365 because they are more likely to be a main subject ... Likewise, image regions 365 located in the periphery ... can be deemed to be of lower relative importance than those which are centrally located”), [0120] (“image regions 365 in a face zone or an autofocus zone can be weighted more highly”), and [0122] (“the shape of the fitting function 475 can provide an indication of the relative confidence level”). Further, Jasinski’s dynamic weighting system may be used to determine image capture settings. *See id.*, ¶ [0031].

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67. It would have been obvious to a POSITA that using Jasinski’s dynamic weighting system in Anon’s weighted image quality evaluation would make the system more adaptive to change in the various parameters analyzed by Anon over time or in different regions of the image. Jasinski would fit naturally as an extension of Anon’s teaching, and the combination would be the use of a known technique (Jasinski’s dynamic weighting) to improve similar devices in the same way. As such, a POSITA would have been motivated to combine the complementary teachings of Anon and Jasinski with a reasonable expectation of success.

- iv. [1.c] “obtaining a second value (QI2), where value is a measurement of under or over exposure of at least one of a part of image or face exposure”

68. Anon does not describe the use of a *measurement of under or over exposure of the image* as one of its quality indicators. That said, Takeuchi uses such exposure data to evaluate image quality. See EX1007, ¶¶ [0084], [0090], and [0137]; see also *id.*, ¶ [0147] (“the body side microcomputer 21 seeks regions where there is underexposure (blackout) or overexposure (whiteout) with respect to the overall picture, and judges whether their proportion is below a predetermined value.”). Further, Takeuchi discloses evaluating *face exposure*, noting that “[t]he body side microcomputer 21 judges whether there is underexposure (blackout) or overexposure (whiteout) at the position of the main subject estimated to be a face.”

Id. A POSITA would have found it obvious that Takeuchi's exposure data is a *second value (QI2)*, as set forth below.

69. In my view, Anon and Takeuchi are directed to the same problem of evaluating and improving digital image quality, and both offer corrective feedback to the user, though Anon's feedback is additionally in real time. *See, e.g.*, EX1007, ¶¶ [0147] and [0290]; EX1004, 1:59-2:8. A POSITA would have found it obvious that exposure data was fundamentally relevant to overall image quality, in part because poor exposure can reduce detail. Anon aims to improve overall image quality, and even does so by offering suggestions related to image brightness, which is directly related to image exposure. *Id.*, 2:9-15.

70. A POSITA would have been motivated to combine Anon with Takeuchi by implementing Takeuchi's consideration of exposure for image quality in Anon's system for several reasons. **First**, Anon's framework has a clear need for a reliable exposure input given its evaluation of total image quality, and this need would be filled by Takeuchi's exposure analysis. **Second**, Anon describes the use of various different characteristics to evaluate an image. EX1004, 8:14–35, 10:48-50 (“what characteristics are used to determine what is a ‘good’ image are very flexible and can be enhanced or changed completely over time”). **Third**, both Anon and Takeuchi provide feedback to the user to improve image quality, demonstrating that they have the same goal and are complementary. *See* EX1007, ¶ [0290]; *see*

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also EX1004, 3:23-26. Finally, exposure is a well-known key determinant of image quality, and a POSITA would have found it obvious to analyze exposure in evaluating image quality. This would include knowledge of prior art systems doing the same. *See, e.g.*, EX1007, U.S. Pat. App. Pub. No. 2010/0246939 to Aisaka, EX1015, U.S. Pat. App. Pub. No. 2005/0270381 to Owens.

71. Moreover, a POSITA would have had a reasonable expectation of success in the combination of Anon and Takeuchi. **First**, Takeuchi's exposure evaluation, which produces quantitative scores and/or flags, would have been easily imported in Anon's system, which readily uses quantities to evaluate image composition. **Second**, both Anon's system and Takeuchi's system describe using modular quality indicators to determine user feedback, and inputting one more "module" (Takeuchi's exposure data) into Anon's system would have been a straightforward extension of Anon. Indeed, multi-feature, modular systems were the norm as of the Priority Date, and a POSITA would not have found combining features for quality assessment to be novel. For instance, a 2013 survey discussing pre-2013 technologies discusses the use of multiple features for both image enhancement and analysis. EX1017, Abstract. It describes how assessment algorithms analyze photos using a variety of features, such as sharpness, brightness, contrast, composition rules (*e.g.*, rule of thirds), face detection, and color harmony. *Id.*, 346-348. The survey also highlights the use of machine learning techniques

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(e.g., SVM, decision trees, PCA) to combine these features for ranking and classification. *Id.*, 348-349.

- v. *[1.d] “estimating a second weight (c2) associated with the second value”*

72. As described with respect to element [1.b], which I incorporate herein, Anon determines several image-based characteristics, uses them to determine image quality, and weighs these characteristics differently, including making tradeoffs between what is optimal for one characteristic and what improves the image composition. *See* Section VIII.A.1.iii. As such, it would have been obvious to a POSITA that when integrated with Anon, Takeuchi’s exposure variable would also have variable weights in Anon’s engine. To the extent “estimating” is narrowly construed to require a real-time and context-dependent determination of a value’s weight, Anon discloses this, or Anon and Jasinski render this obvious. *See supra* in Section VIII.A.1.iii.

- vi. *[1.e] “analyzing the captured image for detecting or recognizing zero or more faces in the picture, calculates properties of at least one of said faces if exist, where said properties are at least one of: looking at camera, smiling, crying, face detection quality, face exposure or subject movement to obtain a third value (QI3)”*

73. It would have been obvious to a POSITA that Anon teaches object detection and recognition within an image, such as faces or distinctively colored objects. EX1004, 3:62-4:3 (“Other inputs might include an indication of where in

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the image the subject is (e.g., find faces and draw a rectangle around the most prominent face in the image, find an object with a defined border that has a color distribution that is wildly different from the histogram of the rest of the image, as might be the case when photographing a red and yellow bird with a background of green and brown of the surrounding trees). This input can be used to influence how various characteristics are weighted.”). A POSITA would further have found it obvious that this “indication of where in the image the subject is” is a third value (QI3).

74. Takeuchi also discloses object detection, including the position of faces in an image. *See* EX1005, ¶ [0115]. It does so using a database and pattern recognition: “the body side microcomputer 21 segments the picture of the target image into a plurality of blocks and compares this image with the face detection region information obtained in Step S103 for the image in question. Then, the body side microcomputer 21 adds a predetermined number of points to the region where a face image is detected.” *Id.*, ¶ [0134]. Takeuchi further adjusts how much each point is weighted: the contribution of each item “may be adjusted by appropriately setting the size of the number of points to be added for each item.” *Id.*, ¶ [0136].

75. Both Anon and Takeuchi additionally calculate facial properties by detecting both movement and exposure of faces, ultimately obtaining a value. Takeuchi discloses analyzing object movement over time by calculating motion

vectors, as “the body side microcomputer 21 detects the correlation value between the image information of the previous acquisition, and the image information of the current acquisition, for the image information acquired at a frame rate... [and] acquires the motion vector of the subject for each block,” and “[t]he body side microcomputer 21 ... calculates a speed change rate (relative movement state) of the main subject between the frames.” *Id.*, ¶¶ [0113] and [0162]. Takeuchi further states that “the microcomputer 29 carries out the exposure computations considering the luminance of the main subject together with the luminance information calculated in Step S302, using the location of the main subject sought in Step S305.” *Id.*, ¶ [0309]. Anon likewise judges exposure during facial recognition using various input parameters, as “parameters from the camera may be used to make the judgment, such as the orientation of the camera, where the camera is focused-upon, where within the scene is a face recognized, and the like,” and further analyzes movement in video analysis: “the video camera might include a motion sensor that can provide the engine with inputs as to how the camera is moving... it might be a preference when a subject is moving quickly in a scene to frame more of the scene in front of the subject than in back of the subject and this could be suggested by the engine to a videographer.” Anon, 8:28-31 and 10:27-35.

76. A POSITA would have found it obvious to use these face exposure and movement values as inputs for Anon’s engine, as both are well-established image

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quality indicators, as noted in Anon and Takeuchi. *Id.*, 8:15-31 (“parameters from the camera may be used to make the judgment, such as the orientation of the camera, where the camera is focused-upon, where within the scene is a face recognized, and the like,” and “the characteristics that are used to judge a properly composed image often depend upon the type of image that is sought to be captured,” such as whether “the subject’s eyes are open, and the energy of the light, color, lines, and subject’s position are in a middle range (so the image is not flat and boring or overwhelmingly detailed.)”); EX1005, ¶¶ [0137] (the system “carries out the exposure computation taking into account the luminance of the main subject”) and [0162] (the system “calculates a speed change rate (relative movement state) of the main subject between the frames.”).

77. Given the above, and Anon’s engine computing a composition measure using “at least two of the plurality of image-based characteristics of the proposed image,” it would have been routine and obvious POSITA to use the discussed face exposure and movement values in Anon’s system as input values. These values directly impact the perceived quality of the image, and improving image quality is a stated goal of both systems. A POSITA would thus have had a reasonable expectation of success in the combination and it would have yielded predictable, beneficial results.

vii. [1.f] “*estimating a third weight (c3) associated*

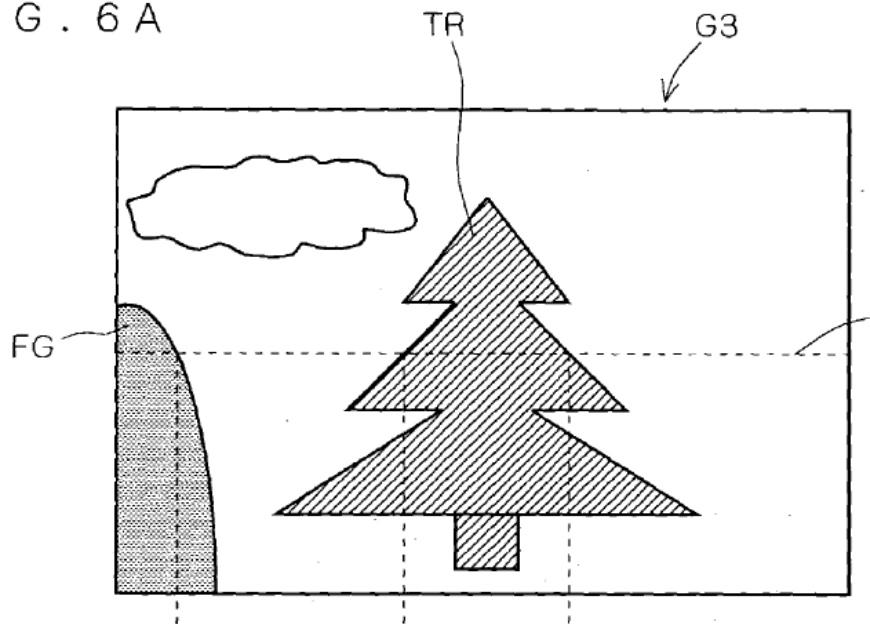
with the third value”

78. As described with respect to element [1.b], which I incorporate herein, Anon determines several image-based characteristics, uses them to determine image quality, and weighs these characteristics differently, including making tradeoffs between what is optimal for one characteristic and what improves the image composition. *See* Section VIII.A.1.iii. As such, it would have been obvious to a POSITA that when integrated with Anon, Takeuchi’s face exposure and motion would also have variable weights in Anon’s engine. To the extent “estimating” is narrowly construed to require a real-time and context-dependent determination of a value’s weight, Anon discloses this, or Anon and Jasinski render this obvious. *See supra* in Section VIII.A.1.iii.

viii. [1.g] *“obtaining a fo[u]rth value (QI4) responsive to obstruction of at least one optical lens”*

79. Anon does not describe the use of an *obstruction of at least one optical lens* as one of its quality indicators. However, Kosaka detects such obstructions to evaluate image quality. *See, e.g.*, EX1006, Fig. 6A.

FIG. 6A



Kosaka's system analyzes images in real time, before capture, and identifies low-brightness areas remaining stationary while other images shake or reframe. *See, e.g.*, EX1006, Figs. 4A–8, ¶¶ [0074] and [0075]. It would have been obvious to a POSITA that this analysis generates a *fourth value (QI4)* as claimed.

80. Kosaka describes how the camera provides feedback to the user before an image is taken when an obstruction is detected. *See id.*, Figs. 9–10, 23–25, ¶ [0089] (“Examples of the notifying operation are, concretely, indication of a note by characters of ‘Note: finger is in’ on the display 7 or a predetermined figure and output of sound of a note from a speaker or voice”). Anon, Takeuchi, and Kosaka each aims to improve image quality and automate the process of selecting such images, including by offering feedback to users. The approaches of each are complementary; where Anon accepts various image characteristics as inputs to its

engine, Takeuchi provides an object detection evaluation (a score), and Kosaka identifies a specific image defect that lowers image quality.

81. A POSITA would have been motivated to combine Anon with Kosaka by implementing Kosaka’s obstruction determination in Anon’s image quality determination engine, including in combination with Takeuchi. **First**, Kosaka describes the ubiquitousness of finger obstructions causing poor image quality, and Anon’s system is designed to detect and fix image quality flaws. *See* EX1006, ¶¶ [0006] and [0007]; *see, e.g.*, EX1004, 2:64–3:1. Using Kosaka’s obstruction signal as an input in Anon’s engine would thus have allowed Anon’s system to provide user feedback and remediate the issue addressed in Kosaka. **Second**, Anon’s system accepts a variety of inputs to its engine, such as “higher-level aspects of the image being sensed” and “image-based characteristics”. *See, e.g.*, EX1004, 2:9-15, 3:53-57. Kosaka’s output regarding an obstruction would have been a natural fit as one such input, *e.g.*, as a binary signal (with a variable weight). **Third**, Anon’s system would naturally benefit from the addition of both Takeuchi and Kosaka, as Takeuchi evaluates subject-centric variables such as focus and exposure, whereas Kosaka measures specific defects such as finger obstructions. EX1007, ¶¶ [0275]-[0286].

82. A POSITA would have had a reasonable expectation of success in implementing the combination of Anon, Takeuchi, and Kosaka. Anon accepts and combines various inputs in various combinations, and Kosaka’s output would

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naturally fit as one such input. And because Anon and Takeuchi both score the quality of an image using evaluation metrics, Kosaka would have been a straightforward addition in that it discloses finger obstructions as one such evaluation metric. The addition of Kosaka would further yield predictable and desired results in yielding recommendations to a user following the combination.

ix. [1.h] “*estimating a fo[u]rth weight (c4) associated with the fo[u]rth value*”

83. As described with respect to Claim 1 and particularly element [1.b], which I incorporate herein, Anon determines several image-based characteristics, uses them to determine image quality, and weighs these characteristics differently, including making tradeoffs between what is optimal for one characteristic and what improves the image composition. *See* Section VIII.A.1.iii. As such, and given Anon’s disclosures noted above (*see* Section VIII.A.1.vi), it would have been obvious to a POSITA that Kosaka’s finger obstruction value would also have a variable weight in Anon’s engine. To the extent “estimating” is narrowly construed to require a real-time and context-dependent determination of a value’s weight, Anon discloses this, or Anon and Jasinski render this obvious. *See supra* in Section VIII.A.1.iii.

x. [1.i] “*wherein at least one of the values Q11, Q12, Q13, Q14 or the weights c1, c2, c3, c4 are calculated based on an artificial neural network*”

employing deep learning algorithm”

84. Anon teaches the use of neural networks for evaluating the inputs to its engine based on sets of training data, however it does not describe artificial neural network algorithms for object detection or recognition. Takeuchi similarly uses pattern matching, statistical analysis, and learning, but not artificial neural network algorithms for object detection or recognition.

85. Aisaka discloses an image processing apparatus and method by which neural networks are used to detect and evaluate subjects in an image. EX1007, ¶ [0020]. Its system uses an artificial neural network and deep learning algorithm to calculate device motion, exposure/focus of an image, face/object recognition, and/or obstruction of the lens, as well as associated weights: “These difference weights W_a , information weights W_b , and subject weight W_c used at the time of the generation of a subject map are determined using, for example, neural-network-based learning.” EX1007, ¶ [0269]. These weights are used to generate information maps such as “luminance,” “color,” “edge,” “face,” and “motion” information, and a subject map, as “difference images obtained from pyramid images of these extracted pieces of information are subjected to weighted addition with difference weights W_a to produce information maps, and these information maps are subjected to weighted addition with information weights W_b .” *Id.*, ¶ [0268]. It would have been obvious to a POSITA that these information maps correspond to exposure/focus, face/object

recognition, and device motion. Aisaka's neural networks are used to calculate these weights, and thus the quality indicator values it generates.

86. In my view, a POSITA would have been motivated to combine Anon with Takeuchi for deep-learning-based image analysis, as both references aim to accurately identify subjects and improve image quality, which would be assisted by the use of artificial neural networks. As noted above, Anon's system provides feedback based on analysis of image characteristics, and Takeuchi estimates subject position and evaluates images using exposure data, motion vectors, and face detection. The use of artificial neural network algorithms would have been a logical improvement, and such algorithms were well known in the art as an effective, reliable method for image analysis. A POSITA would have had a reasonable expectation of success, as both references include modular frameworks that are adaptable for improvement. For similar reasons, a POSITA would have been motivated to combine Aisaka with Anon and Takeuchi by using Aisaka's neural networks analysis for object detection in conjunction with the combination of Anon and Takeuchi. Like Anon, Aisaka analyzes aspects (such as sharpness) of a single subject. Also like Anon, Aisaka aims to evaluate images using a plurality of image-based characteristics.

- xi. [1.j] *“to select, based on values QI1, QI2, QI3, QI4 and weights c1, c2, c3, c4, at least one appropriate suggestion from a pre-stored table of suggestions of how a user of the system may cause*

at least on[e] said value to be above or below a threshold and to present said appropriate suggestion to the user.”

87. It would have been obvious to a POSITA that the combination of Anon, Takeuchi, Kosaka, and Aisaka describes using a pre-stored table of suggestions to improve image quality. Anon, for example, discloses that it relies on various pre-defined rules and criteria to analyze an image, including in the form of a “rule set.” EX1004, 7:15-29. It then uses these rules to generate suggestions for a user based on image composition. *See, e.g.*, EX1004, 5:53-6:8, 6:42-7:14. Anon, Takeuchi, and Kosaka similarly communicate suggestions to the user to capture better images. *See, e.g.*, EX1004, Fig. 3; EX1007, ¶ [284]; EX1008, ¶¶ [0008] and [0098].

88. A POSITA considering Anon, Takeuchi, Kosaka, and Aisaka would have been motivated and found it obvious to use a pre-stored table of suggestions. Such an approach is both streamlined and allows for context-dependent feedback. It is also well established in the art. *See* EX1015 (disclosing use of decision tables and GUI strings). Moreover, algorithmic systems can and do incorporate such personal and contextual factors, and such systems were state-of-the-art in the field during the relevant time period. For instance, a system described by C.-H. Yeh et al., in the paper titled “Personalized Photograph Ranking and Selection System,” allows for “personalized ranking user interfaces,” including both feature-based and example-

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based re-ranking, and incorporates features such as “texture, RGB color, portrait (through face detection), and black-and-white, ... for individual preferences.” EX1016, Abstract. The paper also describes the use of machine learning (ListNet) to learn feature weights based on user preferences, and demonstrates that the “system can re-rank the list closer to user preference.” *Id.*, 2, 6-8.

89. Combining Anon with Takeuchi, Kosaka, and Aisaka would result in a system that takes as inputs various image parameters, then compares them to known thresholds and generates feedback for the user to improve image quality. A POSITA would therefore have selected appropriate suggestion(s) from a pre-stored table to present to the user. To start, Takeuchi evaluates images with various methods, including assigning scores, and offers suggestions to the user. *See, e.g.*, EX1005, ¶¶ [0290]–[0295], Fig. 25. Similarly, Kosaka evaluates images based on finger obstructions and offers suggestions in the form of corrective actions. *See* EX1006, ¶¶ [0008] and [0098]. Anon, meanwhile describes offering suggestions to a user based on image quality that is calculated using various inputs of the kind described in both Takeuchi and Kosaka. *See* EX1004, 5:25-51. I note that Anon describes the use of “rule sets” and “lookup data” for its suggestions. EX1004, 7:15-29.

90. In short, the combined system would respond to a value’s deviation across a threshold, then consult a pre-stored table to generate a suggestion for the

user. A POSITA would have found this an obvious, predictable, and modular approach, would have agreed that this approach is widely used in the art, and would have implemented it in this combination with a reasonable expectation of success. See EX1015, ¶ [0018].

2. Claim 2

91. Claim 2 depends from claim 1 and further recites “where suggestions to the user can be ‘blurred image due to camera shake’, or ‘blurred subject due to subject movement’, or ‘image dynamic range is beyond the sensor dynamic abilities—choose area of interest or take a high dynamic range (HDR) shot’.” Although Anon does not expressly disclose such suggestions, it does disclose suggestions to the user which “might be presented in a viewfinder display,” as well as the fact that a lack of sharp edges might indicate a lack of inappropriate focus. EX1004, 3:53-57, 6:4-9. It would have been a simple matter of design choice to make such suggestions in the manner recited in claim 2.

3. Claim 3

92. Claim 3 depends from claim 1 and further recites “grading the image quality according to, or based on, the total value, and wherein the total value is calculated as a weighted average value according to, or based on, $c1*QI1+c2*QI2+c3*QI3+c4*QI4$, where $c1>0$, $c2>0$, $c3>0$ and $c4>0$.”

93. In Anon’s system, input values “may be input into a fuzzy logic set, or the like, and an evaluation, e.g. weighted, combination of parameters may be performed by the composition and feedback engine.” EX1004, 8:32-35. Anon thus teaches that input parameters can be weighted and combined. Further, a POSITA would have recognized this calculation of a *weighted average value according to, or based on, $c1*QI1+c2*QI2+c3*QI3+c4*QI4$* to be nothing more than the conventional method of combining weighted parameters.

4. Claim 4

94. Claim 4 depends from claim 1 and further recites “wherein the estimating of the one of weights (c1, c2, c3, c4) is responsive to at least on[e] of values (QI1, QI2, QI3, QI4) other than its respectively associated one.”

95. Anon describes that estimation of a quality indicating value influences determination of the weights attached to other characteristics. EX1004, 3:53-4:3 (“The inputs that the engine has to work with can include image inputs, ... as well as camera settings In addition to these intrinsic camera inputs, the engine might work with camera-specific, photographer-specific, or cultural-specific external inputs. Other inputs might include an indication of where in the image the subject is (e.g., find faces and draw a rectangle around the most prominent face in the image, find an object with a defined border that has a color distribution that is wildly different from the histogram of the rest of the image, as might be the case when

photographing a red and yellow bird with a background of green and brown of the surrounding trees). ***This input can be used to influence how various characteristics are weighted.***”). A POSITA would have understood this to indicate that in Anon, the estimation of one value impacts the weighing of other values.

5. Claim 7

96. Claim 7 depends from claim 1 and further recites “wherein at least one of said weights are defined at least partially over a time-dependent confidence level defined over at least one of said values QI1, QI2, QI3, QI4.”

97. Anon does not disclose this claim explicitly. However, Jasinski describes time-dependent confidence of estimates for motion based on changes in a scene’s lighting or camera movement. *See* EX1010, ¶¶ [0030], [0088], and [0122]. A POSITA would have found it obvious that Anon’s estimates would also have different confidence levels over time, and would have been motivated to use these confidence levels to weigh Anon’s input values differently over time. This would allow for more accurate real-time feedback to the user and more reliable estimation of image quality.

98. A POSITA would have found obvious that the use of time-dependent confidence levels, discussed in Jasinski, would pair well with Anon’s weighted parameters, including because this would account for changes in the reliability of the parameters over time. It would have been obvious to a POSITA that weighing

Anon's estimates differently over time would allow for adaptation to any scene conditions, especially in light of Anon's need for real-time accurate feedback to the user. This combination would have been the use of a known technique, a time-dependence confidence level as discussed in Jasinski, to improve similar devices in the same way. As such, a POSITA would have been motivated to combine Anon with Jasinski and would have had a reasonable expectation of success.

6. **Claim 8**

99. Claim 8 depends from claim 1 and further recites "where the second value (QI2) is further based on an object recognition done for the third value (QI3), where the object recognition can change importance of certain areas in the image for the purpose calculation of said second value (QI2): over or under exposure value."

100. Although Anon does not expressly disclose this claim, Takeuchi describes using object detection in conjunction with exposure level, allowing the exposure calculation to dynamically change based on the detection of objects in the scene. *See* EX1005, ¶ [0137] ("carries out the exposure computation **taking into account the luminance of the main subject**"); *see also id.*, ¶¶ [0134]-[0136]. As such, and for the reasons discussed for elements [1.c] and [1.e] (*see* Sections VIII.A.1.iv and VIII.A.1.vi), a POSITA would have been motivated to use Takeuchi's object detection and point evaluation in Anon's image quality determinations.

7. **Claim 9**

101. Claim 9 depends from claim 1 and further recites “wherein at least one of said values (QI1, QI2, QI3, QI4, total value) causes change of one of focus point, ISO or aperture of at least of lens module.”

102. Anon describes the use of various inputs in its image quality estimation system, including geographic location, time of day, camera orientation, and image-based characteristics. *See, e.g.*, EX1004, 4:24-33. These inputs are used to automatically adjust or suggest to the user various changes to, *e.g.*, focus, aperture, and exposure. *Id.*, 2:29–36 (“the image capturing device will automatically make the change”); 1:42-49 (“most cameras can analyze an image and automatically focus the lens, so that that user is freed from having to estimate distances or manually set the focus” and “[m]ost cameras can also set the shutter speed appropriately for a given amount of light that is falling on the camera”); *see also id.*, 8:36-43, 2:29–36, 1:42-49.

103. Takeuchi similarly discloses such automatic correction, including to “exposure conditions such as the aperture value, shutter speed and the like, focus adjustment, and photographic sensitivity,” *i.e.*, values which, in my view, a POSITA would have found obvious to include the focus point, ISO, and aperture discussed in Anon. EX1005, ¶¶ [0281]-[0283] (describing “Self-Correction of Photographic Conditions” including “aperture,” “focus adjustment,” and “photographic

sensitivity.”). A POSITA would have similarly recognized and found obvious that this automatic correction is more convenient for the user, as described in Anon. EX1004, 1:42-49 (“so that the user is freed from having to estimate distances or manually set the focus”). I note that consumer cameras have long had such automatic adjustment optionality (including for focus, ISO, and aperture), and this is by no means new or unique, as discussed in Anon. EX1004, 1:42-49. A POSITA would have been motivated to combine the two references, such that Takeuchi’s automatic correction of focus is implemented in Anon’s camera system, and would have had a reasonable expectation of success. *See* Sections VIII.A.1.iv and VIII.A.1.vi.

8. Claim 10

104. Claim 10 depends from claim 1 and further recites “wherein total value is the threshold, and the image is saved into the user persistent memory.”

105. Anon describes the weighing and combination of its parameters during calculation of an image composition value, stating “these parameters may be input into a fuzzy logic set, or the like, and an evaluation, e.g. weighted, combination of parameters may be performed by the composition and feedback engine.” EX1004, 8:32-35. Anon further describes how the ultimate combined value is compared to a threshold. *See* Section VIII.A.1.xi. Additional “post-processing” occurs based on this calculation, which is then saved in user persistent memory. EX1004, 10:1–25.

It would have been obvious to a POSITA that a quality image is then saved in user persistent memory, as Anon’s invention allows a user to capture the image immediately following Anon’s output of a composition measure—which naturally results in the image being saved in user persistent memory. *See* EX1004, 2:6–8, 3:10-12. Thus, the purpose of Anon is accomplished in only saving high quality images.

B. Ground 1B: Claims 11, 14-17, and 20 are Obvious in View of Anon, Takeuchi, Aisaka, Jasinski, and Cheatle

1. Independent Claim 11

- i. *[11.pre.] “A method for estimating quality of at least one image from a stream of images, for use with a device that comprises in a single enclosure a digital camera module or functionality that comprises at least one optical lens for focusing received light from a scene and an image sensor coupled to at least one optical lens for capturing an image of the scene; at least one motion or location sensor for sensing the device motion; and a processor coupled to the image sensor and to the digital camera for receiving data therefrom, the method by the processor comprising use of at least one value and weight;”*

106. Although claim 11’s preamble allows using *at least one* rather than only one sensor, it is otherwise the same as claim 1’s preamble. As such, to the extent that the preamble is limiting, it is disclosed by Anon for the reasons discussed with respect to claim 1’s preamble. *See* Section VIII.A.1.i.

- ii. *[11.a] “obtaining a first value (Q11) responsive to the device motion from at least one motion or*

location sensor”

107. Anon discloses this limitation for the same reasons discussed with respect to element [1.a]. *See* Section VIII.A.1.ii.

iii. *[11.b] “estimating a first weight (c1) associated with the first value”*

108. Anon discloses this limitation for the same reasons discussed with respect to element [1.b]. *See* Section VIII.A.1.iii. To the extent “estimating” is narrowly construed to require a real-time and context-dependent determination of a value’s weight, Anon discloses this, or Anon and Jasinski render this obvious. *See supra* in Section VIII.A.1.iii.

iv. *[11.c] “obtaining a second value (QI2) value is a combination of at least one of: digital camera exposure, lens focus, under or over exposure of the image or its part or face exposure;”*

109. Anon and Takeuchi both describe the use of lens focus as a quality indicator. Anon states that “the plurality of image-based characteristics include a color characteristic, a focus characteristic, a brightness characteristic, etc.” and further explains that “parameters from the camera may be used to make the judgment, such as the orientation of the camera, where the camera is focused-upon, where within the scene is a face recognized, and the like.” EX1004, 2:9-11 and 8:27-31. Takeuchi likewise states that “image information stored in the buffer 25 may be, evaluated as a characteristic amount of the defocus amount generated between

frames of each block when segmenting the photographed images into a plurality of blocks.” EX1005, ¶ [0298].

110. Anon does not explicitly include *a combination of at least one of: digital camera exposure, lens focus, under or over exposure of the image or its part or face exposure*, and it does not describe the use of over- or under-exposure as one of its quality indicators. Takeuchi, however, obtains a measurement value from the combination of lens focus and exposure values, as well as using such exposure data generally to evaluate image quality. *See* EX1005, ¶¶ [0084], [0090], [0137], and [0142] (“[t]he body side microcomputer 21, in the focus/blurring evaluation, applies a differential filter to the photographed image and detects the edges...”); *see also id.*, ¶ [0147] (“the body side microcomputer 21 seeks regions where there is underexposure (blackout) or overexposure (whiteout) with respect to the overall picture, and judges whether their proportion is below a predetermined value.”). A POSITA would have found it obvious that Takeuchi’s exposure data is a *second value (QI2)*, as set forth below.

111. Takeuchi further discusses the use of focus information, whereby blurring of a subject reduces the points awarded to that region of a photograph. *See id.*, ¶¶ [0142]-[0143]. Takeuchi’s comprehensive approach, including reference to both exposure and focus, as well as related regions of an image, allows the final

image quality to reflect how these elements in *combination* affect the image's overall quality.

112. Moreover, Takeuchi notes that in its combination, “[t]he body side microcomputer 21 carries out the comprehensive evaluation of the photographed image by calculating a total value or average value of the points from the evaluations based on the position of the main subject described above, and the points from the evaluation of the motion vector or the defocus amount or the like as the characteristic amount in the previous Step S105,” showing that Takeuchi’s system generates a single combinatory image quality value. *Id.*, ¶ [0149].

113. In my view, Anon and Takeuchi are directed to the same problem of evaluating and improving digital image quality, and both offer corrective feedback to the user, though Anon’s feedback is additionally in real time. *See, e.g.*, EX1005, ¶¶ [0147] and [0290]; EX1004, 1:59-2:8. A POSITA would have found it obvious that exposure data was fundamentally relevant to overall image quality, in part because poor exposure can reduce detail. Anon aims to improve overall image quality, and even does so by offering suggestions related to image brightness, which is directly related to image exposure. *Id.*, 2:9-15.

114. A POSITA would have been motivated to combine Anon with Takeuchi by implementing Takeuchi’s consideration of exposure for image quality in Anon’s system for several reasons. *First*, Anon’s framework has a clear need for

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a reliable exposure input given its evaluation of total image quality, and this need would be filled by Takeuchi's exposure analysis. **Second**, Anon describes the use of various different characteristics to evaluate an image. EX1004, 8:14–35, 10:47–50 (“what characteristics are used to determine what is a ‘good’ image are very flexible and can be enhanced or changed completely over time”). **Third**, both Anon and Takeuchi provide feedback to the user to improve image quality, demonstrating that they have the same goal and are complementary. *See* EX1005, ¶ [0290]; *see also* EX1004, 3:23–26. **Finally**, exposure is a well-known key determinant of image quality, and a POSITA would have found it obvious to analyze exposure in evaluating image quality. This would include knowledge of prior art systems doing the same. *See, e.g.*, EX1007, U.S. Pat. App. Pub. No. 2010/0246939 to Aisaka, EX1015, U.S. Pat. App. Pub. No. 2005/0270381 to Owens.

115. Moreover, a POSITA would have had a reasonable expectation of success in the combination of Anon and Takeuchi. **First**, Takeuchi's exposure evaluation, which produces quantitative scores and/or flags, would have been easily imported in Anon's system, which readily uses quantities to evaluate image composition. **Second**, both Anon's system and Takeuchi's system describe using modular quality indicators to determine user feedback, and inputting one more ‘module’ (Takeuchi's exposure data) into Anon's system would have been a straightforward extension of Anon. Indeed, as noted above in Section **Error!**

Reference source not found.i, multi-feature, modular systems were the norm as of the Priority Date, and a POSITA would not have found combining features for quality assessment to be novel. *See* EX1017, Abstract, 346-349.

- v. *[11.d] “estimating a second weight (c2) associated with the second value”*

116. Anon discloses this element for the same reasons discussed with respect to element [1.d]. *See* Section VIII.A.1.v. It would have been obvious to a POSITA that the combination described above with respect to the *second value* would have its own weight assigned. To the extent “estimating” is narrowly construed to require a real-time and context-dependent determination of a value’s weight, Anon discloses this, or Anon and Jasinski render this obvious. *See supra* in Section VIII.A.1.iii.

- vi. *[11.e] “analyzing the captured image via deep learning algorithms for detecting or recognizing one or more objects in, or one or more characteristics of the image or at least one of object characteristics to obtain a third value (QI3) associated with the analysis”*

117. Anon teaches object detection and recognition within an image, but does not explicitly disclose the use of a deep learning algorithm for this purpose. Takeuchi also discloses object detection, including the position of faces in an image, but similarly does not explicitly disclose the use of a deep learning algorithm for this purpose. Aisaka discloses an image processing apparatus and method using deep

learning algorithms for image evaluation and detection and evaluation of subjects within images. EX1007, ¶ [0020].

118. Aisaka's system generates a "subject map" by which the region of an image in which a subject is found is identified, using the combination of various image feature values. EX1007, ¶ [0020]. In this system, "the subject extraction unit 21 detects the subject from the supplied input image, generates a subject map that is information for specifying a region including the subject in the input image, and supplies the subject map to the determination unit 22." *Id.*, ¶ [0058]. By Aisaka's learning process, "difference weights W_a , information weights W_b , and subject weight W_c used at the time of the generation of a subject map are determined using, for example, neural-network-based learning." *Id.*, ¶ [0269]. To iteratively update the weights and improve the accuracy of subject detection, the subject map discussed is compared during learning to an "image label that is determined in advance and that represents the region of the subject in the learning image." *Id.*, ¶ [0020]. This approach enables "more reliable detection of the subject from an image using this subject map," and detection of "a general object such as an animal, a plant, or a building." *Id.*, ¶¶ [0301] and [0267]. Aisaka's system further considers image sharpness, as "the blur determination unit 51 calculates the blur degree representing the blur extent of the region of the subject on the input image from the input image and the subject map." *Id.*, ¶ [0256]. Like Takeuchi's approach, Aisaka's system is

comprehensive and learning-centric, allowing the system to detect subjects and objects robustly and adaptably in various types of images.

119. Aisaka’s system implements a deep learning network through which it generates quantitative “information” and “subject” maps, which represent features or characteristics in an image numerically, and as such Aisaka’s system outputs a *value*. *Id.*, ¶¶ [0015] and [0268]. Further, Aisaka’s system outputs a “score” or “index” by which the system “evaluat[es] the degree to which the subject appears sharp in the input image.” *Id.*, ¶¶ [0055]-[0057]. This score is calculated using detected features and learned weights, as “[t]he determination unit 22 calculates a score serving as an index for evaluating the input image using the supplied input image and the subject map.” *Id.*, ¶ [0065]. Aisaka’s system thus uses deep learning analysis that outputs a quantitative value reflecting quality or sharpness of an image subject.

120. In my view, a POSITA would have been motivated to combine Anon with Takeuchi by using Takeuchi’s object detection as an input for Anon’s image quality determination. **First**, Anon describes that a “good” image often has a single subject in focus, and Takeuchi quantifies aspects of a single subject. EX1004, 8:19-26; EX1005, ¶ [0142]. **Second**, Anon aims to evaluate images using a plurality of image-based characteristics, and Takeuchi details one such characteristic—a single score based on several technical factors. *See* EX1004, 3:53-59 (“the engine has to

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work with... higher-level aspects of the image being sensed (e.g., the lack of sharp edges that might indicate a lack of appropriate focus), as well as camera settings”). As such, a POSITA would have had a reasonable expectation of success in combining Anon’s composition and feedback with Takeuchi’s object-based scoring. Using Takeuchi’s system, Anon’s system would be able to more accurately identify images with a well-captured subject, which is in line with the goals of each system.

121. For similar reasons, a POSITA would have been motivated to combine Aisaka with Anon and Takeuchi by using Aisaka’s deep learning analysis for object detection in conjunction with Takeuchi’s object detection and Anon’s image quality determination. Like Anon, Aisaka analyzes aspects (such as sharpness) of a single subject, as noted above. Also like Anon, Aisaka aims to evaluate images using a plurality of image-based characteristics, as noted above. A POSITA would have had a reasonable expectation of success in making this modification, as object detection and recognition through deep learning was well established in the art as of the Priority Date as an effective, reliable image analysis technique. Further, both Anon and Takeuchi are modularly structured so as to readily and adaptably incorporate deep learning algorithms like Aisaka’s.

- vii. *[11.f] “analyzing the captured image for detecting or recognizing zero or more faces in the picture, calculates properties of at least one of said faces, where said properties are at least one of: looking at camera, smiling, crying, face detection quality, face exposure or subject movement to obtain a*

fo[u]rth value (QI4)”

122. Anon discloses this element for the same reasons discussed with respect to element [1.e]. *See* Section VIII.A.1.vi.

- viii. [11.g] “*where the fo[u]rth value (QI4) may be based on the recognition value of at least one of said faces as a known face or unknown face, based on a pre-stored list of configured faces*”

123. Anon discloses facial recognition, but does not explicitly disclose that it *based on a pre-stored list of configured faces*. *See supra* in Section VIII.A.1.vi. Cheatle discusses how facial recognition techniques, such as those discussed *supra* in Section VIII.A.1.vi, may be implemented, by using methods such as “analysis tests” that are “customized to deal with faces,” wherein “images where the face is known to the user might be preferred.” EX1008, ¶ [0042]. Cheatle further notes that the technique may be implemented by “keeping a database of facial features [so] a comparison could be made with the subject area of the captured key frame.” *Id.*

124. A POSITA would have been motivated to combine Anon with Cheatle, as both references aim to improve image quality through facial recognition. Anon’s system can “determine image features to classify a subject of the proposed image; and using the classification to modify the indication of composition measure,” including “the classification of the subject is one of a person’s face.” EX1004, Cls. 5 and 6. Cheatle’s system details the implementation of the same by identifying known faces in a database: “Taking this a stage further, the quality factor might be

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determined according to recognition of facial subject area(s) of interest, the composition quality increasing if there is a facial subject area in the image which is identified as being present in a database of previously-stored facial features.” EX1008, ¶ [0012]. A POSITA would have been motivated to use Cheatle’s pre-stored list of configured faces to implement facial recognition as claimed, and would have had a reasonable expectation of success in doing so. Both Anon and Cheatle have compatible facial recognition teachings, and both disclose standard image processing techniques. This would be using Cheatle’s known technique to improve similar devices in the same way. It would have been a simple substitution of a known element (Cheatle’s facial recognition) for another (Anon’s facial property analysis) to obtain predictable results (a camera using facial recognition with Cheatle’s pre-stored list of configured faces).

- ix. [11.h] “*estimating a fo[u]rth weight (c4) associated with the fo[u]rth value*”

125. Anon discloses this element for the same reasons discussed with respect to element [1.d]. See Section VIII.A.1.v. To the extent “estimating” is narrowly construed to require a real-time and context-dependent determination of a value’s weight, Anon discloses this, or Anon and Jasinski render this obvious. See *supra* in Section VIII.A.1.iii.

- x. [11.i] “*calculating a total quality value according to, or based on values QI1, QI2, QI3, QI4 and weights c1, c2, c3, c4 and previous values QI1,*

*QI2, QI3, QI4 and previous weights c1, c2, c3, c4
in the image stream ”*

126. It would have been obvious to a POSITA that the combination of Anon, Takeuchi, Aisaka, and Cheatle discloses calculating a total image quality value *according to, or based on* quality indicators that reflect aspects of image quality, using weighted values. Anon’s system describes motion sensors “that can provide the engine with inputs as to how the camera is moving.” EX1004, 10:26-35. The system evaluates “inputs that the engine has to work with includ[ing]...the lack of sharp edges that might indicate a lack of appropriate focus,” and “an indication of where in the image the subject is,” which can be affected by motion blur. *Id.*, 3:53-64. Takeuchi similarly discusses that “image information stored in the buffer 25 may be, evaluated as a characteristic amount of the defocus amount generated between frames of each block when segmenting the photographed images into a plurality of blocks.” EX1005, ¶ [0298]. Aisaka’s system uses deep learning algorithms for image analysis and detecting and scoring objects in an image, noting that “a subject map is generated through the extraction of pieces of information such as luminance, colors, edges, a face, and a motion from an input image.” EX1007, ¶¶ [0268]-[0270]. Cheatle’s system recognizes faces by comparing them to a pre-stored list of configured faces. EX1008, ¶¶ [0012] and [0042]. In their combination, the references teach calculating a total quality value based on QI1 (device motion), QI2 (exposure/focus/over-under exposure), QI3 (deep learning-based object/

characteristic recognition), and QI4 (a comparison of detected facial features to a pre-stored list (database) of configured faces).

127. Anon further discloses using *previous values* and *previous weights* in its calculation. Anon notes that to compute the composition value, its engine analyzes *previous* frames in a video. Anon states that “what is explained about a photographer using a camera to capture a photograph can equally apply, unless otherwise indicated, to a videographer using a video camera to capture a video sequence....” EX1004, 3:2-10. Anon specifically discloses that “the video camera might include a motion sensor that can provide the engine with inputs as to how the camera is moving ... it might be a preference when a subject is moving quickly in a scene to frame more of the scene in front of the subject than in back of the subject and this could be suggested by the engine to a videographer.” EX1004, 8:28-31, 10:27-35. In light of these disclosures, it would have been obvious to a POSITA that Anon teaches using *previous values* regarding previous images or frames in a video and similarly *previous weights* in its calculation of a total composition value. Anon further discusses aggregating image characteristics, both internal and external, such as motion, exposure, and content analysis, into one measure of image quality, as “a pleasing image is often not simply obtained by optimizing each characteristic”—instead, assessing a pleasing image accurately requires a system to “compute a composition measure...that depends from at least two of the plurality of

image-based characteristics.” EX1004, 1:50-55, 1:59-67. It would have been obvious to a POSITA that Anon’s image composition measure would have benefited from aggregating both current and previous image characteristics such that the resulting image quality assessment is more adaptive, context-sensitive, and accurate.

128. Additionally, Cheatle discusses *previous values* in comparing faces to a pre-stored list. EX1008, ¶¶ 12 and 42. Such a pre-stored list of faces, containing previous data (*i.e.*, *values*) about previous faces, is used in Cheatle’s analysis. *Id.* It would thus have been obvious to a POSITA that Cheatle uses previous values in calculating image quality, and by extension that the combination of references here would additionally use weights associated with those values.

129. The weights of each quality indicator in the combination would reflect importance, reliability, or contextual factors relating to each input, as Anon’s system discusses using “a weighted, combination of parameters” that “may be input into a fuzzy logic set, or the like, and an evaluation, e.g. weighted, combination of parameters may be performed by the composition and feedback engine.” EX1004, 8:15-35. Likewise, Aisaka states that “difference images obtained from pyramid images...are subjected to weighted addition with difference weights W_a to produce information maps, and these information maps are subjected to weighted addition with information weights W_b . Then, furthermore, the resulting images (maps) are multiplied by a subject weight W_c to produce a subject map.” EX1007, ¶ [0268].

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Each reference demonstrates flexibility in its approach such that the combination of the four inputs into one context-sensitive image quality value would have been natural.

130. A POSITA would have been motivated to combine Anon with Takeuchi, Aisaka, and Cheatle in *calculating a total quality value according to, or based on* various current and previous quality indicator values and weights, including those mapped above. Each reference discusses aspects of automated image evaluation using a variety of technical and aesthetic criteria, as discussed above. The combination of references would have been a straightforward and predictable enhancement, lacking any technical barriers. Further, a POSITA would have had a reasonable expectation of success, as each system emphasizes a multifactor weighted image analysis and has a modular framework.

- xi. [11.j] *“selecting by said processor at least one image from the plurality of images at least partly on said total quality value”*

131. Anon helps users manage large sets of images in its automatic identification of images with the highest total quality value. For example, in one embodiment “a user may direct the automatic selection of images to be placed within an album. Such selection may be based upon the above-described composition judging techniques.” EX1004, 10:8-20. Takeuchi discloses that its processor “evaluates the image information stored in the photographed image storage area of

the buffer 25 based on a characteristic amount which changes in a chronological sequence in the photographic frame when images of a plurality of frames are imaged,” and then “selects at least one image whose image evaluation points are equal to or greater than a predetermined threshold value, from among the plurality of images stored... and deletes from the buffer 25 the [other] images and their evaluation results.” EX1005, ¶¶ [0121] and [0157]. Both Anon and Takeuchi thus disclose *selecting by said processor at least one image from an image stream based on said total quality value*. A POSITA would have recognized that using a processor for this selection had benefits in light of each reference’s numerous quality metrics used to evaluate images.

132. A POSITA would have had a reasonable expectation of success in combining Anon with Takeuchi for this purpose, as each reference explicitly teaches automated composite image evaluation to select images. The combination would have been straightforward and predictable, as both references further provide architectures and algorithms for both calculating and applying image quality values to selections of images, and the system would be expected to function as intended.

2. Claim 14

133. Claim 14 depends from claim 11 and further recites “wherein at least one of said weights are defined at least partially over a time-dependent confidence

level defined over at least one of said values QI1, QI2, QI3, QI4.” This claim element is disclosed for the reasons discussed in Section VIII.A.5.

3. Claim 15

134. Claim 15 depends from claim 11 and further recites “where second value (QI2) is further based on an object recognition done for third value (QI3), where the object recognition can change importance of certain areas in the image for the purpose calculation of said second value (QI2): over or under exposure value.”

135. While Anon does not expressly teach this limitation, Takeuchi discusses object detection for calculating exposure levels. EX1005, ¶ [0137] (“carries out the exposure computation **taking into account the luminance of the main subject**”); *see also id.*, ¶¶ [0134]-[0136]. The most important part of the image is thus optimally exposed, and regional image weighting is dynamically adjusted based on objects in the scene. As noted above with respect to elements [1.c] and [1.e] (*see* Sections VIII.A.1.iv, VIII.A.1.vi), a POSITA would have been motivated to implement Takeuchi’s object detection system in Anon’s engine.

4. Claim 16

136. Claim 16 depends from claim 11 and further recites “wherein at least one of said values (QI1, QI2, QI3, QI4, total value) causes change of one of focus point, ISO or aperture of at least of lens module.”

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137. Anon describes the use of various inputs in its image quality estimation system, including geographic location, time of day, camera orientation, and image-based characteristics. *See, e.g.*, EX1004, 4:24-33. These inputs are used to automatically adjust or suggest to the user various changes to, *e.g.*, focus, aperture, and exposure. *Id.*, 2:29–36 (“the image capturing device will automatically make the change”); 1:42-49 (“most cameras can analyze an image and automatically focus the lens, so that that user is freed from having to estimate distances or manually set the focus” and “[m]ost cameras can also set the shutter speed appropriately for a given amount of light that is falling on the camera”); *see also id.*, 8:36-43, 2:29–36, 1:42-49. Anon’s engine thus may automatically change the focus point if a subject is detected, or similarly adjust ISO or aperture dynamically, as well as updating setting based on the same factors. *See id.*, 8:36-43, 2:29–36, 1:42-49.

138. Takeuchi similarly discloses such automatic correction, including to “exposure conditions such as the aperture value, shutter speed and the like, focus adjustment, and photographic sensitivity,” *i.e.*, values which, in my view, a POSITA would have found obvious to include the focus point, ISO, and aperture discussed in Anon. EX1005, ¶¶ [0281]-[0283] (describing “Self-Correction of Photographic Conditions” including “aperture,” “focus adjustment,” and “photographic sensitivity.”). A POSITA would have similarly recognized and found obvious that this automatic correction is more convenient for the user, as described in Anon.

EX1004, 1:42-49 (“so that the user is freed from having to estimate distances or manually set the focus”). I note that consumer cameras have long had such automatic adjustment optionality (including for focus, ISO, and aperture), and this is by no means new or unique, as discussed in Anon. EX1004, 1:42-49. A POSITA would have been motivated to combine the two references, such that Takeuchi’s automatic correction of focus is implemented in Anon’s camera system, and would have had a reasonable expectation of success. *See* Sections VIII.A.1.iv, VIII.A.1.vi.

5. Claim 17

139. Claim 17 depends from claim 11 and further recites “wherein the total value is a threshold, and the image is saved into a user persistent memory.”

140. Anon describes the weighing and combination of its parameters during calculation of an image composition value, stating “these parameters may be input into a fuzzy logic set, or the like, and an evaluation, e.g. weighted, combination of parameters may be performed by the composition and feedback engine.” EX1004, 8:32-35. Anon further describes how the ultimate combined value is compared to a threshold. *See* Section VIII.A.1.xii. Additional “post-processing” occurs based on this calculation, which is then saved in user persistent memory. EX1004, 10:1–25. It would have been obvious to a POSITA that a quality image is then saved in user persistent memory, as Anon’s invention allows a user to capture the image immediately following Anon’s output of a composition measure—which naturally

results in the image being saved in user persistent memory. *See* EX1004, 2:6–8, 3:10-12. Thus, the purpose of Anon is accomplished in only saving high quality images.

6. Claim 20

141. Claim 20 depends from claim 11 and further recites “the first value (QI1) is based on image stabilization-sensor shift, lens stabilization, gyroscope, accelerometer, Global Positioning System (GPS), 9 Degrees of Freedom (DOF) sensing component or 10 Degrees of Freedom (DOF) sensing component.”

142. Anon discloses using GPS as a quality indicator, by which the camera may obtain a location-responsive value: “Camera-specific external inputs might include the camera's current geographic location, time of day, orientation and the like. These external inputs might actually be provided by circuits and/or sensors inside the camera (such as an internal real-time clock) or in combination with other systems (such as a GPS receiver that receives GPS satellite signals in order to determine a location of the camera).” EX1004, 4:24-33. Anon’s system may thus give feedback based on the GPS coordinates: “if the engine is aware of the camera location and has access to a data set of rules (e.g., 'when located at the GPS coordinates of the front of Cinderella's Castle™ in Disneyland, suggest centering on the castle rather than rule of thirds').” *Id.*, 5:3-7. Anon thus obtains a *first value* based on *GPS* which is used in the image evaluation.

**C. Ground 1C: Claim 5 is Obvious in View of Anon, Takeuchi,
Kosaka, Jasinski, Aisaka, Garcia-Molina, and Cheatle**

1. Claim 5

143. Claim 5 depends from claim 1 and further recites “wherein third value (c3) is estimated according to, or based on, the recognition value of at least one of said faces as a known face or unknown face, based on a pre-stored list of configured faces.” Anon discloses facial recognition, but does not explicitly disclose it *based on a pre-stored list of configured faces*. See *supra* in Section VIII.A.1.vi. Cheatle discusses how facial recognition techniques, such as those discussed in *supra* Section VIII.A.1.vi, may be implemented, such as “analysis tests” that are “customized to deal with faces,” wherein “images where the face is known to the user might be preferred.” EX1008, ¶ [0042]. Cheatle further notes the technique may be implemented to “keep[] a database of facial features [so] a comparison could be made with the subject area of the captured key frame.” *Id.* Cheatle’s system further discloses that “the quality factor might be determined according to recognition of facial subject area(s) of interest, the composition quality increasing if there is a facial subject area in the image which is identified as being present in a database of previously-stored facial features” and “[b]y keeping a database of facial features, a comparison could be made with the subject area of the captured key frame 15.” EX1008, ¶¶ [0012] and [0042].

144. A POSITA would have been motivated to combine Anon with Cheatle, as discussed above in Section VIII.B.1.viii.

D. Ground 1D: Claim 6 is Obvious in View of Anon, Takeuchi, Kosaka, Jasinski, Aisaka, Garcia-Molina, and Ramesh

1. Claim 6

145. Claim 6 depends from claim 1 and further recites “wherein the third weight (c3) is estimated according to, or based on, the estimated error in the analyzing the captured image for detecting or recognizing objects in the image.”

146. Anon does not explicitly disclose this claim. Ramesh’s system uses a “weighted sum of partial evidences” and “online uncertainty estimation” to evaluate the number of objects in a scene, and ensures that guesses with higher error estimates “are weighted less.” EX1009, ¶¶ [0034], [0025], and [0030]. Moreover, Anon describes using varying inputs that would benefit from Ramesh’s probabilistic approach, given the presence of noise and ambiguity in the image. This would allow for estimating error for a value, such as a standard deviation and confidence interval, which would allow Anon to adjust weights of unreliable values accordingly.

147. Various of Anon’s features can have ambiguous or changing conditions such that they would benefit from a probability estimation. *See, e.g.*, EX1004, 10:47-50 (“what characteristics are used to determine what is a ‘good’ image are very flexible and can be enhanced or changed completely over time.”). A POSITA would have found this obvious and would have understood Anon’s

composition engine to be naturally improvable using Ramesh’s probability estimations. This approach would allow Anon’s calculations to define and deal with error, a natural and necessary part of such calculations, as well as standard deviations and confidence intervals. All these estimations would improve the reliability of Anon’s system and its ability to adaptively adjust weights (*e.g.*, by weighing less-certain inputs lower), which is one of its features as noted above. *See* Section VIII.A.4. A POSITA would thus have found it obvious that Anon and Ramesh in combination would have a more accurate estimation of image quality than Anon alone. This combination would have been the application of a known technique—Ramesh’s probabilistic approach and weighing uncertain parameters lower—to a known device ready for improvement to yield predictable results.

E. Ground 1E: Claim 12 is Obvious in View of Anon, Takeuchi, Aisaka, Jasinski, Cheatle, and Alhadeh

1. Claim 12

148. Claim 12 depends from claim 11 and further recites “wherein the first weight (c1) is estimated according to, or based on, a precision error, reading resolution, or drift in time, of the motion or location sensor, and wherein the motion or location sensor consists of, or comprises, an accelerometer, a gyroscope, a Global Positioning System (GPS), or a step counter.”

149. Anon does not explicitly disclose this claim. Alhadeh, however does account for *precision error, reading resolution, or drift in time, of the motion or*

location sensor, including accelerometers, gyroscopes, and GPS. Alhadeef discusses addressing sensor inaccuracies, including drift in time. EX1011, 10:35-44. Alhadeef further describes using GPS and additional sensors to improve measurement accuracy, as well as “predictive modeling... based upon the use of so-called ‘Kalman’ filters” as it relates to sensor drift. *Id.*, 9:35-39, 11:4-6. The error characteristics described in Alhadeef thus weigh how each sensor factors into a position estimation, and in doing so describes the altering of the *first weight* according to the factors listed.

150. A POSITA would have found it obvious to modify the Anon-Takeuchi-Aisaka-Jasinski-Cheatle system in view of Alhadeef to incorporate a first weight (c1) estimated according to, or based on, the precision error, reading resolution, or drift in time of a motion or location sensor, as Alhadeef describes the need for such compensation in the determination of camera position and orientation. *Id.*, 9:35-39, 11:4-6. A POSITA would further have found it obvious that such error metrics would make the combination more reliable, including because Anon and Takeuchi describe using sensor data in evaluating image composition. A POSITA would have had a reasonable expectation of success in implementing this modification, given that such error compensation was already common and well detailed in Alhadeef, and would have simply required weighing more reliable and accurate readings higher.

F. Ground 1F: Claim 13 is Obvious in View of Anon, Takeuchi, Aisaka, Jasinski, Cheatle, and Ramesh

1. Claim 13

151. Claim 13 depends from claim 11 and further recites “wherein at least one of said weights is estimated according to, or based on, the estimated error in the analyzing the captured image for detecting or recognizing objects in the image.”

152. Anon does not expressly disclose this claim; however, Ramesh discloses the use of a computer vision system that uses a probabilistic framework to track multiple objects such as people. EX1009, Abstract, Fig. 1, ¶ [0039]. Ramesh uses a “weighted sum of partial evidences” for its estimation of people in a crowd, and an “online uncertainty estimation” such that “less certain guesses”—with a higher estimated error—“are weighted less.” *Id.*, ¶¶ [0034], [0025], and [0030].

153. A POSITA would have been motivated to combine Anon’s system with Ramesh and would have had a reasonable expectation of success, for the reasons described in Section VIII.D.1.

G. Ground 1G: Claim 18 is Obvious in View of Anon, Takeuchi, Aisaka, Jasiniski, Cheatle, and Garcia-Molina

1. Claim 18

154. Claim 18 depends from claim 11 and further recites “to select, based on values QI1, QI2, QI3, QI4 and weights c1, c2, c3, c4, at least one appropriate suggestion from a pre-stored table of suggestions of how a user of the system may

cause at least on[e of] the value[s] to be above or below a threshold and to present said appropriate suggestion to the user.”

155. It would have been obvious to a POSITA that the combination of Anon, Takeuchi, Aisaka and Cheatle describes using a pre-stored table of suggestions to improve image quality. Anon, for example, notes that it relies on various pre-defined rules and criteria to analyze an image, including in the form of a “rule set.” EX1004, 7:15-29. It then uses these rules to generate suggestions for a user based on image composition. *See, e.g.*, EX1004, 5:53-6:8, 6:42-7:14. To the extent that Anon does not disclose a *pre-stored table*, a POSITA would have been motivated to use a pre-stored table of suggestions in view of Anon, Takeuchi, Aisaka and Cheatle. A POSITA would have known that using a pre-stored table of suggestions is efficient and consistent, as such an approach is both streamlined and allows for context-dependent feedback. It is also well established in the art. *See* EX1015 (disclosing use of decision tables and GUI strings). Indeed, as noted above in Section **Error! Reference source not found.**, algorithmic systems can and do incorporate personal and contextual factors, and such systems were state-of-the-art in the field during the relevant time period. *See* EX1016, Abstract, 2, 6-8. Anon further discloses the use of textual suggestions which “might be presented in a viewfinder display” to a user. EX1004, 3:53-57, 6:4-8. Any specific suggestions would thus be a matter of design choice.

156. Combining Anon with Takeuchi, Aisaka and Cheatle would result in a system that takes as inputs various image parameters, then compares them to known thresholds and generates feedback for the user to improve image quality. A POSITA would therefore have selected appropriate suggestion(s) from a pre-stored table to present to the user. To start, Takeuchi evaluates images with various methods, including assigning scores, and offers suggestions to the user. *See, e.g.*, EX1005, ¶¶ [0290]–[0295], Fig. 25. Anon, meanwhile describes offering suggestions to a user based on image quality that is calculated using various inputs of the kind described in each of the other references. *See* EX1004, 5:25-51. I note again that Anon describes the use of “rule sets” and “lookup data” for its suggestions. EX1004, 7:15-29.

157. In short, the combined system would respond to a value’s deviation across a threshold, then consult a pre-stored table to generate a suggestion for the user. A POSITA would have found this an obvious, predictable, and modular approach, would have agreed that this approach is widely used in the art, and would have implemented it in this combination with a reasonable expectation of success. *See* EX1015, ¶ [0018].

H. Ground 1H: Claim 19 is Obvious in View of Anon, Takeuchi,

Aisaka, Jasinski, Cheatle, and Staudacher

1. Claim 19

158. Claim 19 depends from claim 11 and further recites “where fo[u]rth value (QI4) or fo[u]rth weight (c4) can be a combination of multiple face quality or weights and based on the percentage of faces above with individual value above some threshold.”

159. Anon does not explicitly disclose this claim element. Staudacher describes combining multiple face quality or weights to form a single value or weight, and that this may be based on the percentage of faces with values over a threshold: “[t]he pose metric calculator 18 can combine the results from such separately analyzed metrics to derive the value of the pose metric signal MET. The pose metric calculator 18 can combine such results, for example, in either equal contributions or individually weighted contributions.” EX1012, ¶¶ [0010] and [0020] (“For instance, weights can be established to place more emphasis on motion of subjects than on the subjects facing the camera, and to place more emphasis on facing the camera than on smiling. but may still require the subjects to face towards the camera”). Staudacher further notes that “[w]hen a scene contains multiple subjects, the pose analyzer can generate the value of the pose metric signal MET according to a percentage of the multiple subjects that satisfy each of the pose metrics 16” and “the value of the pose metric signal MET can vary based on the

number of subjects that satisfy the one or more pose characteristics 16.” *Id.*, ¶ [0022]. It would have been obvious to a POSITA that the overall value or weight would thus be based on several face quality metrics combined, and on a proportion of faces that meet a criteria (threshold).

160. A POSITA would have been motivated to combine Anon with Staudacher. Both references discuss evaluating image quality or composition by aggregating inputs such as those related to faces, and combining and weighting these inputs for a final evaluation, with Staudacher further disclosing this being based on the percentage of faces meeting a threshold. As Anon states, “[o]ther inputs might include an indication of where in the image the subject is (e.g., find faces and draw a rectangle around the most prominent face in the image.” EX1004, 3:62-64. A POSITA would therefore have a clear motivation to combine the references. A POSITA would further have a reasonable expectation of success in this combination. Anon’s system has a modular framework and is designed to weight various measures, such as Staudacher’s, and Staudacher’s method of weighting would provide further color to Anon’s teachings. The combination would be straightforward and predictable.

IX. SECONDARY CONSIDERATIONS

161. I am not aware of any evidence of secondary considerations that have a nexus to the claimed inventions that would overcome the demonstration of

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obviousness of the claims of the '325 patent in light of the combinations of prior art
discussed above, given the volume of independent and simultaneously developed
inventions, but I reserve the right to respond to any such secondary considerations
of non-obviousness put forth by Patent Owner.

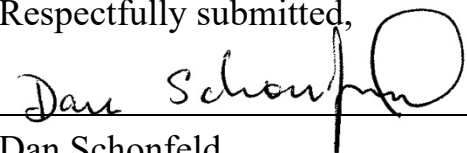
X. CONCLUSION

162. For the reasons set forth above, it is my opinion that every claim of the
'325 patent is invalid.

163. I hereby declare under penalty of perjury under the laws of the United
States of America that the foregoing is true and correct, and that all statements made
of my own knowledge are true and that all statements made on information and belief
are believed to be true. I understand that willful false statements are punishable by
fine or imprisonment or both. *See* 18 U.S.C. §1001.

Dated: September 5, 2025

Respectfully submitted,



Dan Schonfeld