APPENDIX A

Claims 1-20 of U.S. Patent No. 11,129,591 ("the '591 patent") are invalid in view of US2005/0251013 ("Krishnan") (published November 10, 2005), WO2016/189313 ("Paterson") (published December 1, 2016, claiming priority to May 28, 2015), US2016/0247034 ("Lee") (published August 25, 2016, and filed on February 22, 2016), US2017/0262982 ("Pagoulatos") (published September 14, 2017, claiming priority to March 9, 2016), and "Automatic Fetal Ultrasound Standard Plane Detection Using Knowledge Transferred Recurrent Neural Networks" ("Chen") (published online 18 November 2015), alone and/or in combination with each other and/or the knowledge of a person of ordinary skill in the art ("POSITA"), as set forth in the chart below and explained in Defendants' Amended Invalidity Contentions and IPR2025-01066.

Parenthetical quotations provided herein are for emphasis and should not be interpreted as limiting the broader citations to Figures, paragraphs, or lines.

	US 11,129,591 Claim Language	Exemplary Citations to Disclosures of the Claim Element in the Prior Art
[1pre]	A computer- implemented system for facilitating echocardiographic image analysis, the system comprising at least one processor configured to:	Krishnan: Abstract ("Systems and methods are provided for processing a medical image to automatically identify the anatomy and view (or pose) from the medical image and automatically assess the diagnostic quality of the medical image."), [0005], [0009] ("For imaging modalities, such as ultrasound imaging (e.g., 2-D echocardiography) for heart imaging, a sonographer has very limited time to acquire images during a stress stage. By providing a real-time quality assessment of the image acquisition, the sonographer can determine whether the acquired images are of sufficient diagnostic quality, thereby allowing for changes in image acquisition, if necessary."), Fig. 1 (10, 101), [0045] ("It is to be understood that the systems and methods described herein in accordance with the present invention may be implemented in various forms of hardware, software, firmware, special purpose processors, or a combination thereof.")

		Lee: Abstract ("An electronic device that includes an image quality measuring function and an operation method thereof are disclosed."), [0038] ("[T]he electronic device may include at least one of various medical devices (e.g., … an ultrasonic machine).") Paterson: Abstract, Fig. 1, p.1, ln. 4-7 ("[T]he present invention relates to systems and methods which provide feedback regarding the acquisition of each of a series of required images during an imaging procedure and/or to the quality of the acquired images."), p.8, ln. 30-31 ("For example, a number of different anatomical views of the heart may be defined in the imaging protocol."), p. 6, ln. 30 – p. 7, ln. 2 ("The system 10 comprises an image acquisition component 20, image assessment component 22 and a feedback delivery component 24 which operate on a computer processor 26.") Pagoulatos: Abstract, Fig. 1, [0007] ("The ultrasound image recognition module is configured to receive the acquired ultrasound images from the ultrasound imaging device and to determine whether the received ultrasound images represent a clinically desirable view of an organ or other body feature."), [0036] ("The ultrasound image recognition module 120 may include, or otherwise be executed by, a computer processor configured to perform the various functions and operations described herein."), [0035] ("[T]he image knowledge database 122 may include information associated with clinically standard or desirable views of a heart. The clinically standard views of a heart may include, for example, suprasternal, subcostal, short- and long-axis parasternal, 2-chamber apical, 3-chamber apical, 4-chamber apical and 5-chamber apical views.")
[1a]	receive signals representing a first at least one echocardiographic image;	Krishnan: Fig. 1 ("Medical Image Data 10"), Fig. 2 ("Obtain Medical Image Dataset"), [0009], [0016] ("FIG. 1 illustrates a high-level block diagram of a system (100) for providing automated decision support for medical imaging, according to an exemplary embodiment of the invention. In general, the exemplary system (100) comprises a data processing module (101) that implements various methods for analyzing medical image data (10) in one or more imaging modalities (e.g., ultrasound image data, MRI data, nuclear medicine data, etc.) to automatically extract and process relevant information from the medical image data to provide various decision support function(s) for evaluating the medical images."), [0017] ("The system (100) can

		process digital image data (10) in the form of raw image data, 2D-reconstructed data (e.g., axial slices), or 3D-reconstructed data (volumetric image data or multiplanar reformats), 4D-reconstructed data, or other image modalities/formats.”), [0032] (“For example, with 2-D echocardiography ….”) (“loops of data for each view, where each loop represents a heart cycle”), [0033] (“Initially, a physician, clinician, radiologist, etc., will obtain a medical image dataset comprising one or more medical images of a region of interest of a subject patient (step 200).”) (“The digital image data (10) may comprise one or more 2D slices or three-dimensional volumetric images, which are reconstructed from the raw image data and persistently stored…. Image data can be 2D (e.g. X-ray Mammography images), 3D (e.g. CT, MRI, PET), 4D (Dynamic 3D MRI, multiple views of a beating heart acquired with a 3D Ultrasound probe), etc.”), Claims 24-26 Lee: Abstract (“An electronic device that includes an image quality measuring function and an operation method thereof are disclosed.”), [0038] (“[T]he electronic device may include at least one of various medical devices (e.g., … an ultrasonic machine).”), [0009] (“[A]n electronic device is provided, including: a memory that stores a plurality of images and a plurality of classifiers; and a processor that is electrically connected with the memory, wherein the processor is configured to: analyze a category of an image of which an image quality evaluation is requested.”), [0011] (“[A] method of measuring the quality of an image is provided, the method including: obtaining an image.”), [0150] (“The image managing module 510 may obtain an image photographed through the camera module 470, an image stored in the memory 450, or an image received from an external device (e.g., another electronic device or a server).”), Fig. 5 (“Image Managing Module 510”), Fig. 6 (“Obtain Image 601”), [0174]-[0175] (“Referring to FIG. 6, in operation 601, the controller 480 is configured to obtain an image. For example the controller 480 (e.g., the image managing module 510) may obtain an image photographed using the camera module 470, an image stored in the memory 450, an image received from an external device (e.g., another electronic device or a server), or the like, in response to a user's request.”) Paterson: Fig. 2 (“User controls ultrasound machine, positions probe to acquire protocol view 100”), p.3, ln. 9-17 (“The system incorporates a protocol database

		comprising at least one imaging protocol which defines one or more images to be acquired by an imaging machine, such as an ultrasound, … during an imaging procedure. The definition of the one or more images to be acquired may include, for example, … a particular view of the object to be imaged.”), p.3, ln. 26- p.4, ln. 4 (“The system comprises an image acquisition component which is configured to determine when an image has been acquired by the imaging machine. It will be understood that images acquired during an imaging procedure can be single frames or can be image sequences (videos).”), p.8, ln. 30-31 (“For example, a number of different anatomical views of the heart may be defined in the imaging protocol.”) Pagoulatos: Fig. 1 (“Ultrasound Imaging Device 110”) (“Image 101”), [0007] (“The ultrasound image recognition module is configured to receive the acquired ultrasound images from the ultrasound imaging device and to determine whether the received ultrasound images represent a clinically desirable view of an organ or other body feature.”), [0054] (“Using the ultrasound imaging device 110, a user may select (e.g., via the input elements 412 and/or display 112) or otherwise input a desired view of an organ that is to be imaged in a patient. For example, a user may select one view (e.g., a subcostal view of a heart) from among a plurality of clinically desirable views that are stored in the ultrasound imaging device 110 and presented to the user. The ultrasound imaging device 110 may communicate the selected view to the ultrasound image recognition module 120, and the ultrasound image recognition module 120 may thus be configured to determine whether received ultrasound images represent the selected view.”)
[1b]	associate the first at least one echocardiographic image with a first view category of a plurality of predetermined echocardiographic image view categories;	Krishnan: Fig. 1 (“Automatic View Identification 104”), Fig. 2 (“Perform Automatic … View Identification 202”) (“Label/Characterize Image Dataset Based on Processing Results 203”), [0019] (“The view identification module (103) [sic] implements methods for using the extracted features/parameters to automatically identify the view of an acquired image. In other words, the view identification module (104) implements methods for pose estimation and label a medical image with respect to what view of the anatomy the medical image contains. By way of example, for cardiac ultrasound imaging, the American Society of Echocardiography (ASE) recommends using standard ultrasound views in B-mode to obtain sufficient cardiac image data—the

		apical two-chamber view (A2C), the apical four-chamber view (A4C), the apical long axis view (ALAX), the parasternal long axis view (PLAX), the parasternal short axis view (PSAX). Ultrasound images of the heart can be taken from various angles, but efficient analysis of cardiac ultrasound images requires recognizing the position of the imaged heart (view) to enable identification of important cardiac structures. In accordance with an exemplary embodiment of the invention, view identification module (103) [sic] implements methods for identifying an unknown cardiac image as one of the standard views.”), [0036] (“The image dataset will be labeled or otherwise classified based on the processing results obtained (step 203). For instance, for anatomy and view identification, a medical image will be labeled with the appropriate anatomy and view identification.”), Claims 24-26 Lee: Abstract, [0009], [0011], [0151] (“The category classifying module 520 may classify an image scene category of the image based on at least some of the image or the image information transferred from the image managing module 510. For example, the category classifying module 520 may classify the category of the image by analyzing a type of scene that the image corresponds to, for example, mountain, ocean, sky, beach, streets, night view, or the like. According to an example embodiment of the present disclosure, the category classifying module 520 may define a type of scene (e.g., a category or a class) of an image through an image classifying method that classifies an image by quantizing feature vectors of an image or an image classifying method that classifies an image using deep learning…. The image classifying method using deep learning may define a class of an image by attempting, for example, a high level abstraction (which abstracts main contents or functions from a large amount of data or complex materials) through the combination of various non-linear conversion schemes.”), [0168], Fig. 5 (“Category Classifying Module 520”), Fig. 6 (“Classify Image Scene Category of Image 603”), [0176] (“[T]he controller 480 (e.g., the category classifying module 520) may be configured to analyze an image scene that the obtained image corresponds to, for example, mountain, ocean, sky, beach, streets, night view, or the like, and may be configured to classify the category of the image based on a result of the analysis.”)

		Paterson: Fig. 3 (“Image view content determined 210”), p.4, ln. 9-25 (“The image assessment component then determines a feedback response, for example the confirmation that at least one image required in the imaging protocol has been acquired.”) p.7, ln. 22-27 (“The image assessment component 22 then assesses, at step 106, the type and quality of the image using automatic image recognition methods; and, at step 108, determines whether the image meets the image characteristics defined in the imaging protocol which determines a feedback response. The automatic image recognition methods firstly determine which protocol view the image belongs to and secondly determines quality aspects of the image.”), p.8, ln. 30-31 (“For example, a number of different anatomical views of the heart may be defined in the imaging protocol.”) Pagoulatos: [0007] (“To assist the system in determining whether a clinically desirable view has been captured, the user may identify, before or during the image capture process, the particular image perspective or view the user desires to capture, which input the system then can use to assist in identifying whether the desired view in fact has been captured.”), [0054] (“Using the ultrasound imaging device 110, a user may select (e.g., via the input elements 412 and/or display 112) or otherwise input a desired view of an organ that is to be imaged in a patient. For example, a user may select one view (e.g., a subcostal view of a heart) from among a plurality of clinically desirable views that are stored in the ultrasound imaging device 110 and presented to the user. The ultrasound imaging device 110 may communicate the selected view to the ultrasound image recognition module 120, and the ultrasound image recognition module 120 may thus be configured to determine whether received ultrasound images represent the selected view.”), Fig. 5 (“Determining, by the ultrasound image recognition module, whether the acquired ultrasound images represent a clinically desirable view of an organ 506”)
[1c]	determine, based on the first at least one echocardiographic image and the first view category, a first quality assessment value representing a	Krishnan: Fig. 1 (“Automatic Quality Assessment 105”), [0006] (“[A]utomated anatomy identification, view identification and/or image quality assessment are performed using associated classifiers that process the extracted feature data.”), [0009], [0019] (“Ultrasound images of the heart can be taken from various angles, but efficient analysis of cardiac ultrasound images requires recognizing the position of the imaged

	view category specific quality assessment of the first at least one echocardiographic image;	heart (view) to enable identification of important cardiac structures. In accordance with an exemplary embodiment of the invention, view identification module (103) [sic] implements methods for identifying an unknown cardiac image as one of the standard views."), [0020] ("The quality assessment module (105) implements methods for using the extracted features/parameters to assess a level of diagnostic quality of an acquired image data set and determine whether errors occurred in the image acquisition process. In other exemplary embodiments of the invention, the results of anatomy and/or view identification may be used for quality assessment. Moreover, methods can be implemented for providing real-time feedback during image acquisition regarding the diagnostic quality of the acquired images, allowing for changes in the image acquisition. In addition, methods can be implemented for determining a quality measure within a predefined range of values to provide an indication as the quality level of the acquired images based on some specified criteria."), [0029] ("The results of anatomy identification and/or view identification can be used to perform automatic image quality assessment process according to an exemplary embodiment of the invention."), [0032], [0036] ("[F]or image quality assessment, the medical images may include a quality score (within a predefined range) that provides an indication a diagnostic quality level of the medical images."), [0042]-[0043], Claims 24-27 Lee: Abstract, [0009], [0011], [0096] ("[A]n electronic device may classify an image based on an image scene category (e.g., mountain, ocean, sky, beach, streets, night view, or the like) when measuring the quality of the image, and may determine an image scene classifier corresponding to the corresponding image scene category. According to various example embodiments of the present disclosure, the image quality may be determined by applying, to the image, a different weight based on the determined image scene classifier."), [0153] ("[T]he classifier selecting module 530 may change an image quality classifier to correspond to an image scene category, and thereby changing a perspective of measurement. For example, the classifier selecting module 530 may select and provide an image quality classifier that is appropriate for a night view image in a case of a night view image, and may select and provide an image quality classifier that is appropriate for a sky (cloud) image."), [0160] ("The image quality evaluating module 550 (e.g., a total image quality evaluator) may extract a total image quality score with respect to the image using the image quality factor scores

		transferred from the image factor extracting module 540 and the image quality classifier transferred from the classifier selecting module 530.”), Fig. 5 (“Image Quality Evaluating Module 550”), Fig. 6 (“Determine Image Quality Score Using Image Quality Factor Scores and Classifier 609”), [0181] Paterson: Fig. 2 (106), Fig. 3 (“Image view content determined, quality of image determined 210”), p.4, ln. 9-25, p.7, ln. 22-27 (“The image assessment component 22 then assesses, at step 106, the type and quality of the image using automatic image recognition methods; and, at step 108, determines whether the image meets the image characteristics defined in the imaging protocol which determines a feedback response. The automatic image recognition methods firstly determine which protocol view the image belongs to and secondly determines quality aspects of the image.”), p.8, ln. 30-31 (“For example, a number of different anatomical views of the heart may be defined in the imaging protocol.”), p.9, ln. 13 (“A continuous scale of quality may also be used.”) Pagoulatos: [0054] (“[A] user may select … or otherwise input a desired view of an organ that is to be imaged in a patient. For example, a user may select one view (e.g., a subcostal view of a heart) from among a plurality of clinically desirable views that are stored in the ultrasound imaging device 110 and presented to the user. The ultrasound imaging device 110 may communicate the selected view to the ultrasound image recognition module 120, and the ultrasound image recognition module 120 may thus be configured to determine whether received ultrasound images represent the selected view. That is, the ultrasound image recognition module 120 may access the appropriate ultrasound image knowledge (e.g., knowledge, rules or relations associated with a subcostal view of a heart) in the image knowledge database 122 such that received ultrasound images may be compared with, or processed by, knowledge corresponding to the selected view.”), [0060] (“In embodiments where a feedback signal 103 indicates that the received ultrasound images are sequentially approaching or moving away from the clinically desirable view of the organ, the ultrasound imaging device 110 may communicate this to the user, for example, by providing a changing feedback effect, such as … illuminating a different color or position of lights as the received ultrasound image are approaches [sic] or moving away from the clinically desired view (e.g.,

		illuminating red outer lights 420 c, then yellow intermediate lights 420 b, then green center light 420 a as the received ultrasound images approach the clinically desired view).
[1d]	produce signals representing the first quality assessment value for causing the first quality assessment value to be associated with the first at least one echocardiographic image;	Krishnan: [0020] ("The quality assessment module (105) implements methods for using the extracted features/parameters to assess a level of diagnostic quality of an acquired image data set and determine whether errors occurred in the image acquisition process…. Moreover, methods can be implemented for providing real-time feedback during image acquisition regarding the diagnostic quality of the acquired images, allowing for changes in the image acquisition. In addition, methods can be implemented for determining a quality measure within a predefined range of values to provide an indication as the quality level of the acquired images based on some specified criteria."), [0032] ("In addition to searching for problems, the automatic image quality assessment can be implemented to provide general feedback on the diagnostic quality of an image. For example, with 2-D echocardiography, particularly stress-echo, the sonographer has very limited time to acquire images during a stress stage. It is important for the sonographer to acquire, as quickly as possible, diagnostic quality images at multiple views. Many times, because of the time pressure of a stress-echo, diagnostic quality images are not obtained, and the images are useless. By providing a quality check, the sonographer can be assured that images are being acquired of diagnostic quality. The advantage of doing such a quality check is that feedback can be provided back to the operator of the imaging device in real time, allowing for changes in acquisition."), [0036] ("The image dataset will be labeled or otherwise classified based on the processing results obtained (step 203)…. [F]or image quality assessment, the medical images may include a quality score (within a predefined range) that provides an indication a diagnostic quality level of the medical images."), Fig. 2 (203), Claims 24-30 Lee: Fig. 5 ("Total Image Quality Score"), Fig. 6, [0182] ("In operation 611, the controller 480 determines and provides the quality of the image based on the image quality scores.")

		Paterson: P.5, ln. 19-21 ("Preferably, the feedback comprises an indication of the quality of acquired images, for example by the display of an indicator providing feedback on the acquired image quality."), p.9, ln. 13 ("A continuous scale of quality may also be used.")
[1e]	receive signals representing a second at least one echocardiographic image;	Krishnan: Fig. 1 ("Medical Image Data 10"), Fig. 2 ("Obtain Medical Image Dataset"), [0009], [0016] ("FIG. 1 illustrates a high-level block diagram of a system (100) for providing automated decision support for medical imaging, according to an exemplary embodiment of the invention. In general, the exemplary system (100) comprises a data processing module (101) that implements various methods for analyzing medical image data (10) in one or more imaging modalities (e.g., ultrasound image data, MRI data, nuclear medicine data, etc.) to automatically extract and process relevant information from the medical image data to provide various decision support function(s) for evaluating the medical images."), [0017] ("The system (100) can process digital image data (10) in the form of raw image data, 2D-reconstructed data (e.g., axial slices), or 3D-reconstructed data (volumetric image data or multiplanar reformats), 4D-reconstructed data, or other image modalities/formats."), [0032] ("For example, with 2-D echocardiography …."), [0033] ("Initially, a physician, clinician, radiologist, etc., will obtain a medical image dataset comprising one or more medical images of a region of interest of a subject patient (step 200).") ("The digital image data (10) may comprise one or more 2D slices or three-dimensional volumetric images, which are reconstructed from the raw image data and persistently stored…. Image data can be 2D (e.g. X-ray Mammography images), 3D (e.g. CT, MRI, PET), 4D (Dynamic 3D MRI, multiple views of a beating heart acquired with a 3D Ultrasound probe), etc."), [0028] ("Further, automated view identification methods according to the invention could provide significant workflow enhancement for medical imaging applications, such as 2-D echocardiography, and specifically stress-echo. In stress-echo, the sonographer has a very limited time (90 seconds or so for exercise stress) to acquire images from four different views. To save time, the sonographer often just records for a significant portion of the 90 seconds, and then proceed to label the views after imaging is done. This is a cumbersome process, and could be improved by automatically identifying the views."), [0032] ("In addition to searching for problems, the automatic image quality assessment can be implemented to provide general

		feedback on the diagnostic quality of an image. For example, with 2-D echocardiography, particularly stress-echo, the sonographer has very limited time to acquire images during a stress stage. It is important for the sonographer to acquire, as quickly as possible, diagnostic quality images at multiple views. Many times, because of the time pressure of a stress-echo, diagnostic quality images are not obtained, and the images are useless. By providing a quality check, the sonographer can be assured that images are being acquired of diagnostic quality. The advantage of doing such a quality check is that feedback can be provided back to the operator of the imaging device in real time, allowing for changes in acquisition."), Claims 24-26 Lee: Abstract ("An electronic device that includes an image quality measuring function and an operation method thereof are disclosed."), [0038] ("[T]he electronic device may include at least one of various medical devices (e.g., … an ultrasonic machine)."), [0009] ("[A]n electronic device is provided, including: a memory that stores a plurality of images and a plurality of classifiers; and a processor that is electrically connected with the memory, wherein the processor is configured to: analyze a category of an image of which an image quality evaluation is requested."), [0011] ("[A] method of measuring the quality of an image is provided, the method including: obtaining an image."), [0150] ("The image managing module 510 may obtain an image photographed through the camera module 470, an image stored in the memory 450, or an image received from an external device (e.g., another electronic device or a server)."), Fig. 5 (Image Managing Module 510"), Fig. 6 ("Obtain Image 601"), [0174]-[0175] ("Referring to FIG. 6, in operation 601, the controller 480 is configured to obtain an image. For example the controller 480 (e.g., the image managing module 510) may obtain an image photographed using the camera module 470, an image stored in the memory 450, an image received from an external device (e.g., another electronic device or a server), or the like, in response to a user's request.") Paterson: Fig. 2 ("User controls ultrasound machine, positions probe to acquire protocol view 100"), p.3, ln. 9-17 ("The system incorporates a protocol database comprising at least one imaging protocol which defines one or more images to be acquired by an imaging machine, such as an ultrasound, … during an imaging procedure. The definition of the one or more images to be acquired may include, for

		example, … a particular view of the object to be imaged.”), p.3, ln. 26- p.4, ln. 4 (“The system comprises an image acquisition component which is configured to determine when an image has been acquired by the imaging machine. It will be understood that images acquired during an imaging procedure can be single frames or can be image sequences (videos).”), p.8, ln. 30-31 (“For example, a number of different anatomical views of the heart may be defined in the imaging protocol.”) Pagoulatos: Fig. 1 (“Ultrasound Imaging Device 110”) (“Image 101”), [0007] (“The ultrasound image recognition module is configured to receive the acquired ultrasound images from the ultrasound imaging device and to determine whether the received ultrasound images represent a clinically desirable view of an organ or other body feature.”), [0054] (“Using the ultrasound imaging device 110, a user may select (e.g., via the input elements 412 and/or display 112) or otherwise input a desired view of an organ that is to be imaged in a patient. For example, a user may select one view (e.g., a subcostal view of a heart) from among a plurality of clinically desirable views that are stored in the ultrasound imaging device 110 and presented to the user. The ultrasound imaging device 110 may communicate the selected view to the ultrasound image recognition module 120, and the ultrasound image recognition module 120 may thus be configured to determine whether received ultrasound images represent the selected view.”)
[1f]	associate the second at least one echocardiographic image with a second view category of the plurality of predetermined echocardiographic image view categories, said second view category being different from the first view category;	Krishnan: Fig. 1 (“Automatic View Identification 104”), Fig. 2 (“Perform Automatic … View Identification 202”) (“Label/Characterize Image Dataset Based on Processing Results 203”), [0019] (“The view identification module (103) [sic] implements methods for using the extracted features/parameters to automatically identify the view of an acquired image. In other words, the view identification module (104) implements methods for pose estimation and label a medical image with respect to what view of the anatomy the medical image contains. By way of example, for cardiac ultrasound imaging, the American Society of Echocardiography (ASE) recommends using standard ultrasound views in B-mode to obtain sufficient cardiac image data—the apical two-chamber view (A2C), the apical four-chamber view (A4C), the apical long axis view (ALAX), the parasternal long axis view (PLAX), the parasternal short axis

		view (PSAX). Ultrasound images of the heart can be taken from various angles, but efficient analysis of cardiac ultrasound images requires recognizing the position of the imaged heart (view) to enable identification of important cardiac structures. In accordance with an exemplary embodiment of the invention, view identification module (103) [sic] implements methods for identifying an unknown cardiac image as one of the standard views.”), [0036] (“The image dataset will be labeled or otherwise classified based on the processing results obtained (step 203). For instance, for anatomy and view identification, a medical image will be labeled with the appropriate anatomy and view identification.”), [0028] (“Further, automated view identification methods according to the invention could provide significant workflow enhancement for medical imaging applications, such as 2-D echocardiography, and specifically stress-echo. In stress-echo, the sonographer has a very limited time (90 seconds or so for exercise stress) to acquire images from four different views. To save time, the sonographer often just records for a significant portion of the 90 seconds, and then proceed to label the views after imaging is done. This is a cumbersome process, and could be improved by automatically identifying the views.”), Claims 24-26 Lee: Abstract, [0009], [0011], [0151] (“The category classifying module 520 may classify an image scene category of the image based on at least some of the image or the image information transferred from the image managing module 510. For example, the category classifying module 520 may classify the category of the image by analyzing a type of scene that the image corresponds to, for example, mountain, ocean, sky, beach, streets, night view, or the like. According to an example embodiment of the present disclosure, the category classifying module 520 may define a type of scene (e.g., a category or a class) of an image through an image classifying method that classifies an image by quantizing feature vectors of an image or an image classifying method that classifies an image using deep learning…. The image classifying method using deep learning may define a class of an image by attempting, for example, a high level abstraction (which abstracts main contents or functions from a large amount of data or complex materials) through the combination of various non-linear conversion schemes.”), [0168], Fig. 5 (“Category Classifying Module 520”), Fig. 6 (“Classify

		Image Scene Category of Image 603"), [0176] ("[T]he controller 480 (e.g., the category classifying module 520) may be configured to analyze an image scene that the obtained image corresponds to, for example, mountain, ocean, sky, beach, streets, night view, or the like, and may be configured to classify the category of the image based on a result of the analysis.") Paterson: Fig. 3 ("Image view content determined 210"), p.4, ln. 9-25 ("The image assessment component then determines a feedback response, for example the confirmation that at least one image required in the imaging protocol has been acquired.") p.7, ln. 22-27 ("The image assessment component 22 then assesses, at step 106, the type and quality of the image using automatic image recognition methods; and, at step 108, determines whether the image meets the image characteristics defined in the imaging protocol which determines a feedback response. The automatic image recognition methods firstly determine which protocol view the image belongs to and secondly determines quality aspects of the image."), p.8, ln. 30-31 ("For example, a number of different anatomical views of the heart may be defined in the imaging protocol.") Pagoulatos: [0007] ("To assist the system in determining whether a clinically desirable view has been captured, the user may identify, before or during the image capture process, the particular image perspective or view the user desires to capture, which input the system then can use to assist in identifying whether the desired view in fact has been captured."), [0054] ("Using the ultrasound imaging device 110, a user may select (e.g., via the input elements 412 and/or display 112) or otherwise input a desired view of an organ that is to be imaged in a patient. For example, a user may select one view (e.g., a subcostal view of a heart) from among a plurality of clinically desirable views that are stored in the ultrasound imaging device 110 and presented to the user. The ultrasound imaging device 110 may communicate the selected view to the ultrasound image recognition module 120, and the ultrasound image recognition module 120 may thus be configured to determine whether received ultrasound images represent the selected view."), Fig. 5 ("Determining, by the ultrasound image

		recognition module, whether the acquired ultrasound images represent a clinically desirable view of an organ 506”)
[1g]	determine, based on the second at least one echocardiographic image and the second view category, a second quality assessment value representing a view category specific quality assessment of the second at least one echocardiographic image; and	Krishnan: Fig. 1 (“Automatic Quality Assessment 105”), [0006] (“[A]utomated anatomy identification, view identification and/or image quality assessment are performed using associated classifiers that process the extracted feature data.”), [0009], [0019] (“Ultrasound images of the heart can be taken from various angles, but efficient analysis of cardiac ultrasound images requires recognizing the position of the imaged heart (view) to enable identification of important cardiac structures. In accordance with an exemplary embodiment of the invention, view identification module (103) [sic] implements methods for identifying an unknown cardiac image as one of the standard views.”), [0020] (“The quality assessment module (105) implements methods for using the extracted features/parameters to assess a level of diagnostic quality of an acquired image data set and determine whether errors occurred in the image acquisition process. In other exemplary embodiments of the invention, the results of anatomy and/or view identification may be used for quality assessment. Moreover, methods can be implemented for providing real-time feedback during image acquisition regarding the diagnostic quality of the acquired images, allowing for changes in the image acquisition. In addition, methods can be implemented for determining a quality measure within a predefined range of values to provide an indication as the quality level of the acquired images based on some specified criteria.”), [0029] (“The results of anatomy identification and/or view identification can be used to perform automatic image quality assessment process according to an exemplary embodiment of the invention.”), [0032], [0036] (“[F]or image quality assessment, the medical images may include a quality score (within a predefined range) that provides an indication a diagnostic quality level of the medical images.”), [0032] (“In addition to searching for problems, the automatic image quality assessment can be implemented to provide general feedback on the diagnostic quality of an image. For example, with 2-D echocardiography, particularly stress-echo, the sonographer has very limited time to acquire images during a stress stage. It is important for the sonographer to acquire, as quickly as possible, diagnostic quality images at multiple views. Many times, because of the time pressure of a stress-echo, diagnostic quality images are not obtained, and the images are useless. By providing a quality check, the sonographer can be assured that images are being acquired of diagnostic quality. The advantage of doing such a

		quality check is that feedback can be provided back to the operator of the imaging device in real time, allowing for changes in acquisition.”), [0042]-[0043], Claims 24-27 Lee: Abstract, [0009], [0011], [0096] (“[A]n electronic device may classify an image based on an image scene category (e.g., mountain, ocean, sky, beach, streets, night view, or the like) when measuring the quality of the image, and may determine an image scene classifier corresponding to the corresponding image scene category. According to various example embodiments of the present disclosure, the image quality may be determined by applying, to the image, a different weight based on the determined image scene classifier.”), [0153] (“[T]he classifier selecting module 530 may change an image quality classifier to correspond to an image scene category, and thereby changing a perspective of measurement. For example, the classifier selecting module 530 may select and provide an image quality classifier that is appropriate for a night view image in a case of a night view image, and may select and provide an image quality classifier that is appropriate for a sky (cloud) image.”), [0160] (“The image quality evaluating module 550 (e.g., a total image quality evaluator) may extract a total image quality score with respect to the image using the image quality factor scores transferred from the image factor extracting module 540 and the image quality classifier transferred from the classifier selecting module 530.”), Fig. 5 (“Image Quality Evaluating Module 550”), Fig. 6 (“Determine Image Quality Score Using Image Quality Factor Scores and Classifier 609”), [0181] Paterson: Fig. 2 (106), Fig. 3 (“Image view content determined, quality of image determined 210”), p.4, ln. 9-25, p.7, ln. 22-27 (“The image assessment component 22 then assesses, at step 106, the type and quality of the image using automatic image recognition methods; and, at step 108, determines whether the image meets the image characteristics defined in the imaging protocol which determines a feedback response. The automatic image recognition methods firstly determine which protocol view the image belongs to and secondly determines quality aspects of the image.”), p.8, ln. 30-31 (“For example, a number of different anatomical views of the heart may be defined in the imaging protocol.”), p.9, ln. 13 (“A continuous scale of quality may also be used.”)

		Pagoulatos: [0054] ("[A] user may select … or otherwise input a desired view of an organ that is to be imaged in a patient. For example, a user may select one view (e.g., a subcostal view of a heart) from among a plurality of clinically desirable views that are stored in the ultrasound imaging device 110 and presented to the user. The ultrasound imaging device 110 may communicate the selected view to the ultrasound image recognition module 120, and the ultrasound image recognition module 120 may thus be configured to determine whether received ultrasound images represent the selected view. That is, the ultrasound image recognition module 120 may access the appropriate ultrasound image knowledge (e.g., knowledge, rules or relations associated with a subcostal view of a heart) in the image knowledge database 122 such that received ultrasound images may be compared with, or processed by, knowledge corresponding to the selected view."), [0060] ("In embodiments where a feedback signal 103 indicates that the received ultrasound images are sequentially approaching or moving away from the clinically desirable view of the organ, the ultrasound imaging device 110 may communicate this to the user, for example, by providing a changing feedback effect, such as … illuminating a different color or position of lights as the received ultrasound image are approaches [sic] or moving away from the clinically desired view (e.g., illuminating red outer lights 420 c, then yellow intermediate lights 420 b, then green center light 420 a as the received ultrasound images approach the clinically desired view).
[1h]	produce signals representing the second quality assessment value for causing the second quality assessment value to be associated with the second at least one echocardiographic image;	Krishnan: [0020] ("The quality assessment module (105) implements methods for using the extracted features/parameters to assess a level of diagnostic quality of an acquired image data set and determine whether errors occurred in the image acquisition process…. Moreover, methods can be implemented for providing real-time feedback during image acquisition regarding the diagnostic quality of the acquired images, allowing for changes in the image acquisition. In addition, methods can be implemented for determining a quality measure within a predefined range of values to provide an indication as the quality level of the acquired images based on some specified criteria."), [0032] ("In addition to searching for problems, the automatic image quality assessment can be implemented to provide general feedback on the diagnostic quality of an image. For example, with 2-D echocardiography, particularly stress-echo, the sonographer has very limited time to acquire images during a stress

		stage. It is important for the sonographer to acquire, as quickly as possible, diagnostic quality images at multiple views. Many times, because of the time pressure of a stress-echo, diagnostic quality images are not obtained, and the images are useless. By providing a quality check, the sonographer can be assured that images are being acquired of diagnostic quality. The advantage of doing such a quality check is that feedback can be provided back to the operator of the imaging device in real time, allowing for changes in acquisition.”), [0036] (“The image dataset will be labeled or otherwise classified based on the processing results obtained (step 203)…. [F]or image quality assessment, the medical images may include a quality score (within a predefined range) that provides an indication a diagnostic quality level of the medical images.”), Fig. 2 (203), Claims 24-30 Lee: Fig. 5 (“Total Image Quality Score”), Fig. 6, [0182] (“In operation 611, the controller 480 determines and provides the quality of the image based on the image quality scores.”) Paterson: P.5, ln. 19-21 (“Preferably, the feedback comprises an indication of the quality of acquired images, for example by the display of an indicator providing feedback on the acquired image quality.”), p.9, ln. 13 (“A continuous scale of quality may also be used.”)
[1i]	wherein each of the plurality of predetermined echocardiographic image view categories is associated with a respective set of assessment parameters, each of the sets of assessment parameters being a set of neural network parameters that define a neural network having a plurality of layers including an input layer configured to receive one	Krishnan: Fig. 1 (“Automatic View Identification 104”) (“Automatic Quality Assessment 105”) (“Learning Engine 109”) (“Classification Models/Parameters” 110”), [0006] (“[A]utomated anatomy identification, view identification and/or image quality assessment are performed using associated classifiers that process the extracted feature data. The classifiers can be implemented using machine learning methods, model-based methods, or any combination of machine learning and model-based methods.”), [0020] (“[T]he results of … view identification may be used for quality assessment.”), [0021] (“The system (100) further comprises a database (106) of previously diagnosed/labeled medical images, a template database (107) and a classification system (108), which can be used singularly, or in combination, by one or more of the various automated decision support modules (102-105) of the data processing system (101) to perform their respective functions.”), [0023] (“[T]he

	or more echocardiographic images and an output layer configured to output one or more quality assessment values, and	various modules (103), (104) and (105) can implement classification methods that utilize the classification module (108) to process extracted feature data to classify the image dataset under consideration. In the exemplary embodiment of FIG. 1, the classification module (108) comprises a learning engine (109) and knowledge base (110) to implement a principle (machine) learning classification system. The learning engine (109) includes methods for training/building one or more classifiers using training data that is learned from the database (106) of previously diagnosed/labeled cases. The classifiers are implemented by the various decision support modules (102-105) for performing their respective functions.”), [0029] (“The results of … view identification can be used to perform automatic image quality assessment process according to an exemplary embodiment of the invention.”), [0032], [0034], [0035], Fig. 5, [0042]-[0044] (“It is to be understood that the term “classifiers” as used herein generally refers to various types of classifier frameworks, such as hierarchical classifiers, ensemble classifiers, etc.”) (“The classification methods implemented may be “black boxes” that are unable to explain their prediction to a user (which is the case if classifiers are built using neural networks, example).”) (“[A] bank of classifiers could be constructed to classify the images based on the features extracted. That is, a set of classifiers would be ‘learned’ based on a database of cases. These classifiers would use the set of features as an input, and classify the image as belonging to a particular anatomy, view, or level of quality. In the exemplary embodiment of FIG. 1, the classification system (108) includes the knowledge base (110) that is used to process the extracted features/parameters and classify the images. The knowledge base (110) maintains one or more trained classification models, parameters, and/or other data structures of learned knowledge, etc.”), [0041] (“The content of the identified templates would then be used … to determine the quality of the acquired image (step 402)…. For example, templates could be constructed for different cardiac views: apical four chamber, apical two chamber, etc.”), Claims 1, 10-11, 24-27 Lee: [0096] (“[T]he image quality may be determined by applying, to the image, a different weight based on the determined image scene classifier.”), [0153] (“[T]he classifier selecting module 530 may change an image quality classifier to correspond to an image scene category, and thereby changing a perspective of measurement. For example, the classifier selecting module 530 may select and provide an image quality

		classifier that is appropriate for a night view image in a case of a night view image, and may select and provide an image quality classifier that is appropriate for a sky (cloud) image. The classifier selecting module 530 may transfer, to the image quality evaluating module 550, an image quality classifier that is determined for the image.”), [0160] (“The image quality evaluating module 550 (e.g., a total image quality evaluator) may extract a total image quality score with respect to the image using the image quality factor scores transferred from the image factor extracting module 540 and the image quality classifier transferred from the classifier selecting module 530. For example, the image quality evaluating module 550 may extract a likelihood score between a low quality image class and a high quality image class, using the image quality classifier based on the image quality factor scores. According to various example embodiments of the present disclosure, the extraction of the likelihood score may be an example of a score-based determination scheme that does not overestimate or underestimate reliability with respect to the image, but executes accurate determination. According to an example embodiment of the present disclosure, the image quality evaluating module 550 may compare learning data stored in advance and the image that is the target of image quality evaluation, and may determine a similarity (reliability) between the image and the learning data. According to various example embodiments of the present disclosure, the learning data may include sample data corresponding to a high-quality image and a low-quality image, which are stored by learning various images in advance.”), [0161] Paterson: P.3, ln. 9-10 (“The system incorporates a protocol database comprising at least one imaging protocol which defines one or more images to be acquired by an imaging machine.”), p.3, ln. 20-25 (“Preferably the protocol defines at least one quality metric for each of the one or more images to be acquired. This metric may, for example, relate to the presence of one or more required features, the angle of capture of a required feature in the image, the presence of a measurement of a feature in the image, etc.”), p.4, ln. 9-25 (“The system also comprises an image assessment component which is configured to compare at least one characteristic of the acquired image to the imaging protocol and determine a feedback response. This comparison may comprise the identification of at least one object contained within the image and a confirmation of the presence of the at least one object in the imaging protocol. The

		comparison may additionally comprise the assessment of at least one qualitative and/or quantitative feature of the image, for example the presence or absence of a measurement, the presence of one or more anatomical features, etc., and a comparison of the one or more features with information relating to the one or more features stored in the imaging protocol. The image assessment component may, for example, use object recognition techniques to match the acquired image against a library of example images. The image assessment component may utilize, for example, one or more of object or feature detection, optical character recognition or template detection methods.”), p.7, ln. 22-29 (“The image assessment component 22 then assesses, at step 106, the type and quality of the image using automatic image recognition methods; and, at step 108, determines whether the image meets the image characteristics defined in the imaging protocol which determines a feedback response. The automatic image recognition methods firstly determine which protocol view the image belongs to and secondly determines quality aspects of the image. In both cases standard object recognition techniques are used to match the acquired image against a library of "known good" example images.”), p.9, ln. 28-31 (“The image assessment component 22 may utilise a range of computer vision and image processing techniques depending on which aspects of the image are relevant for quality assessment purposes e.g. object and feature detection, optical character recognition, template detection, etc.”) Pagoulatos: [0034] (“’Artificial intelligence’ is used herein to broadly describe any computationally intelligent systems and methods that can learn knowledge (e.g., based on training data), and use such learned knowledge to adapt its approaches for solving one or more problems. Artificially intelligent machines may employ, for example, neural network, deep learning, convolutional neural network, and Bayesian program learning techniques to solve problems such as image recognition.”), Fig. 3, [0044]-[0045] (“FIG. 3 is a block diagram illustrating one example of an artificial neural network 300, which may be implemented by the ultrasound image recognition module 120.”) (“The artificial neural network 300 shown in FIG. 3 includes three layers: an input layer 310 including input neurons i1 through i3, a hidden layer 320 including hidden layer neurons h1 through h4, and an output layer 330 including output neurons f1 and f2.”), [0046] (“Relationships between neurons of the input layer 310, hidden layer 320 and output layer 330, formed through the training process and which may

		include weight connection relationships, are generally referred to herein as "ultrasound image knowledge," and may be stored, for example, in the ultrasound image knowledge database 122."), [0096], [0054] ("Using the ultrasound imaging device 110, a user may select (e.g., via the input elements 412 and/or display 112) or otherwise input a desired view of an organ that is to be imaged in a patient. For example, a user may select one view (e.g., a subcostal view of a heart) from among a plurality of clinically desirable views that are stored in the ultrasound imaging device 110 and presented to the user. The ultrasound imaging device 110 may communicate the selected view to the ultrasound image recognition module 120, and the ultrasound image recognition module 120 may thus be configured to determine whether received ultrasound images represent the selected view. That is, the ultrasound image recognition module 120 may access the appropriate ultrasound image knowledge (e.g., knowledge, rules or relations associated with a subcostal view of a heart) in the image knowledge database 122 such that received ultrasound images may be compared with, or processed by, knowledge corresponding to the selected view.")
[1j]	wherein the at least one processor is configured to determine the first quality assessment value by: determining that a first set of assessment parameters of the sets of assessment parameters is associated with the first view category; and in response to determining that the first set of assessment parameters is associated with the first view	Krishnan: [0006] ("[A]utomated anatomy identification, view identification and/or image quality assessment are performed using associated classifiers that process the extracted feature data. The classifiers can be implemented using machine learning methods, model-based methods, or any combination of machine learning and model-based methods."), [0044] ("It is to be understood that the term "classifiers" as used herein generally refers to various types of classifier frameworks, such as hierarchical classifiers, ensemble classifiers, etc.… The classification methods implemented may be "black boxes" that are unable to explain their prediction to a user (which is the case if classifiers are built using neural networks, example [sic])."), [0023] ("In the exemplary embodiment of FIG. 1, the classification module (108) comprises a learning engine (109) and knowledge base (110) to implement a principle (machine) learning classification system. The learning engine (109) includes methods for training/building one or more classifiers using training data that is learned from the database (106) of previously diagnosed/labeled cases."), [0043] ("[A] bank of classifiers could be constructed to classify the images based on the features extracted. That is, a set of classifiers would be "learned" based on a database of cases. These classifiers would use the set of features as an input, and classify the image as belonging to a particular …

	category, inputting the first at least one echocardiographic image into the neural network defined by the first set of assessment parameters; and	level of quality. In the exemplary embodiment of FIG. 1, the classification system (108) includes the knowledge base (110) that is used to process the extracted features/parameters and classify the images. The knowledge base (110) maintains one or more trained classification models, parameters, and/or other data structures of learned knowledge, etc."), [0020] ("[T]he results of … view identification may be used for quality assessment."), [0029] ("The results of … view identification can be used to perform automatic image quality assessment process according to an exemplary embodiment of the invention."), Fig. 5 ("Input Extracted Feature Data to Classifiers 500") ("Determine Feature Data Classification 501") ("Determine … Quality of Image Dataset based on Classification Results 502"), [0021] ("The system (100) further comprises … a template database (107) and a classification system (108), which can be used singularly, or in combination, by one or more of the various automated decision support modules (102-105) of the data processing system (101) to perform their respective functions."), [0041] ("For example, templates could be constructed for different cardiac views: apical four chamber, apical two chamber, etc ."), [0032],Claims 1, 10-11, 24-27 Lee: [0096] ("[T]he image quality may be determined by applying, to the image, a different weight based on the determined image scene classifier."), [0153] ("[T]he classifier selecting module 530 may change an image quality classifier to correspond to an image scene category, and thereby changing a perspective of measurement. For example, the classifier selecting module 530 may select and provide an image quality classifier that is appropriate for a night view image in a case of a night view image, and may select and provide an image quality classifier that is appropriate for a sky (cloud) image. The classifier selecting module 530 may transfer, to the image quality evaluating module 550, an image quality classifier that is determined for the image."), [0160] ("The image quality evaluating module 550 (e.g., a total image quality evaluator) may extract a total image quality score with respect to the image using the image quality factor scores transferred from the image factor extracting module 540 and the image quality classifier transferred from the classifier selecting module 530. For example, the image quality evaluating module 550 may extract a likelihood score between a low quality image class and a high quality image class, using the image quality classifier based on the image quality factor scores. According to various

		example embodiments of the present disclosure, the extraction of the likelihood score may be an example of a score-based determination scheme that does not overestimate or underestimate reliability with respect to the image, but executes accurate determination. According to an example embodiment of the present disclosure, the image quality evaluating module 550 may compare learning data stored in advance and the image that is the target of image quality evaluation, and may determine a similarity (reliability) between the image and the learning data. According to various example embodiments of the present disclosure, the learning data may include sample data corresponding to a high-quality image and a low-quality image, which are stored by learning various images in advance."), [0161], [0177] ("In operation 605, the controller 480 may be configured to determine a classifier corresponding to the classified image scene category. For example, the controller 480 (e.g., the classifier selecting module 530) may be configured to select a classifier corresponding to the image scene category from among various image quality classifiers stored in advance in the memory 450. For example, the controller 480 may be configured to select an image quality classifier corresponding to a night view image when the image scene category of the image is night view, and may select an image quality classifier corresponding to a sky image when the image scene category of the image is sky (cloud).") Paterson: P.3, ln. 20-25 ("Preferably the protocol defines at least one quality metric for each of the one or more images to be acquired. This metric may, for example, relate to the presence of one or more required features, the angle of capture of a required feature in the image, the presence of a measurement of a feature in the image, etc."), p.4, ln. 9-25 ("The system also comprises an image assessment component which is configured to compare at least one characteristic of the acquired image to the imaging protocol and determine a feedback response. This comparison may comprise the identification of at least one object contained within the image and a confirmation of the presence of the at least one object in the imaging protocol. The comparison may additionally comprise the assessment of at least one qualitative and/or quantitative feature of the image, for example the presence or absence of a measurement, the presence of one or more anatomical features, etc., and a comparison of the one or more features with information relating to the one or more features stored in the imaging protocol. The image assessment component may, for example, use object recognition techniques to

		match the acquired image against a library of example images. The image assessment component may utilize, for example, one or more of object or feature detection, optical character recognition or template detection methods.”), p.7, ln. 22-29 (“The image assessment component 22 then assesses, at step 106, the type and quality of the image using automatic image recognition methods; and, at step 108, determines whether the image meets the image characteristics defined in the imaging protocol which determines a feedback response. The automatic image recognition methods firstly determine which protocol view the image belongs to and secondly determines quality aspects of the image. In both cases standard object recognition techniques are used to match the acquired image against a library of "known good" example images.”), p.9, ln. 28-31 (“The image assessment component 22 may utilise a range of computer vision and image processing techniques depending on which aspects of the image are relevant for quality assessment purposes e.g. object and feature detection, optical character recognition, template detection, etc.”) Pagoulatos: [0054] (“Using the ultrasound imaging device 110, a user may select (e.g., via the input elements 412 and/or display 112) or otherwise input a desired view of an organ that is to be imaged in a patient. For example, a user may select one view (e.g., a subcostal view of a heart) from among a plurality of clinically desirable views that are stored in the ultrasound imaging device 110 and presented to the user. The ultrasound imaging device 110 may communicate the selected view to the ultrasound image recognition module 120, and the ultrasound image recognition module 120 may thus be configured to determine whether received ultrasound images represent the selected view. That is, the ultrasound image recognition module 120 may access the appropriate ultrasound image knowledge (e.g., knowledge, rules or relations associated with a subcostal view of a heart) in the image knowledge database 122 such that received ultrasound images may be compared with, or processed by, knowledge corresponding to the selected view.”)
[1k]	wherein the at least one processor is configured to determine the second quality assessment value	Krishnan: [0006] (“[A]utomated anatomy identification, view identification and/or image quality assessment are performed using associated classifiers that process the extracted feature data. The classifiers can be implemented using machine learning methods, model-based methods, or any combination of machine learning and model-

	by: determining that a second set of assessment parameters of the sets of assessment parameters is associated with the second view category; and in response to determining that the second set of assessment parameters is associated with the second view category, inputting the second at least one echocardiographic image into the neural network defined by the second set of assessment parameters.	based methods.”), [0044] (“It is to be understood that the term “classifiers” as used herein generally refers to various types of classifier frameworks, such as hierarchical classifiers, ensemble classifiers, etc…. The classification methods implemented may be “black boxes” that are unable to explain their prediction to a user (which is the case if classifiers are built using neural networks, example [sic]).”), [0023] (“In the exemplary embodiment of FIG. 1, the classification module (108) comprises a learning engine (109) and knowledge base (110) to implement a principle (machine) learning classification system. The learning engine (109) includes methods for training/building one or more classifiers using training data that is learned from the database (106) of previously diagnosed/labeled cases.”), [0043] (“[A] bank of classifiers could be constructed to classify the images based on the features extracted. That is, a set of classifiers would be “learned” based on a database of cases. These classifiers would use the set of features as an input, and classify the image as belonging to a particular … level of quality. In the exemplary embodiment of FIG. 1, the classification system (108) includes the knowledge base (110) that is used to process the extracted features/parameters and classify the images. The knowledge base (110) maintains one or more trained classification models, parameters, and/or other data structures of learned knowledge, etc.”), [0020] (“[T]he results of … view identification may be used for quality assessment.”), [0029] (“The results of … view identification can be used to perform automatic image quality assessment process according to an exemplary embodiment of the invention.”), Fig. 5 (“Input Extracted Feature Data to Classifiers 500”) (“Determine Feature Data Classification 501”) (“Determine … Quality of Image Dataset based on Classification Results 502”), [0021] (“The system (100) further comprises … a template database (107) and a classification system (108), which can be used singularly, or in combination, by one or more of the various automated decision support modules (102-105) of the data processing system (101) to perform their respective functions.”), [0041] (“For example, templates could be constructed for different cardiac views: apical four chamber, apical two chamber, etc .”), [0032],Claims 1, 10-11, 24-27 Lee: [0096] (“[T]he image quality may be determined by applying, to the image, a different weight based on the determined image scene classifier.”), [0153] (“[T]he classifier selecting module 530 may change an image quality classifier to correspond to

		an image scene category, and thereby changing a perspective of measurement. For example, the classifier selecting module 530 may select and provide an image quality classifier that is appropriate for a night view image in a case of a night view image, and may select and provide an image quality classifier that is appropriate for a sky (cloud) image. The classifier selecting module 530 may transfer, to the image quality evaluating module 550, an image quality classifier that is determined for the image.”), [0160] (“The image quality evaluating module 550 (e.g., a total image quality evaluator) may extract a total image quality score with respect to the image using the image quality factor scores transferred from the image factor extracting module 540 and the image quality classifier transferred from the classifier selecting module 530. For example, the image quality evaluating module 550 may extract a likelihood score between a low quality image class and a high quality image class, using the image quality classifier based on the image quality factor scores. According to various example embodiments of the present disclosure, the extraction of the likelihood score may be an example of a score-based determination scheme that does not overestimate or underestimate reliability with respect to the image, but executes accurate determination. According to an example embodiment of the present disclosure, the image quality evaluating module 550 may compare learning data stored in advance and the image that is the target of image quality evaluation, and may determine a similarity (reliability) between the image and the learning data. According to various example embodiments of the present disclosure, the learning data may include sample data corresponding to a high-quality image and a low-quality image, which are stored by learning various images in advance.”), [0161], [0177] (“In operation 605, the controller 480 may be configured to determine a classifier corresponding to the classified image scene category. For example, the controller 480 (e.g., the classifier selecting module 530) may be configured to select a classifier corresponding to the image scene category from among various image quality classifiers stored in advance in the memory 450. For example, the controller 480 may be configured to select an image quality classifier corresponding to a night view image when the image scene category of the image is night view, and may select an image quality classifier corresponding to a sky image when the image scene category of the image is sky (cloud).”)

		Paterson: P.3, ln. 20-25 ("Preferably the protocol defines at least one quality metric for each of the one or more images to be acquired. This metric may, for example, relate to the presence of one or more required features, the angle of capture of a required feature in the image, the presence of a measurement of a feature in the image, etc."), p.4, ln. 9-25 ("The system also comprises an image assessment component which is configured to compare at least one characteristic of the acquired image to the imaging protocol and determine a feedback response. This comparison may comprise the identification of at least one object contained within the image and a confirmation of the presence of the at least one object in the imaging protocol. The comparison may additionally comprise the assessment of at least one qualitative and/or quantitative feature of the image, for example the presence or absence of a measurement, the presence of one or more anatomical features, etc., and a comparison of the one or more features with information relating to the one or more features stored in the imaging protocol. The image assessment component may, for example, use object recognition techniques to match the acquired image against a library of example images. The image assessment component may utilize, for example, one or more of object or feature detection, optical character recognition or template detection methods."), p.7, ln. 22-29 ("The image assessment component 22 then assesses, at step 106, the type and quality of the image using automatic image recognition methods; and, at step 108, determines whether the image meets the image characteristics defined in the imaging protocol which determines a feedback response. The automatic image recognition methods firstly determine which protocol view the image belongs to and secondly determines quality aspects of the image. In both cases standard object recognition techniques are used to match the acquired image against a library of "known good" example images."), p.9, ln. 28-31 ("The image assessment component 22 may utilise a range of computer vision and image processing techniques depending on which aspects of the image are relevant for quality assessment purposes e.g. object and feature detection, optical character recognition, template detection, etc.") Pagoulatos: [0054] ("Using the ultrasound imaging device 110, a user may select (e.g., via the input elements 412 and/or display 112) or otherwise input a desired view of an organ that is to be imaged in a patient. For example, a user may select one view (e.g., a subcostal view of a heart) from among a plurality of clinically desirable views that are

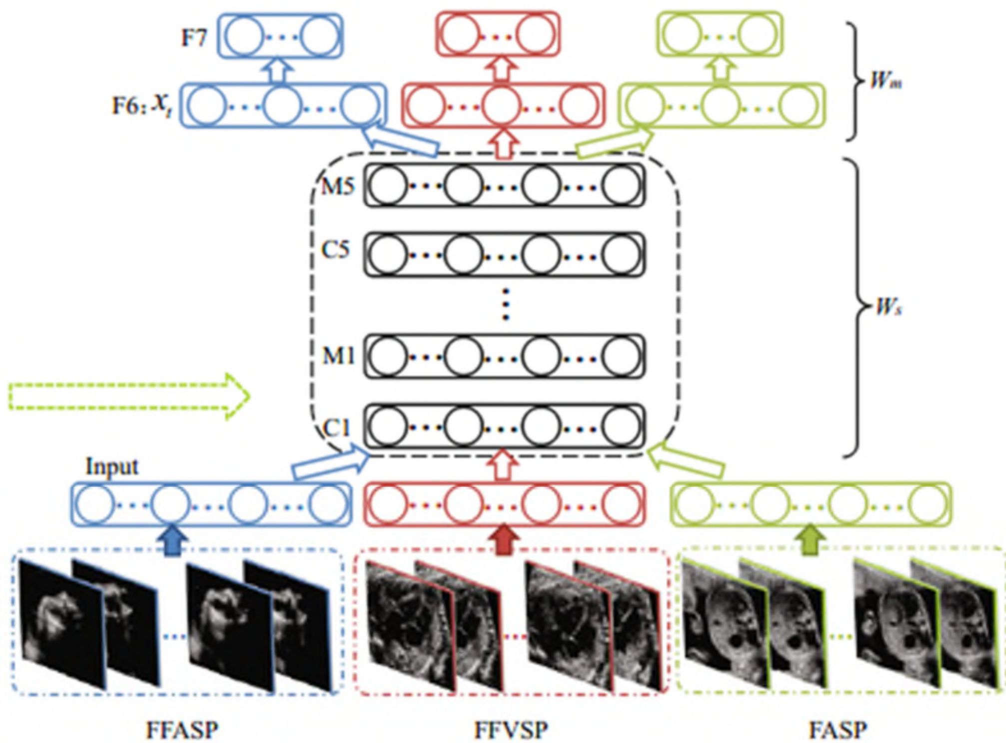
		stored in the ultrasound imaging device 110 and presented to the user. The ultrasound imaging device 110 may communicate the selected view to the ultrasound image recognition module 120, and the ultrasound image recognition module 120 may thus be configured to determine whether received ultrasound images represent the selected view. That is, the ultrasound image recognition module 120 may access the appropriate ultrasound image knowledge (e.g., knowledge, rules or relations associated with a subcostal view of a heart) in the image knowledge database 122 such that received ultrasound images may be compared with, or processed by, knowledge corresponding to the selected view.”)
[2]	The system of claim 1 wherein the first quality assessment value represents an assessment of suitability of the first at least one echocardiographic image for quantified clinical measurement of anatomical features and wherein the second quality assessment value represents an assessment of suitability of the second at least one echocardiographic image for quantified measurement of anatomical features.	See [1pre]-[1k] Krishnan: [0020] (“The quality assessment module (105) implements methods for using the extracted features/parameters to assess a level of diagnostic quality of an acquired image data set and determine whether errors occurred in the image acquisition process…. In addition, methods can be implemented for determining a quality measure within a predefined range of values to provide an indication as the quality level of the acquired images based on some specified criteria.”), [0029]-[0030], [0036] (“[F]or image quality assessment, the medical images may include a quality score (within a predefined range) that provides an indication a diagnostic quality level of the medical images.”) Paterson: P.3, ln. 20-25 (“Preferably the protocol defines at least one quality metric for each of the one or more images to be acquired. This metric may, for example, relate to the presence of one or more required features, the angle of capture of a required feature in the image, the presence of a measurement of a feature in the image, etc.”), p.8, ln. 27 – p.9, ln. 5 (“The image assessment component 22 then, at step 210, automatically assesses the quality of the image and, at step 212, automatically determines whether the image meets the image characteristics defined in the imaging protocol which determines a feedback response. For example, a number of different anatomical views of the heart may be defined in the imaging protocol and for each view a variety of different imaging modes are required, such as a four chamber view with a colour-flow

		Doppler (CF) map of the tricuspid valve. The image assessment component 22 identifies that the acquired image is a four chamber (4CH) view using object recognition techniques. Template matching may then be used on overlaid text in the image to determine imaging mode (e.g. CF enabled). Colour histogram matching may then be used to identify Doppler pixels in the image, and a cascaded, boosted object detector used to locate the boundaries of the tricuspid valve in the image. With this resolved information the image assessment component 22 identifies that the 4CH CF image of the tricuspid valve has been acquired, and whether or not the acquired image meets quality metrics defined in the imaging protocol, for example accuracy of Doppler placement etc.”) Pagoulatos: Abstract (“The ultrasound image recognition module is configured to … receive the acquired ultrasound images from the ultrasound imaging device, and determine … whether the received ultrasound images represent a clinically desirable view of an organ ….”), [0054] (“The system would then repeat this process, in series, for each of the desired standard views of the organ to be imaged.”)
[3]	The system of claim 1 wherein the at least one processor is configured to: produce signals for causing a representation of the first quality assessment value to be transmitted to at least one display for causing the at least one display to display the first quality assessment value in association with the first at least one echocardiographic	See [1pre]-[1k] Krishnan: [0020] (“[M]ethods can be implemented for providing real-time feedback during image acquisition regarding the diagnostic quality of the acquired images, allowing for changes in the image acquisition.”), [0032] (“In addition to searching for problems, the automatic image quality assessment can be implemented to provide general feedback on the diagnostic quality of an image. For example, with 2-D echocardiography, particularly stress-echo, the sonographer has very limited time to acquire images during a stress stage. It is important for the sonographer to acquire, as quickly as possible, diagnostic quality images at multiple views. Many times, because of the time pressure of a stress-echo, diagnostic quality images are not obtained, and the images are useless. By providing a quality check, the sonographer can be assured that images are being acquired of diagnostic quality. The advantage of doing such a quality check is that feedback can be provided back to the operator of the imaging device in real time, allowing for changes in acquisition.”); [0036] (“[F]or image quality

	image, to assist one or more operators of an echocardiographic device in capturing at least one subsequent echocardiographic image; and produce signals for causing a representation of the second quality assessment value to be transmitted to the at least one display for causing the at least one display to display the second quality assessment value in association with the second at least one echocardiographic image, to assist the one or more operators in capturing at least one subsequent echocardiographic image.	assessment, the medical images may include a quality score (within a predefined range) that provides an indication a diagnostic quality level of the medical images.") Paterson: P.4, ln. 26-29 ("The system comprises a feedback delivery component which is configured to provide feedback to the operator of the imaging machine during the imaging procedure. The feedback delivery component is configured to provide feedback on a means suitable for providing the feedback, for example, on a monitor screen, or any other display screen."), p.5, ln. 19-20 ("Preferably, the feedback comprises an indication of the quality of acquired images, for example by the display of an indicator providing feedback on the acquired image quality.") Pagoulatos: [0030] ("[T]he ultrasound images may be provided to the display 112, which may display the ultrasound images and/or any other relevant information to the user."), [0054], [0056] ("Feedback signals 103 provided by the ultrasound image recognition module 120 may indicate any of a variety of determinations made by the ultrasound image recognition module 120 regarding ultrasound images received from the ultrasound imaging device 110."), [0058] ("For example, the feedback signal 103 may indicate that the current or most recently received ultrasound image represents a clinically desirable view of an organ. In such a case, the feedback effect provided by the ultrasound imaging device 110 may include flashing a green light 420 a of the visual feedback element 420…."), Fig. 4 (112, 420)
[4]	The system of claim 1 wherein the at least one processor is configured to: apply one or more view categorization functions to the first at least one	See [1pre]-[1k] Krishnan: Fig. 1 ("Automatic View Identification 104") ("Classification Models/Parameters 110"), Fig. 4 ("Compare Extracted Feature Data with Feature Data of Templates to Identify Similar Templates 401") ("Determine … Most Likely View … based on Content of the Similar Template(s) 402"), Fig. 5 ("Determine … Most Likely View … based on Classification Results 502"), [0006] ("[A]utomated anatomy

	echocardiographic image to determine that the first at least one echocardiographic image falls within the first view category; and apply one or more view categorization functions to the second at least one echocardiographic image to determine that the second at least one echocardiographic image falls within the second view category.	identification, view identification and/or image quality assessment are performed using associated classifiers that process the extracted feature data. The classifiers can be implemented using machine learning methods, model-based methods, or any combination of machine learning and model-based methods.”), [0019] (“The view identification module (103) [sic] implements methods for using the extracted features/parameters to automatically identify the view of an acquired image. In other words, the view identification module (104) implements methods for pose estimation and label a medical image with respect to what view of the anatomy the medical image contains. By way of example, for cardiac ultrasound imaging, the American Society of Echocardiography (ASE) recommends using standard ultrasound views in B-mode to obtain sufficient cardiac image data—the apical two-chamber view (A2C), the apical four-chamber view (A4C), the apical long axis view (ALAX), the parasternal long axis view (PLAX), the parasternal short axis view (PSAX)…. In accordance with an exemplary embodiment of the invention, view identification module (103) [sic] implements methods for identifying an unknown cardiac image as one of the standard views.”), [0023], [0028], [0041], [0042] (“[T]he feature data extracted from the image dataset would be input to classifiers (step 500) that are trained or designed to process the feature data to classify the image data (step 501). The classification results would be used to determine the most likely … view …(step 502).”), [0043]-[0044] Paterson: Fig. 3 (210), p.7, ln. 23-29 (“The image assessment component 22 then assesses, at step 106, the type and quality of the image using automatic image recognition methods; and, at step 108, determines whether the image meets the image characteristics defined in the imaging protocol which determines a feedback response. The automatic image recognition methods firstly determine which protocol view the image belongs to and secondly determines quality aspects of the image. In both cases standard object recognition techniques are used to match the acquired image against a library of "known good" example images.”), p.8, ln. 33-34 (“The image assessment component 22 identifies that the acquired image is a four chamber (4CH) view using object recognition techniques.”) Pagoulatos: [0054]

[5]	The system of claim 1 wherein the first at least one echocardiographic image comprises a plurality of echocardiographic images and wherein the at least one processor is configured to determine the first quality assessment value by determining a single quality assessment value representing a view category specific assessment of the plurality of echocardiographic images.	See [1pre]-[1k] Krishnan: [0017] ("In general, the feature analysis module (102) implements methods for automatically extracting one or more types of features/parameters from input medical image data and combining the extracted features/parameters in a manner that is suitable for processing by the decision support modules (103, 104 and/or 105). The system (100) can process digital image data (10) in the form of raw image data, 2D-reconstructed data (e.g., axial slices), or 3D-reconstructed data (volumetric image data or multiplanar reformats), 4D-reconstructed data, or other image modalities/formats."), [0032] ("[A]nother application would be to automatically select the images of highest quality for the cardiologist to review. Often in stress-echo, the sonographer acquires up to four (and sometimes more) loops of data for each view, where each loop represents a heart cycle, or at least the systole portion of the heart cycle. Typically, either the sonographer or cardiologist selects which of the loops provides the best images from a diagnostic standpoint, and uses them. By providing a quality check, this could be done automatically."), [0033] ("Initially, a physician, clinician, radiologist, etc., will obtain a medical image dataset comprising one or more medical images of a region of interest of a subject patient (step 200)…. The digital image data (10) may comprise one or more 2D slices …, which are reconstructed from the raw image data and persistently stored…. Image data can be … 4D (Dynamic 3D MRI, multiple views of a beating heart acquired with a 3D Ultrasound probe), etc.") Paterson: P.3, ln. 27-29 ("It will be understood that images acquired during an imaging procedure can be single frames or can be image sequences (videos).")
[6]	The system of claim 1 wherein each of the sets of assessment parameters includes: a set of common assessment parameters,	See [1pre]-[1k] Chen: Fig. 2, right side (W_s) (W_m), p.507 ("In order to extract visual features effectively, we propose a joint learning framework with knowledge transfer across multi-tasks to address the insufficiency issue with limited training data."), p.509 ("[A] joint learning model for effective spatial feature learning across multi-tasks is

	which are common to each of the sets of assessment parameters; and a set of view category specific assessment parameters, which are unique to the set of assessment parameters.	presented, which reduces the overfitting problem caused by the inadequacy of training data.”), p.510 (“In [Fig. 2], the matrix W_s denoting the parameters of layers from C1 to M5 is trained from all training samples of the three detection tasks [(i.e., FFASP, FFVSP, FASP)] and shared among these tasks. The W_m (m = 1, 2, 3 represents the task of FFASP, FFVSP and FASP, respectively) denotes the parameters of F6 and F7 layers and is trained individually on each task for the discrimination of different standard planes.”)  Krishnan: Fig. 1 (“Classification Models/Parameters 110”), [0023], [0043]-[0044]

[7]	The system of claim 1 wherein the at least one processor is configured to train the neural networks by: receiving signals representing a plurality of echocardiographic training images, each of the plurality of echocardiographic training images associated with one of the plurality of predetermined echocardiographic image view categories; receiving signals representing respective expert quality assessment values representing view category specific quality assessments of the plurality of echocardiographic training images, each of the expert quality assessment values provided by an expert echocardiographer and associated with one of the plurality of echocardiographic training images; and training the neural	See [1pre]-[1k] Krishnan: Fig. 1 ("Learning Engine 109") ("Classification Models/Parameters 110"), [0021] ("The system (100) further comprises a database (106) of previously diagnosed/labeled medical images … and a classification system (108)."), [0023] ("The learning engine (109) incudes methods for training/building one or more classifiers using training data that is learned from the database (106) of previously diagnosed/labeled cases."), [0043], [0044] ("classifiers are built using neural networks"), [0045] ("[T]he systems and methods described herein in accordance with the present invention may be implemented in various forms of hardware, software, firmware, special purpose processors, or a combination thereof.") Lee: [0160] ("[T]he image quality evaluating module 550 may compare learning data stored in advance and the image that is the target of image quality evaluation, and may determine a similarity (reliability) between the image and the learning data. According to various example embodiments of the present disclosure, the learning data may include sample data corresponding to a high-quality image and a low-quality image, which are stored by learning various images in advance."), [0161] ("[T]he learning data used by the image quality evaluation module 550 may be learning data of images included in an image scene category that is classified by the category classifying module 520, and the images included in the image scene category may be classified into a high-quality image and a low-quality image based on an image quality classifier selected by the classifier selecting module 530.") Pagoulatos: Abstract ("An ultrasound data information system includes an ultrasound recognition training network that is configured to receive ultrasound training images and to develop ultrasound image knowledge based on the received ultrasound training images."), Fig. 2, [0025] ("trained using a large number of ultrasound images representing known or clinically determined views"), [0036] ("a computer processor configured to perform the various functions and operations described herein"), [0037] ("Training images 210 may include any ultrasound image information. For example, the training images 210 may include a variety of ultrasound image information

	networks using the plurality of echocardiographic training images as inputs and the associated expert quality assessment values as desired outputs to determine the sets of neural network parameters defining the neural networks.	associated with known views of an organ, such as the heart. As a further example, the training images 210 may be clinically desirable images of, e.g., suprasternal views of a heart. In such a case, the training images 210 may be ultrasound images which have been pre-determined (e.g., by a physician) as adequately showing a clinically desirable suprasternal view of a heart. Each such training image 210 may have slightly different characteristics (e.g., higher quality images, lower quality images, blurry images, images taken at slightly different angles, and so on), yet each such training image 210 may nonetheless be pre-determined as adequately representing a clinically desirable view of a heart.”), [0040] (“Using training images 210, the ultrasound image recognition module 120 may implement an iterative training process. Training may be based on a wide variety of learning rules or training algorithms.”), [0041] (“The back-propagation learning algorithm is a common method of training artificial neural networks…. Back-propagation generally includes two phases: propagation and weight update. In the propagation phase, a training pattern's input is forward propagated through the neural network in order to generate the propagation's output activations. Then, the propagation's output activations are backward propagated through the neural network using the training pattern target in order to generate deltas (i.e., the difference between the input and output values) of all output and hidden neurons…. The propagation and weight update phases are repeated as desired until performance of the network is satisfactory.”) [0044], [0046] (“The neural network 300 may be trained by providing training images 210 to the input layer 310. As described with respect to FIG. 2, the training images may include ultrasound image information having a wide variety of known characteristics, including, for example, various organ views, various image qualities or characteristics, various imaging angles, and so on. Through training, the neural network 300 may generate and/or modify the hidden layer 320, which represents weighted connections mapping the training images 210 provided at the input layer 310 to known output information at the output layer 330….”), [0047] (“[T]he neural network 300 may make determinations about the received ultrasound image information at the output layer 330.”), [0049] (“Moreover, the ultrasound recognition module 120 may be trained, utilizing a variety of training images 210 and/or a variety of sequences of training images 210, to make a variety of determinations relating to received ultrasound image information.”), [0072] (“The AI training network 620 may include, or otherwise be executed by, one or more computer processors configured to

		perform the various functions and operations described herein. For example, the AI training network 620 may be executed by one or more general purpose computers or data processors selectively activated or configured by a stored computer program, or may be a specially constructed computing platform for carrying out the features and operations described herein. In particular, the AI training network 620 may be a cloud-based or distributed computing artificial intelligence network having a high level of computational capability such that it can receive and process a very large number (e.g., tens of thousands, or more) of training images.")
[8]	The system of claim 7 wherein each of the expert quality assessment values represents an assessment of suitability of the associated echocardiographic image for quantified clinical measurement of anatomical features.	See [7] Krishnan: [0020] ("The quality assessment module (105) implements methods for using the extracted features/parameters to assess a level of diagnostic quality of an acquired image data set and determine whether errors occurred in the image acquisition process…. In addition, methods can be implemented for determining a quality measure within a predefined range of values to provide an indication as the quality level of the acquired images based on some specified criteria."), [0029]-[0030], [0036] ("[F]or image quality assessment, the medical images may include a quality score (within a predefined range) that provides an indication a diagnostic quality level of the medical images.") Pagoulatos: [0037] ("Training images 210 may include any ultrasound image information. For example, the training images 210 may include a variety of ultrasound image information associated with known views of an organ, such as the heart. As a further example, the training images 210 may be clinically desirable images of, e.g., suprasternal views of a heart. In such a case, the training images 210 may be ultrasound images which have been pre-determined (e.g., by a physician) as adequately showing a clinically desirable suprasternal view of a heart. Each such training image 210 may have slightly different characteristics (e.g., higher quality images, lower quality images, blurry images, images taken at slightly different angles, and so on), yet each such training image 210 may nonetheless be pre-determined as adequately representing a clinically desirable view of a heart.")

[9]	The system of claim 7 wherein the at least one processor is configured to derive each of the expert quality assessment values at least in part from a clinical plane assessment value representing an expert opinion whether the associated echocardiographic training image was taken in an anatomical plane suitable for quantified clinical measurement of anatomical features.	See [7] Krishnan: [0029]-[0030] Pagoulatos: [0037] ("Training images 210 may include any ultrasound image information. For example, the training images 210 may include a variety of ultrasound image information associated with known views of an organ, such as the heart. As a further example, the training images 210 may be clinically desirable images of, e.g., suprasternal views of a heart. In such a case, the training images 210 may be ultrasound images which have been pre-determined (e.g., by a physician) as adequately showing a clinically desirable suprasternal view of a heart. Each such training image 210 may have slightly different characteristics (e.g., higher quality images, lower quality images, blurry images, images taken at slightly different angles, and so on), yet each such training image 210 may nonetheless be pre-determined as adequately representing a clinically desirable view of a heart.")
[10]	The system of claim 7 wherein each of the sets of neural network parameters includes: a set of common neural network parameters, which are common to each of the sets of neural network parameters; and a set of view category specific neural network parameters, which are unique to the set of neural network parameters; and	See [7] Krishnan: Fig. 1 ("Learning Engine 109") ("Classification Models/Parameters 110"), [0021] ("The system (100) further comprises a database (106) of previously diagnosed/labeled medical images … and a classification system (108)."), [0023], [0043]-[0044] Chen: Fig. 2 (right side, W_s, W_m), p.507 ("In order to extract visual features effectively, we propose a joint learning framework with knowledge transfer across multi-tasks to address the insufficiency issue with limited training data."), p.509 ("[A] joint learning model for effective spatial feature learning across multi-tasks is presented, which reduces the overfitting problem caused by the inadequacy of training data."), p.510 ("In [Fig. 2], the matrix W_s denoting the parameters of layers from C1 to M5 is trained from all training samples of the three detection tasks [(i.e., FFASP, FFVSP, FASP)] and

	wherein the at least one processor is configured to, for each echocardiographic training image: select one of the sets of view category specific neural network parameters based on the predetermined echocardiographic image view category associated with the echocardiographic training image; and using the echocardiographic training image as an input and the associated expert quality assessment values as a desired output, train a neural network defined by the set of common neural network parameters and the selected one of the sets of view category specific neural network parameters to update the set of common neural network parameters and the selected one of the sets of view category specific neural network parameters.	shared among these tasks. The W_m (m = 1, 2, 3 represents the task of FFASP, FFVSP and FASP, respectively) denotes the parameters of F6 and F7 layers and is trained individually on each task for the discrimination of different standard planes.”)

[11pre]	A computer-implemented system for training neural networks to facilitate echocardiographic image analysis, the system comprising at least one processor configured to:	See [7]
[11a]	receive signals representing a plurality of echocardiographic training images, each of the plurality of echocardiographic training images associated with one of a plurality of predetermined echocardiographic image view categories;	See [7]
[11b]	receive signals representing expert quality assessment values representing view category specific quality assessments of the plurality of echocardiographic training images, each of the expert quality assessment values provided by an expert echocardiographer and associated with one of the plurality of echocardiographic training images; and	See [7]
[11c]	train the neural networks using the plurality of echocardiographic training images and the associated expert	See [7]

	quality assessment values to determine sets of neural network parameters defining the neural networks, at least a portion of each of said neural networks associated with one of the plurality of predetermined echocardiographic image view categories;	
[11d]	wherein the at least one processor is further configured to, once the neural networks are trained: receive signals representing a first at least one echocardiographic image; associate the first at least one echocardiographic image with a first view category of a plurality of predetermined echocardiographic image view categories; determine, based on the first at least one echocardiographic image and the first view category, a first quality assessment value representing a view category specific quality assessment of the first at least one echocardiographic image; produce signals representing the first quality assessment value for causing the first quality	See [1a]-[1h]

	assessment value to be associated with the first at least one echocardiographic image; receive signals representing a second at least one echocardiographic image; associate the second at least one echocardiographic image with a second view category of the plurality of predetermined echocardiographic image view categories, said second view category being different from the first view category; determine, based on the second at least one echocardiographic image and the second view category, a second quality assessment value representing a view category specific quality assessment of the second at least one echocardiographic image; and produce signals representing the second quality assessment value for causing the second quality assessment value to be associated with the second at least one echocardiographic image;	
[11e]	wherein each of the plurality of predetermined echocardiographic image view	See [1i]-[1k]

	categories is associated with a respective set of assessment parameters, each of the sets of assessment parameters being a set of neural network parameters that define a neural network having a plurality of layers including an input layer configured to receive one or more echocardiographic images and an output layer configured to output one or more quality assessment values, and wherein the at least one processor is configured to determine the first quality assessment value by: determining that a first set of assessment parameters of the sets of assessment parameters is associated with the first view category; and in response to determining that the first set of assessment parameters is associated with the first view category, inputting the first at least one echocardiographic image into the neural network defined by the first set of assessment parameters; and wherein the at least one processor is configured to	

	determine the second quality assessment value by: determining that a second set of assessment parameters of the sets of assessment parameters is associated with the second view category; and in response to determining that the second set of assessment parameters is associated with the second view category, inputting the second at least one echocardiographic image into the neural network defined by the second set of assessment parameters.	
[12]	The system of claim 11 wherein each of the expert quality assessment values represents an assessment of suitability of the associated echocardiographic image for quantified clinical measurement of anatomical features.	See [11pre]-[11e], [2]
[13]	The system of claim 11 wherein the at least one processor is configured to derive each of the expert quality assessment values at least in part from a clinical plane assessment value representing an expert opinion	See [11pre]-[11e], [9]

	whether the associated echocardiographic training image was taken in an anatomical plane suitable for a quantified clinical measurement of anatomical features.	
[14]	The system of claim 11 wherein each of the sets of neural network parameters includes: a set of common neural network parameters, which are common to each of the sets of neural network parameters; and a set of view category specific neural network parameters, which are unique to the set of neural network parameters; and wherein the at least one processor is configured to, for each echocardiographic training image: select one of the sets of view category specific neural network parameters based on the predetermined echocardiographic image view category associated with the echocardiographic training image; and using the echocardiographic training image as an input and	See [11pre]-[11e], [10]

	the associated expert quality assessment value as a desired output, train a neural network defined by the set of common neural network parameters and the selected one of the sets of view category specific neural network parameters to update the set of common neural network parameters and the selected one of the sets of view category specific neural network parameters.	
[15pre]	A computer-implemented method of facilitating echocardiographic image analysis, the method comprising:	See [1pre]
[15a]	receiving signals representing a first at least one echocardiographic image;	See [1a]
[15b]	associating the first at least one echocardiographic image with a first view category of a plurality of predetermined echocardiographic image view categories;	See [1b]

[15c]	determining, based on the first at least one echocardiographic image and the first view category, a first quality assessment value representing a view category specific quality assessment of the first at least one echocardiographic image;	See [1c]
[15d]	producing signals representing the first quality assessment value for causing the first quality assessment value to be associated with the first at least one echocardiographic image;	See [1d]
[15e]	receiving signals representing a second at least one echocardiographic image;	See [1e]
[15f]	associating the second at least one echocardiographic image with a second view category of the plurality of predetermined echocardiographic image view categories, said second view category being different from the first view category;	See [1f]
[15g]	determining, based on the second at least one echocardiographic image and the second view category, a	See [1g]

	second quality assessment value representing a view category specific quality assessment of the second at least one echocardiographic image; and	
[15h]	producing signals representing the second quality assessment value for causing the second quality assessment value to be associated with the second at least one echocardiographic image;	See [1h]
[15i]	wherein each of the plurality of predetermined echocardiographic image view categories is associated with a respective set of assessment parameters, each of the sets of assessment parameters being a set of neural network parameters that defines a neural network having a plurality of layers including an input layer configured to receive one or more echocardiographic images and an output layer configured to output one or more quality assessment values and wherein:	See [1i]
[15j]	determining the first quality assessment value comprises:	See [1j]

	determining that a first set of assessment parameters of the sets of assessment parameters is associated with the first view category; and in response to determining that the first set of assessment parameters is associated with the first view category, inputting the first at least one echocardiographic image into the neural network defined by the first set of assessment parameters applying a first function based on the first set of assessment parameters to the first at least one echocardiographic image; and	
[15k]	determining the second quality assessment value comprises: determining that a second set of assessment parameters of the sets of assessment parameters is associated with the second view category; and in response to determining that the second set of assessment parameters is associated with the second view category, inputting the second at least one echocardiographic image into the neural network defined by	See [1k]

	the second set of assessment parameters.	
[16]	The method of claim 15 wherein the first quality assessment value represents an assessment of suitability of the first at least one echocardiographic image for quantified clinical measurement of anatomical features and wherein the second quality assessment value represents an assessment of suitability of the second at least one echocardiographic image for quantified measurement of anatomical features.	See [15pre]-[15k], [2]
[17]	The method of claim 15 wherein: producing the signals representing the first quality assessment value comprises producing signals for causing a representation of the first quality assessment value to be transmitted to at least one display for causing the at least one display to display the first quality assessment value in association with the first at least one echocardiographic image, to assist one or more operators of	See [15pre]-[15k], [3]

	an echocardiographic device in capturing at least one subsequent echocardiographic image; and producing the signals representing the second quality assessment value comprises producing signals for causing a representation of the second quality assessment value to be transmitted to the at least one display for causing the at least one display to display the second quality assessment value in association with the second at least one echocardiographic image, to assist the one or more operators in capturing at least one subsequent echocardiographic image.	
[18]	The method of claim 15 wherein: associating the first at least one echocardiographic image with the first view category comprises applying one or more view categorization functions to the first at least one echocardiographic image to determine that the first at least one echocardiographic image falls within the first view category; and	See [15pre]-[15k], [4]

	associating the second at least one echocardiographic image with the second view category comprises applying one or more view categorization functions to the second at least one echocardiographic image to determine that the second at least one echocardiographic image falls within the second view category.	
[19]	The method of claim 15 wherein the first at least one echocardiographic image comprises a plurality of echocardiographic images and wherein determining the first quality assessment value comprises determining a single quality assessment value representing a view category specific assessment of the plurality of echocardiographic images.	See [15pre]-[15k], [5]
[20]	The method of claim 15 wherein each of the sets of assessment parameters includes: a set of common assessment parameters, which are common	See [15pre]-[15k], [6]

	to each of the sets of assessment parameters; and a set of view category specific assessment parameters, which are unique to the set of assessment parameters.	