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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
17/558,271	12/21/2021	Liye Pei	602209-US-2	1057
61604	7590	06/04/2024	EXAMINER	
GE Precision Healthcare LLC			KLEIN, BROOKE L	
IP Department				
3000 N. Grandview Blvd.				
Mail Code W436				
Waukesha, WI 53188				
			ART UNIT	PAPER NUMBER
			3797	
			NOTIFICATION DATE	DELIVERY MODE
			06/04/2024	ELECTRONIC

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DETAILED ACTION

Notice of Pre-AIA or AIA Status

The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

Claim Objections

Claims 13-14, 17 are objected to because of the following informalities:

- In claim 13, line 5 “dertermind” should be amended to read –determine—
- In claim 14, line 2 “leat” should be amended to read –least—
- In claim 17, line 3, “according” should be amended to read –according—
- In claim 17, line 4, “reflection” should be amended to read –reflecting—
- In claim 17, line 5, “anatomica” should be amended to read –anatomical—
- In claim 17, line 6, “first signal signal” should be amended to read –first signal—

Appropriate correction is required.

Claim Rejections - 35 USC § 101

35 U.S.C. 101 reads as follows:

Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

Claims 1-20 are rejected under 35 U.S.C. 101 because the claimed invention is directed to a judicial exception in the form of an abstract idea without significantly more.

In a test for patent subject matter eligibility, the claims pass Step 1 (see 2019 Revised Patent Subject Matter Eligibility), as they are related to a process, machine, manufacture, or composition of matter.

When assessed under Step 2A, Prong I, Independent claims 1 and 12 are found to recite a judicial exception (i.e. abstract idea). In this instance, claims 1 and 12 recite the limitations “determine/determining an anatomical region corresponding to the ultrasonic image”, “generate/generating a first visual indication reflecting the anatomical region corresponding to the ultrasonic image”, “determine/determining a quality level of the ultrasonic image”, “generate/generating a second visual indication reflecting the quality level of the ultrasonic image”. The cited limitations, under their broadest reasonable interpretation, encompass a mental process (i.e. abstract idea) of determining and generating visual indications which can be performed in the mind or by a human using a pen and a paper (e.g. observation, evaluation, judgment, opinion). In other words, a person could reasonably determine an anatomical region corresponding to an ultrasonic image (e.g. via observation/evaluation), generate a first visual indication reflecting the anatomical region (e.g. via a mental image or by using pen and paper to draw/write an indication of the anatomical region), determine a quality level of the ultrasonic image (e.g. via observation/evaluation/opinion), generate a second visual indication reflecting the quality level of the ultrasonic image (e.g. via a mental image or by using pen and paper to draw/write an indication of the anatomical region) . Examiner notes with respect to claim 12 that with the exception of generic computer-implemented steps (e.g. the processor recited in claim 12), there is nothing in the claims that preclude the cited limitations from being performed by a human, mentally or with pen and paper and with respect to claim 1, there is nothing in the claims that preclude the cited limitations from being performed by a human, mentally or with pen and paper, thus the claimed limitations recite a judicial exception (MPEP 2106.04(a)) and the claim must be reviewed under Step 2A, Prong II to determine patent eligibility.

Step 2A, Prong II determines whether any claim recites an additional element that integrates the judicial exception into a practical application. Independent claims recites the following additional element(s):

- Obtain/obtaining ultrasonic data about tissue to be imaged
- Generate/generating an ultrasonic image based on the ultrasonic data
- Send/sending a first signal to a display device, wherein the first signal is configured so that the display device simultaneously displays the ultrasonic image, the first visual indication, and the second visual indication.
- A probe configured to acquire ultrasonic data (claim 12)
- A display device (claim 12)
- A processor (claim 12)

The additional element(s) in the cited independent claim(s) are not found to integrate the judicial exception into a practical application. In this case, obtaining ultrasonic data is merely insignificant pre-solution activity of data gathering, generating an ultrasonic image is merely insignificant extra-solution activity of generic processing of medical data to generate an image (as evidenced by NPL textbook Szabo "Diagnostic Ultrasound Imaging: Inside Out" specifically chapter 10 provided herein pg. 373, which discloses the backend digital scan converter (of a generic ultrasound imaging system (see fig. 10.4)) performs image formation from beamformed radiofrequency (FR) data line), sending a first signal to a display wherein the first signal is configured so that display device simultaneously displays the ultrasonic image, the first visual indication, and the second visual indication is merely insignificant post solution activity of displaying data/results. These elements are seen as adding insignificant extra-solution activity to the judicial exception. Furthermore, a probe, a display device, and a processor are seen as merely generic components of an ultrasound imaging system (as evidenced by Szabo pg. 373 fig. 10.4 described as a block diagram of a generic ultrasound imaging system comprising a probe (identified as "transducer"), a display device (identified as "Display"), and a processor (identified as "back end" including a plurality of processors (i.e. CPUs, microprocessors, digital scan converter, postprocessor, pre-processor, signal processors, etc. see also description on pg. 373 regarding controller(computers) which

discloses a typical system will have one or more microprocessor or a PC that directs the operation of the entire system) and thus are not found to amount to a particular machine. They do no more than link the judicial exception to a particular technological environment or field of use. Therefore, under step 2A Prong II the Judicial exception is not integrated into a practical application by additional elements of independent claims 1 and 12 and the claims must be reviewed under Step 2B to determine patent eligibility.

Step 2B determines where a claim amounts to significantly more.

The additional elements listed above do not amount to significantly more than the judicial exception. In this instance, as noted above, the additional elements amount to merely adding insignificant extra-solution activity to the judicial exception and/or are generic components of an ultrasound imaging system. Additionally there is no improvement in the functioning of the computer or technological field, and there is no transformation of subject matter into a different state. Therefore, under Step 2B in a test for patent subject matter eligibility, the judicial exception of the independent claim(s) do not amount to significantly more and the independent claim(s) remain patent ineligible.

Dependent claims 2-11 and 13-20 further limit the abstract idea of independent claims 1 and 12. When analyzed as a whole, these claims are held to be patent ineligible under 35 U.S.C. 101 because the additional recited limitations fail to establish that the claims are not directed towards an abstract idea and do not sufficiently integrate the subject matter into a practical application or recite elements which constitute significantly more than the abstract ideas identified. The dependent claims are directed toward additional elements which encompass abstract ideas

In this instance, dependent claims recite the following limitations:

- Generating, according to the quality level of (each of the plurality of) the ultrasonic image(s) and the anatomical region(s) corresponding to (each of the plurality of) the ultrasonic image(s), a third visual indication reflecting scan completeness of the

tissue to be imaged where the anatomical region(s) is/are located (claims 6, 11, and 17)

The cited limitation, under their broadest reasonable interpretation, encompass mental processes (i.e. abstract idea) which can be performed in the mind or by a human using a pen and a paper (e.g. observation, evaluation, judgment, opinion). In other words, a human could reasonably generate a third visual indication reflecting scan completeness of the tissue to be imaged (e.g. via mental image or with the help of pen and paper to indicate the “scan completeness”). Examiner notes that with the exception of generic computer-implemented steps (e.g. the processor of claim 17), there is nothing in the claims that preclude the limitation from being performed by a human, mentally or with pen and paper, thus the claimed limitation is considered to be directed towards a judicial exception (MPEP 2106.04(a)).

Under Step 2A, Prong II for dependent claims 2-11 and 13-20, present additional elements which only further narrow the judicial exceptions (e.g. claims 2 and 13 which only further narrows the determining of the quality level to be automatic by using a corresponding neural network (seen as a generic computing elements without reciting a specific configuration of the neural network to amount to a particular machine), claims 3 and 14 which only further narrow the nature of the second visual indication, claims 4 and 15 which only further narrow the nature of the positioning of the second visual indication seen as insignificant extra-solution activity, claims 5 and 16 which only further narrow the nature of the first visual indication to be a visual indication of a position of the anatomical region, claims 6, 11, and 17 which further narrow the nature of the first signal to include the third visual indication for simultaneous display seen as merely insignificant extra-solution activity of displaying results/data, claims 7 and 18 which recite sending a second signal to the display device in response to user input seen as merely insignificant extra-solution activity of receiving a user input for controlling a display which is generic to ultrasound imaging systems as evidenced by Szabo pg. 373 which discloses The controller

senses the settings of the controls and input devices, such as the keyboard, and executes the commands to control the hardware to function in the desired mode. It orchestrates the necessary setup of the transmit and receive beamformers as well as the signal processing, display, and output functions, claims 7 and 8 further narrow the nature of the second signal such that it is configured so that the display device displays an enlarged ultrasonic image, such display of an enlarged image by a second signal is merely insignificant post-solution activity of displaying results, such display of an enlarged ultrasound image by user input is further generic as evidenced by Szabo pg. 376 describing a zoom mode in which a video zoom is a magnification (i.e. enlargement) of a region of interest in the video image, such a mode would be controlled by a signal from a user input as described above, claims 9-10 and 20 which further narrow the nature of the ultrasonic images, the first visual indication, the second visual indication and the anatomical region(s)) and provide no additional element which are found to integrate the judicial exception into a practical application.

These dependent claims include no additional claims that are sufficient to amount to significantly more than the judicial exception. Additionally, there is no improvement in the functioning of the computer or technological field, and there is no transformation of subject matter into a different state. As discussed above with respect to integration of the abstract idea into a practical application, the additional claims do not provide any additional elements that would amount to significantly more than the judicial exception. Under Step 2B, these claims are not patent eligible.

Claim Rejections - 35 USC § 112

The following is a quotation of 35 U.S.C. 112(b):

(b) CONCLUSION.—The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the inventor or a joint inventor regards as the invention.

The following is a quotation of 35 U.S.C. 112 (pre-AIA), second paragraph:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 7-8 and 12-20 are rejected under 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA), second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventor or a joint inventor (or for applications subject to pre-AIA 35 U.S.C. 112, the applicant), regards as the invention.

Claims 7 and 18 recites the limitation “an enlarged ultrasonic image”. It is unclear if the enlarged ultrasonic image is or corresponds with the ultrasonic image of claim 1 or if this is a different ultrasonic image. Furthermore, it is unclear if the claim is attempting to further define the display of the ultrasonic image in claim 1 such that the first signal corresponds with the second signal and displays the enlarged ultrasonic image as the ultrasonic image of claim 1 or if this is a different display of images. In other words, it is unclear if the claim is attempting to further narrow the ultrasonic image to be an enlarged ultrasonic image or if this is a separate displayed image that may or may not correspond with the previously displayed ultrasonic image. For examination purposes, it has been interpreted to mean any enlarged ultrasonic image, however, clarification is required.

Claims 8 and 19 recite the limitation “a quality indication of the ultrasonic image”. It is unclear if the quality indication is the same as or corresponds with the second visual indication reflecting the quality level or if this is a different quality indication. For examination purposes, it has been interpreted to mean any quality indication, however, clarification is required.

Claims 9 and 20 recite the limitation “an anatomical region corresponding to each of the plurality of ultrasonic images”. It is unclear if this is the same anatomical region recited previously (i.e. which is determined in claims 1 and 12, respectively) or if this is a different/distinct anatomical region. For examination purposes, it has been interpreted to mean any anatomical region(s), however, clarification is required.

Claims 9 and 20 recite the limitation “a quality level”. It is unclear if this is the same quality level recited previously (i.e. which is determined in claims 1 and 12 respectively) or if this is a different quality level. For examination purposes, it has been interpreted to mean any quality level, however, clarification is required.

Claims 10 and 11 recite the limitation “the anatomical regions”. Examiner notes that anatomical regions suggests/implies plural anatomical regions, which lacks sufficient antecedent basis. For example, claim 9 merely sets forth an anatomical region corresponding to each of the plurality of ultrasonic images. Such a limitation in claim 9 includes an interpretation in which only one anatomical region corresponds to each of the plurality of ultrasonic images, therefore making the claim limitation “anatomical regions” unclear as to whether the claim is attempting to further narrow the anatomical region of claim 9 to be multiple anatomical regions or if these are new anatomical regions. For examination purposes, it has been interpreted to mean any anatomical regions corresponding to the plurality of ultrasonic image, however, clarification is required.

Claim 12 recites the limitation “a processor”. It is unclear if this is the processor recited previously with respect to the display device or if this is a new/different processor. In other words, it is unclear if the claim is attempting to recite multiple processors that send different signals for reception by the display device or if this is the same processor. If the claim is attempting to recite the same processor, it is recommended to first recite “a processor” and corresponding configurations of the processor and subsequently recite “a display device” and corresponding configurations of the display device such that the processor described in the configurations of the display device hold antecedent basis to the processor of the ultrasonic imaging system. Examiner notes that such switching of recitations would further require changing the language regarding the display device in line 14 such that it reads “a display device” or such that the limitation regarding the signal is recited as a further configuration of the processor recited after the display device is introduced. For examination purposes,

it has been interpreted that they may be the same processor or different processors, however, clarification is required.

Claim 12 recites the limitation “obtain ultrasonic data”. It is unclear if this is the same ultrasonic data acquired by the probe or if this is different ultrasonic data (i.e. data from another probe, stored data, ultrasonic data transferred from an external device, etc.). For examination purposes, it has been interpreted to mean any ultrasonic data, however, clarification is required.

Claim 12 recites the limitation “the ultrasonic data”. It is unclear which of the previously recited ultrasonic data the claim is referring to. For examination purposes, it has been interpreted to mean either of the previously recited ultrasonic data, however, clarification is required.

Claim 12 recites the limitation “a first signal”. It is unclear if this is the same “signal” recited previously with respect to the display device receiving a signal from the processor, or if this is a different signal. For examination purposes, it has been interpreted to mean any first signal, however, clarification is required.

Claim Rejections - 35 USC § 102

In the event the determination of the status of the application as subject to AIA 35 U.S.C. 102 and 103 (or as subject to pre-AIA 35 U.S.C. 102 and 103) is incorrect, any correction of the statutory basis (i.e., changing from AIA to pre-AIA) for the rejection will not be considered a new ground of rejection if the prior art relied upon, and the rationale supporting the rejection, would be the same under either status.

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(a)(1) the claimed invention was patented, described in a printed publication, or in public use, on sale, or otherwise available to the public before the effective filing date of the claimed invention.

(a)(2) the claimed invention was described in a patent issued under section 151, or in an application for patent published or deemed published under section 122(b), in which the patent or application, as the case may be, names another inventor and was effectively filed before the effective filing date of the claimed invention.

Claims 1, 3-5, 9-10, 12, 14-16, and 20 are rejected under 35 U.S.C. 102(a)(1) as being anticipated by Choi et al. (US 20180161010 A1), hereinafter Choi.

Regarding claims 1 and 12,

Choi discloses an ultrasonic imaging system (at least fig. 1 (100) and corresponding disclosure in at least [0038] or at least fig. 4 (400) and corresponding disclosure in at least [0098]), comprising:

A probe (at least fig. 1 or 4 (20) and corresponding disclosure in at least [0040]), configured to acquire ultrasonic data ([0040] which discloses the probe may include a plurality of transducers which may receive ultrasound signals (i.e. data) from the object to generate reception signals);

A display device (at least fig. 1 or 4 (140) and corresponding disclosure in at least [0044]), configured to receive a signal from the processor (at least fig. 1 (120/130) and corresponding disclosure in at least [0041]-[0045] or at least fig. 4 (310) and corresponding disclosure in at least [0064]) for display ([0090] which discloses the display may display an operation state of the ultrasound image processing apparatus 300, an ultrasound image, a user interface screen, etc. based on a control signal from the processor 310); and

A processor (120/130 or 310), wherein the processor (120/130 or 310) is configured to:

Obtain ultrasonic data about tissue to be imaged ([0042]-[0043] which discloses the controller may control the ultrasound receiver to generate ultrasound data converting reception signals received from the probe and the image processor may generate an ultrasound image by using ultrasound data generated from the ultrasound receiver 115, thus image processor obtains ultrasonic data about tissue to be imaged [0068] The processor 310 generates at least one ultrasound image based on ultrasound

image data acquired by the probe 20. Thus the processor obtains the ultrasonic data acquired by the probe)

Generate an ultrasonic image (at least fig. 5 (510) and corresponding disclosure in at least [0106]) based on the ultrasonic data ([0068] The processor 310 generates at least one ultrasound image based on ultrasound image data acquired by the probe 20. Thus the processor obtains the ultrasonic data acquired by the probe)

Determine an anatomical region corresponding to the ultrasonic image (at least fig. 5 (542-5546 and corresponding disclosure in at least [0108]-[0110] which discloses, the ultrasound image processing apparatus analyzes target regions respectively included in the ultrasound images, may extract features data from the generated ultrasound images and identify anatomical structures, and may automatically tag, based on the identified anatomical structures, the ultrasound images with pieces of information about the target regions included in the ultrasound images. And [0111] which discloses the ultrasound image processing apparatus may detect a target region of which imaging is omitted among target regions in the imaging list based on the pieces of information with which the ultrasound images are automatically tagged. Examiner notes that identifying anatomical structures is interpreted as determining an anatomical region or detecting a target region of which imaging is omitted is interpreted to be a determination of an anatomical region corresponding to the ultrasonic image or since the processor detects target regions which are omitted, it thus determines target regions (i.e. anatomical regions) which have been imaged accordingly), and generating a first visual indication (at least fig. 5 (548) and corresponding disclosure in at least [0113] or at least at least fig. 11D (1110d) and corresponding disclosure in at least [0155]. See also fig. 11A (1110) and corresponding disclosure in at least [0151] which discloses the second sub-list 1110 includes at least one of a target region currently being imaged and a target region of which imaging is omitted and [0083] which discloses the processor 310 may generate a second sub-list including at least one of a target region currently being imaged and

a target region of which imaging is omitted, based on the recommended imaging order in the imaging list and the first imaging status information) reflecting the anatomical region corresponding to the ultrasonic image ([0113] which discloses the first imaging status information indicating whether target regions in the imaging list 520 have been imaged);

Determine a quality level of the ultrasonic image (at least fig. 5 (S552-S554) and corresponding disclosure in at least [0115]-[0118]), and generate a second visual indication reflecting the quality level of the ultrasonic image (at least fig. 5 (558) and corresponding disclosure in at least [0121] or at least fig. 11D (1125d) and corresponding disclosure in at least [0155] which discloses a target region of which imaging has an image quality lower than a threshold may be represented by an indicator 1125d); and

Send a first signal to the display device, wherein the first signal is configured to cause the display device to simultaneously display the ultrasonic image (at least fig. 7 (700) and corresponding disclosure in at least [0133] or at least fig. 11D (1120d) and corresponding disclosure in at least [0155]), the first visual indication (at least fig. 7 (710-720) and corresponding disclosure in at least [0131] or at least fig. 11D (1110d) and corresponding disclosure in at least [0155]). See also fig. 11A (1110) and corresponding disclosure in at least [0151] which discloses the second sub-list 1110 includes at least one of a target region currently being imaged and a target region of which imaging is omitted), and the second visual indication (at least fig. 7 (730) and corresponding disclosure in at least [0132] or at least fig. 11D (1125d) and corresponding disclosure in at least [0155] which discloses a target region of which imaging has an image quality lower than a threshold may be represented by an indicator 1125d) (Such display of the visual indicators simultaneously as depicted in figs. 7 and/or 11D would require a first signal from the processor to the display device to be displayed accordingly).

Examiner notes that the system would perform the method of claim 1 having corresponding method steps.

Regarding claims 3 and 14,

Choi further discloses wherein the second visual indication comprises at least one of a color indication ([0133] which discloses the ultrasound image processing apparatus may indicate whether a quality value is less than the first reference value by using various graphical indicators other than pass or fail, such as colors and see also at least fig. 11D (1125d) in which the indication is a color as described in [0152] in which the second sub-list is displayed such that region is indicated in a color or with shading that is distinguishable from that of the other regions on the thumbnail images) or an icon indication (see at least fig. 7 in which 730 is an icon indication of “pass” or “fail” and [0133] which discloses the ultrasound image processing apparatus may indicate whether a quality value is less than the first reference value by using various graphical indicators other than pass or fail, such as geometrical shapes, checkboxes, icons, etc.)

Regarding claims 4 and 15,

Choi further discloses wherein the second visual indication is provided at an edge of the ultrasound image (See at least fig. 11D in which the second visual indication is provided over the entire ultrasound image 1120d in the thumbnail list)

Regarding claims 5 and 16,

Choi further discloses wherein the first visual indication comprises a visual indication of a position of the anatomical region corresponding to the ultrasonic image on the tissue to be imaged (at least fig. 11D (1110d) depicting a visual indication of a position of the anatomical region corresponding to the ultrasonic image on the tissue to be imaged (e.g. long axis of the uterus: lower uterine segment and cervix region, long axis of the uterus: uterine body and fundus region, etc. thus a visual indication of the position (long axis lower uterine segment and cervix region or long axis uterine body and fundus

region) of the anatomical region (e.g. the uterus). See also at least fig. 14 in which the imaging list may include target regions and standard views (i.e. positions) of the anatomical region)

Regarding claims 9 and 20,

Choi further discloses wherein the ultrasonic image comprises a plurality of ultrasonic images (510 and see at least fig. 11D depicting a plurality of ultrasonic images as thumbnails 1120d);

The first visual indication comprises a plurality of first visual indications separately reflecting an anatomical region corresponding to each of the plurality of ultrasonic images (at least fig. 11D depicting a plurality of first visual indications separately reflecting an anatomical region corresponding to each of the plurality of ultrasound images 1120d); and

The second visual indication comprises a plurality of second visual indications separately reflecting a quality level of each of the plurality of ultrasonic images (see at least fig. 11D. Examiner notes that display of the ultrasound image thumbnail 1120d with or without the shading/coloring of 1125d constitutes a plurality of second visual indications separately reflecting a quality level of each of the plurality of ultrasonic images. In other words, there is a visual indication for each ultrasound image in which the quality level is above the reference value by displaying the ultrasound image with no shading/coloring as depicted in 1125d and a visual indication for each ultrasound image in which the quality level is below the reference value as indicated by indicator 1125d. Additionally, it is noted that in an instance where each of the images is below the reference value, a plurality of second visual indications (1125d) would exist reflecting the quality level below the reference value for each of the ultrasound images accordingly).

Regarding claim 10,

Choi further discloses the anatomical regions corresponding to the plurality of ultrasonic images come from the same tissue to be images ([0071] which discloses an imaging list means a list including at least one target region of an object (i.e. the same subject) that needs to be imaged for performing a specific test and [0073] which discloses the imaging list may include not only a target region of the object but also at least one or a combination of a recommended imaging order and a standard view of the target region. The imaging list will now be described in more detail with reference to FIGS. 13 and 14)

Claim Rejections - 35 USC § 103

In the event the determination of the status of the application as subject to AIA 35 U.S.C. 102 and 103 (or as subject to pre-AIA 35 U.S.C. 102 and 103) is incorrect, any correction of the statutory basis (i.e., changing from AIA to pre-AIA) for the rejection will not be considered a new ground of rejection if the prior art relied upon, and the rationale supporting the rejection, would be the same under either status.

The following is a quotation of 35 U.S.C. 103 which forms the basis for all obviousness rejections set forth in this Office action:

A patent for a claimed invention may not be obtained, notwithstanding that the claimed invention is not identically disclosed as set forth in section 102, if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 2 and 13 are rejected under 35 U.S.C. 103 as being unpatentable over Choi in view of Lu et al. (US 20210077068 A1), hereinafter Lu.

Regarding claims 2 and 13,

Choi teaches the elements of claims 1 and 12 as previously stated. Choi further teaches wherein the processor is configured to determine the quality level of the ultrasonic image automatically.

Choi fails to explicitly teach wherein the processor is configured to determine the quality level of the ultrasonic image automatically by using a corresponding neural network based on the tissue to be imaged.

Lu teaches wherein a processor (at least fig. 1 (105) and corresponding disclosure in at least [0028] which discloses the machine learning circuitry 104 may include or be executed by a computer processor) is configured to determine a quality level of an ultrasonic image automatically by using a corresponding neural network (at least fig. 3 (300) and corresponding disclosure in at least [0048]) based on a tissue to be imaged ([0051] which discloses the neural network 300 may determine whether the received ultrasound images represent one or more clinically desirable or non-clinically desirable views of an organ, and may further recognize one or more anatomical structures in the received ultrasound images and may automatically label the recognized anatomical structures in the images, and still further may automatically determine and assign an image quality grade to the received ultrasound images and [0038] which discloses each training image may nonetheless be pre-determined as adequately representing a clinically desirable view of a heart or other anatomical structure, thus is based on a tissue to be imaged)

and generating a second visual indication reflecting the quality level of the ultrasonic image ([0074] which discloses any suitable identifying information may be utilized to display the determined image grade of the ultrasound images, including, for example, numbers, textual description, colors (e.g. red color may indicate poor image quality; green color may indicate good image quality) or the like)

It would have been obvious to a person having ordinary skill in the art before the effective filing date to have modified Choi to include using a corresponding neural network based on a tissue to be imaged to determine the quality level of the ultrasonic image automatically as taught by Lu in order to

employ a computationally intelligent technique, allowing the processor to learnt to adapt to unknown and/or changing environment for better performance (Lu [0033]). Such a modification would thus enhance the quality level determination of Choi by providing such computationally intelligent techniques. Furthermore, such a modification amounts to merely one known quality level determination method for another yielding predictable results with respect to ultrasound image quality monitoring thereby rendering the claim obvious (MPEP 2143).

Claims 6, 11, and 17 are rejected under 35 U.S.C. 103 as being unpatentable over Choi in view of WIPO Roundhill (WO 2012073164 A1), hereinafter Roundhill.

Regarding claims 6 and 17,

Choi teaches the elements of claims 1 and 12 as previously stated. Choi further teaches wherein the processor is further configured to:

Generate according to the anatomical region corresponding to the ultrasonic image, a third visual indication reflection scan completeness of the tissue to be imaged where the anatomical region is located (at least fig. 11D (1110d) and corresponding disclosure in at least [0155] and [0151] which discloses in detail the ultrasound image processing apparatus 300 may display as the list 1110 the second sub-list including at least one of a target region currently being imaged and a target region of which imaging is omitted. Thus by displaying a second sub-list including at least one of a target region currently being imaged and a target region of which imaging is omitted, this includes a second sub-list including both a target region currently being imaged and a target region of which imaging is omitted, thus reflecting a scan completeness of the tissue to be imaged where the anatomical region is located), wherein the first signal is further configured so that the display device simultaneously displays the ultrasonic image, the first visual indication, the second visual indication, and the third visual indication (see at least fig. 11D).

Choi fails to explicitly teach wherein the processor is configured to generate, according to the quality level of the ultrasonic image and the anatomical region, the third visual indication reflecting scan completeness of the tissue to be imaged where the anatomical region is located.

Roundhill, in a similar field of endeavor involving ultrasound imaging, teaches wherein a processor is configured to generate, according to a quality level (at least fig. 2 (8a) and corresponding disclosure in at least pg. 13 lines 3-12 which discloses Three visual indicators can be seen at 8a, 8b, 8c, each of which conveys different information about the quality of the scanning performed at that region of the body part) of the ultrasonic image and an anatomical region corresponding to the ultrasonic image (at least fig. 2 (8a) and corresponding disclosure in at least pg. 13 lines 3-12 which discloses Three visual indicators can be seen at 8a, 8b, 8c, each of which conveys different information about the quality of the scanning performed at that region of the body part), a third visual indication (at least fig. 2 (6) and corresponding disclosure in at least pg. 13 lines 3-15) reflecting scan completeness of a tissue to be imaged where the anatomical region is located (pg. 13 lines 15-17 which discloses as the transducer 3 scans more and more of the patient's anatomy, the anatomy in the video display is increasingly overlaid by visual indicators 8. Feedback, by these visual means on the progress and completeness of the scanning is thus available to the operator or technician. Thus the feedback using the video display of fig. 6 with visual indicators 8 is interpreted to be a reflection of completeness of a tissue to be imaged)

Wherein a first signal is further configured so that a display device simultaneously displays the ultrasonic image (pg. 6 lines 18-34 which discloses in order to facilitate ease of use of the medical imaging 30 system, the invention provides for the possibility that the normal ultrasound image can be displayed such that both the ultrasound image and the image on patient image display can be viewed simultaneously. This can be achieved either by allocating a section of the patient image display for the ultrasound image), a first visual indication reflecting the anatomical region corresponding to the ultrasound image (see at least fig. 2 (8) in which the position of the indicator is considered a first visual

indication reflecting the anatomical region), a second visual indication reflecting the quality level of the ultrasonic image (see at least fig. 2 (8a/8b) and corresponding disclosure in at least pg. 13 lines 3-15.

Examiner notes that the pattern of the indicator as disclosed in pg. 13 is considered the second visual indication reflecting the quality level), and the third visual indication (considered to be all of the elements of fig. 2 in combination including all of the indicators 8 at each of the regions reflecting the completeness of the scan)

It would have been obvious to a person having ordinary skill in the art before the effective filing date to have modified Choi to include generating a third visual indication, according to the quality level and anatomical region and simultaneously displaying the ultrasound image, the first visual indication, the second visual indication, and third visual indication as taught by Roundhill in order to lower the threshold of operator skill required to perform an exam of a patient, requiring less training while maintaining, or even improving, the consistency and quality of the data obtained from the patient (Roundhill pg. 6-7). Furthermore, such a modification would provide for visual display of an area actually covered with respect to the total area of the selected body part, and only a glance is required to see which part of the patient has been scanned previously (Roundhill pg. 7 lines 23-29) with enhanced visualization of the quality level at the scanned region.

Examiner notes that Roundhill further teaches an embodiment in which the third visual indication reflecting scan completeness may be displayed on a model image (see fig. 11C), a person having ordinary skill in the art would have recognized applying the configurations/methods of Roundhill to such a model image of Choi to provide such enhanced visualization of progress/completion or including the third indication with the first signal for display of figs. 7 and 11D as previously relied upon to provide detailed lists of the image quality/anatomical regions in addition to the third visual indication providing for enhanced visualizations of the scan completeness/progress.

Regarding claim 11,

Choi teaches the elements of claim 9 as previously stated. Choi further teaches further comprising:

Generating according to the anatomical region corresponding to each of the ultrasonic images, a third visual indication reflection scan completeness of the tissue to be imaged where the anatomical region is located (at least fig. 11D (1110d) and corresponding disclosure in at least [0155] and [0151] which discloses in detail the ultrasound image processing apparatus 300 may display as the list 1110 the second sub-list including at least one of a target region currently being imaged and a target region of which imaging is omitted. Thus by displaying a second sub-list including at least one of a target region currently being imaged and a target region of which imaging is omitted, this includes a second sub-list including both a target region currently being imaged and a target region of which imaging is omitted, thus reflecting a scan completeness of the tissue to be imaged where the anatomical region is located), wherein the first signal is further configured so that the display device simultaneously displays the ultrasonic images, the first visual indications, the second visual indications, and the third visual indications (see at least fig. 11D).

Choi fails to explicitly teach generating according to the quality level of each of the plurality of ultrasonic images and the anatomical region, the third visual indication reflecting scan completeness of the tissue to be imaged where the anatomical region is located.

Roundhill, in a similar field of endeavor involving ultrasound imaging, teaches generating according to a quality level (at least fig. 2 (8a) and corresponding disclosure in at least pg. 13 lines 3-12 which discloses Three visual indicators can be seen at 8a, 8b, 8c, each of which conveys different information about the quality of the scanning performed at that region of the body part) of each of a plurality of ultrasonic images and an anatomical region corresponding to the ultrasonic image (at least fig. 2 (8a) and corresponding disclosure in at least pg. 13 lines 3-12 which discloses Three visual

indicators can be seen at 8a, 8b, 8c, each of which conveys different information about the quality of the scanning performed at that region of the body part), a third visual indication (at least fig. 2 (6) and corresponding disclosure in at least pg. 13 lines 3-15) reflecting scan completeness of a tissue to be imaged where the anatomical region is located (pg. 13 lines 15-17 which discloses as the transducer 3 scans more and more of the patient's anatomy, the anatomy in the video display is increasingly overlaid by visual indicators 8. Feedback, by these visual means on the progress and completeness of the scanning is thus available to the operator or technician. Thus the feedback using the video display of fig. 6 with visual indicators 8 is interpreted to be a reflection of completeness of a tissue to be imaged)

Wherein a first signal is further configured so that a display device simultaneously displays an ultrasonic image (pg. 6 lines 18-34 which discloses in order to facilitate ease of use of the medical imaging 30 system, the invention provides for the possibility that the normal ultrasound image can be displayed such that both the ultrasound image and the image on patient image display can be viewed simultaneously. This can be achieved either by allocating a section of the patient image display for the ultrasound image), first visual indications reflecting the anatomical region corresponding to each of the ultrasound image (see at least fig. 2 (8) in which the position of the indicator is considered a first visual indication reflecting the anatomical regions), second visual indication reflecting the quality level of the ultrasonic image (see at least fig. 2 (8a/8b) and corresponding disclosure in at least pg. 13 lines 3-15. Examiner notes that the pattern of the indicator as disclosed in pg. 13 is considered the second visual indication reflecting the quality level), and the third visual indication (considered to be all of the elements of fig. 2 in combination including all of the indicators 8 at each of the regions reflecting the completeness of the scan)

It would have been obvious to a person having ordinary skill in the art before the effective filing date to have modified Choi to include generating a third visual indication, according to the quality level and anatomical region and simultaneously displaying the ultrasound image, the first visual indication,

the second visual indication, and third visual indication as taught by Roundhill in order to lower the threshold of operator skill required to perform an exam of a patient, requiring less training while maintaining, or even improving, the consistency and quality of the data obtained from the patient (Roundhill pg. 6-7). Furthermore, such a modification would provide for visual display of an area actually covered with respect to the total area of the selected body part, and only a glance is required to see which part of the patient has been scanned previously (Roundhill pg. 7 lines 23-29) with enhanced visualization of the quality level at the scanned region.

a person having ordinary skill in the art would have recognized applying the configurations/methods of Roundhill including the third indication with the first signal for display of 11D of Choi as previously relied upon to provide detailed lists of the image quality/anatomical regions in addition to the third visual indication providing for enhanced visualizations of the scan completeness/progress.

In such a modified system, by including the third visual indication to be displayed with the elements of fig. 11D, the ultrasound images of Choi, the first visual indications, the second visual indications, and the third visual indication are displayed simultaneously.

Claims 7-8 and 18-19 are rejected under 35 U.S.C. 103 as being unpatentable over Choi in view of Singhal et al. (US 20100119164 A1), hereinafter Singhal.

Regarding claims 7 and 18,

Choi teaches the elements of claims 1 and 12 as previously stated. Choi further teaches wherein the processor is further configured to send a second signal to the display device in response to a user input ([0057] which discloses the main display and the sub-display 122 may provide graphic user interfaces (GUI) to receive user's inputs of data or a command to control the ultrasound image

processing apparatus 100. For example, the main display 121 may display an ultrasound image and the sub-display 122 may display a control panel to control display of the ultrasound image as a GUI).

Choi further teaches wherein the display device is caused to display an enlarged ultrasonic image (see at least figs. 11A-11C depicting enlarged ultrasonic images (i.e. enlarged with respect to other ultrasonic images (such as those depicted in figs. 7 or 11D)).

While it would appear that the second signal may be used to cause the display device to display the enlarged ultrasonic image since the second signal is for controlling display of the ultrasonic image as a GUI, this feature is not explicitly disclosed.

Singhal, in a similar field of endeavor involving medical image processing, teaches sending a second signal to a display device in response to a user input ([0019] which discloses the user may, in accordance with an embodiment of the present invention, point/click/select one of the ROIs 311-315, Upon selection, the view on the display would change to a “zoomed in” (i.e. enlarged) version of the portion of the image 302 that was bounded by the selected ROI), wherein the second signal causes the display device to display an enlarged medical image (see at least figs. 5-6 (412 and 416) and corresponding disclosure in at least [0022] interpreted as enlarged medical images in that portions of the medical image of fig. 4 are enlarged (i.e. zoomed in on)).

It would have been obvious to a person having ordinary skill in the art before the effective filing date to have modified Choi to include sending a second signal as taught by Singhal in order to allow a user to visualize ROIs within at least one of the ultrasound images acquired by Choi, thereby allowing enhanced visualization of said ROIs by a user. Such a modification would allow for enhanced diagnosis of the subject by allowing a user to focus on specific desired regions within the ultrasonic image data.

Regarding claims 8 and 19,

Choi, as modified, teaches the elements of claims 7 and 18 as previously stated. Choi, as currently modified, fails to explicitly teach wherein the second signal causes the display device to display the enlarged ultrasound image and a quality indication of the ultrasonic image.

Nonetheless, Singhal further teaches wherein the second signal causes the display device to display (see at least figs. 5 and 6 and [0022]. Such display would be caused by a second signal in response to the user input for zooming in) the enlarged medical image (412/416) and a quality indication (at least figs. 5/6 (351 or 352) and corresponding disclosure in at least [0022]) of the medical image ([0026] which discloses In a one bit implementation, the quality stamp would indicate whether the image being supplied is either lossy or lossless, i.e., one of two possibilities, or simply whether the image is above a predetermined quality requirement (e.g., peak signal-to-noise ratio)).

It would have been obvious to a person having ordinary skill in the art before the effective filing date to have modified Choi, as currently modified, to include the second signal as taught by Singhal in order to allow for the user to allow the user to readily recognize the quality level of the medical image data that he/she perceives on the display, thereby avoiding harm in the reliability of making diagnoses and further avoiding legal and regulatory disputes in a case of misdiagnosis (Singhal [0016]) when viewing the enlarged image.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Abolmaes (US 20200069292 A1), teaches simultaneous display of an ultrasound image (see fig. 4 (406) and corresponding disclosure in at least [0098]), a first visual indication (see fig. 4 (404) and corresponding disclosure in at least [0098]) reflecting an anatomical region corresponding to the ultrasonic image determined by a processor ([0052] which discloses [0052] The analyzer 14 may also determine, based on the derived one or more extracted feature representations, an image property

associated with the set of ultrasound images. In some embodiments, the image property may be a view category, for example. Accordingly, in some embodiments, the analyzer 14 may input the one or more extracted feature representations into a view category specific neural network in order to determine a view category within which the set of ultrasound images are determined to fall), and a second visual indication (see fig. 4 (402) and corresponding disclosure in at least [0099]) reflecting a quality level of the ultrasound image determined by a processor ([0051] which discloses the analyzer 14 may then determine, based on the derived one or more extracted feature representations, a quality assessment value representing a quality assessment of the set of ultrasound images)

Any inquiry concerning this communication or earlier communications from the examiner should be directed to BROOKE L KLEIN whose telephone number is (571)270-5204. The examiner can normally be reached Mon-Fri 7:30-4.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at <http://www.uspto.gov/interviewpractice>.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ashley Buran can be reached on 571-270-5284. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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assistance from a USPTO Customer Service Representative, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/BROOKE LYN KLEIN/

Examiner, Art Unit 3793

/KATHERINE L FERNANDEZ/

Primary Examiner, Art Unit 3798

Notice of References Cited	Application/Control No. 17/558,271		Applicant(s)/Patent Under Reexamination Pei et al.	
	Examiner BROOKE L KLEIN		Art Unit 3797	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date YYYY-MM-DD	Name	CPC Classification	US Classification
*	A	US-20100119164-A1	2010-05-13	Singhal; Dave M.	H04N19/33	382/233
*	B	US-20200069292-A1	2020-03-05	Abolmaesumi; Purang	A61B8/5207	1/1
*	C	US-20210077068-A1	2021-03-18	Lu; Allen	G06T7/0012	1/1
*	D	US-20180161010-A1	2018-06-14	Choi; Choong-hwan	A61B8/54	1/1
	E					
	F					
	G					
	H					
	I					
	J					
	K					
	L					
	M					

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date YYYY-MM-DD	Country	Name	CPC Classification
	N	WO-2012073164-A1	2012-06-07	WO	ROUNDHILL D N	A61B8/00
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	Thomas Szabo, "Diagnostic Ultrasound Imaging: Inside Out", 2014, pg. 365-430 (Year: 2014)
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in YYYY-MM-DD format are publication dates. Classifications may be US or foreign.

<i>Search Notes</i> 	Application/Control No. 17/558,271	Applicant(s)/Patent Under Reexamination Pei et al.
	Examiner BROOKE L KLEIN	Art Unit 3797

CPC - Searched*		
Symbol	Date	Examiner
G06T2207/30168 OR G06T2207/30004 OR G06T2207/10132 OR G06T7/0012 OR A61B8/463 OR A61B8/465	05/29/2024	BK

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	Date	Examiner
PE2E Search including inventor and assignee	05/29/2024	BK

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner

/BROOKE LYN KLEIN/ Examiner, Art Unit 3797	UBC-2006
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PE2E SEARCH - Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	British Equivalents	Time Stamp
L1	1	("20220202395").pn.	(US-PGPUB; USPAT)	OR	ON	ON	2024/03/07 11:44 PM
L2	459	((("PEI") near3 ("Liye")) OR (("YANG") near3 ("Yue")) OR (("QIN") near3 ("Xiaoyan")) OR (("LIU") near3 ("Houbing")) OR (("SHI") near3 ("Kejian"))).INV.	(US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT)	OR	ON	ON	2024/03/08 08:45 AM
L4	300679	general near3 electric ge! near3 precision ge! near3 health	(US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT)	OR	ON	ON	2024/03/08 08:54 AM
L6	198873732	@ad<"20201231"	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO)	OR	ON	ON	2024/03/08 08:55 AM
L7	184832747	@pd<"20191231"	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO)	OR	ON	ON	2024/03/08 08:55 AM
L8	165851	(L2 OR L4)	(US-PGPUB; USPAT)	OR	ON	ON	2024/03/08 08:55 AM
L9	2895998	(quality! WITH image)	(US-PGPUB; USPAT; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO)	OR	ON	ON	2024/03/08 08:56 AM
L10	16694	L9 AND L8 AND L7	(US-PGPUB; USPAT; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO)	OR	ON	ON	2024/03/08 08:56 AM
L11	42054	(G06T2207/30168 OR G06T2207/30004 OR G06T2207/10132 OR G06T7/0012 OR A61B8/463 OR A61B8/465).cpc.	(US-PGPUB; USPAT)	OR	ON	ON	2024/03/08 09:03 AM
L12	194060	(G06T2207/30168 OR G06T2207/30004 OR	(US-PGPUB; USPAT; FIT (AU, AP, AT, CA,	OR	ON	ON	2024/03/08 09:03 AM

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L13	5025	G06T2207/10132 OR G06T7/0012 OR A61B8/463 OR A61B8/465).cpc. (G06T2207/30168).cpc.	CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO) (US-PGPUB; USPAT)	OR	ON	ON	2024/03/08 09:04 AM
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L18	10	L17 AND body near3 mark	(US-PGPUB; USPAT; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO)	OR	ON	ON	2024/03/08 09:11 AM
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L20	28	L19 AND ultra\$1so\$9 WITH imag\$5 AND L6 AND body near3 mark	(US-PGPUB; USPAT; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO)	OR	ON	ON	2024/03/08 09:12 AM
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		degree value) WITH imag\$4 AND ultra\$1so\$9 WITH imag\$5					09:53 AM
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L27	108	L26 AND L23 AND L6	(US-PGPUB; USPAT)	OR	ON	ON	2024/04/01 12:31 PM
L28	420	L26 AND L23 AND L6	(US-PGPUB; USPAT; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO)	OR	ON	ON	2024/04/01 12:31 PM
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UBC-2006

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L43	13	"57733938".fmid.	KR, OA, RU, SU, WO); FPRS; EPO; JPO) (US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; JPO)	OR	ON	ON	2024/05/14 01:24 PM
L44	3007687	quality WITH image	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; JPO)	OR	ON	ON	2024/05/14 03:06 PM
L45	705632	ultra\$1so\$9 WITH imag\$5	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; JPO)	OR	ON	ON	2024/05/14 03:07 PM
L46	35146	L44 AND L45	(US-PGPUB; USPAT)	OR	ON	ON	2024/05/23 01:38 PM
L47	398065	(determin\$8 estimat\$5 calculat\$5 compute computed computing) WITH quality WITH image	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL,	OR	ON	ON	2024/05/23 01:39 PM

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L48	21151	L45 AND L47	PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; JPO) (US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; JPO)	OR	ON	ON	2024/05/23 01:39 PM
L49	6880535	(determin\$9 identif\$8 estimat\$5) WITH ((body examin\$8 anatom\$8) near3 (part region area) target)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; JPO)	OR	ON	ON	2024/05/23 01:41 PM
L50	8694	L49 AND L48	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; JPO)	OR	ON	ON	2024/05/23 01:41 PM
L51	4513	L50 AND a61b\$.cpc.	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL,	OR	ON	ON	2024/05/23 01:41 PM

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L52	525305	(determin\$9 identif\$8 estimat\$5) WITH ((body examin\$8 anatom\$8) near3 (part region area))	PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; JPO) (US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; JPO)	OR	ON	ON	2024/05/23 02:07 PM
L53	18483	L52 AND L45 AND a61b\$.cpc. AND L6	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; JPO)	OR	ON	ON	2024/05/23 02:08 PM
L54	1610	L52 AND L45 AND L47 AND a61b\$.cpc. AND L6	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; JPO)	OR	ON	ON	2024/05/23 02:09 PM
L55	1610	L52 AND L45 AND L47 AND a61b\$.cpc. AND L6	(US-PGPUB; USPAT; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL,	OR	ON	ON	2024/05/23 02:09 PM

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L56	25	"20170360403"	PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO)	OR	ON	ON	2024/05/23 02:46 PM
L57	10	("2014/0004488").urpn. AND (PGPB USPT USOC).dbnm.	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2024/05/23 03:01 PM
L58	9	"69701068".fmid.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; JPO)	OR	ON	ON	2024/05/23 04:31 PM
L59	503	L47 AND body near3 mark\$4 AND L45 AND L6	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; JPO)	OR	ON	ON	2024/05/23 07:01 PM
L60	503	L47 AND body near3 mark\$4 AND L45 AND L6	(US-PGPUB; USPAT; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP,	OR	ON	ON	2024/05/23 07:01 PM

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L61	1	"78850608".fmid.	ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO)	OR	ON	ON	2024/05/23 07:02 PM
L62	2	"80741277".fmid.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; JPO)	OR	ON	ON	2024/05/23 08:17 PM
L63	279	measur\$8 WITH quality WITH image AND L52 AND L45 AND a61b\$.cpc. AND L6 NOT L55	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; JPO)	OR	ON	ON	2024/05/24 08:20 AM
L64	86	body near2 mark AND (display monitor) WITH (signal near2 noise SNR "s/n" s\$1n near2	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU,	OR	ON	ON	2024/05/24 08:58 AM

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		ratio)	CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; JPO)				
L65	41	L64 AND L6 AND ultra\$1so\$9	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; JPO)	OR	ON	ON	2024/05/24 08:59 AM
L66	41	L64 AND L6 AND ultra\$1so\$9	(US-PGPUB; USPAT; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO)	OR	ON	ON	2024/05/24 08:59 AM
L67	9627	(complet\$5 in\$1complet\$6) SAME quality WITH image AND ultra\$1so\$9 WITH imag\$5	(US-PGPUB; USPAT; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO)	OR	ON	ON	2024/05/28 09:50 AM
L68	4025	L67 AND a61b\$.cpc.	(US-PGPUB; USPAT; FIT (AU, AP, AT, BE,	OR	ON	ON	2024/05/28 09:50 AM

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L69	3419	L68 AND L6	BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO)	OR	ON	ON	2024/05/28 09:50 AM
L70	2664	((re\$1scan (complet\$5 in\$1complet\$6) WITH (imag\$5 scan\$5 acquir\$3 aquisition\$4)) SAME quality WITH image AND ultra\$1so\$9 WITH imag\$5) AND a61b\$.cpc.) AND L6	(US-PGPUB; USPAT; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO)	OR	ON	ON	2024/05/28 09:54 AM
L71	876	((re\$1scan (complet\$5 in\$1complet\$6) WITH (scan\$5 acquir\$3 aquisition\$4)) SAME quality WITH image AND ultra\$1so\$9 WITH imag\$5) AND a61b\$.cpc.) AND L6	(US-PGPUB; USPAT; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO)	OR	ON	ON	2024/05/28 10:32 AM

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L72	943	((re\$1scan\$4 (complet\$5 in\$1complet\$6) WITH (scan\$5 acquir\$3 aquisition\$4)) SAME quality WITH image AND ultra\$1so\$9 WITH imag\$5) AND a61b\$.cpc.) AND L6	JPO) (US-PGPUB; USPAT; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO)	OR	ON	ON	2024/05/28 10:32 AM
L73	822	quality WITH image SAME (neural near3 network) AND L6 AND ultra\$1so\$9 WITH imag\$4 AND a61b\$.cpc.	(US-PGPUB; USPAT; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO)	OR	ON	ON	2024/05/28 01:11 PM
L74	389	(re\$1scan\$6 re\$1acqui\$8 re\$1imag\$5) WITH (region portion area) AND quality WITH image AND ultra\$1so\$9 WITH imag\$4 AND L6 AND a61b\$.cpc.	(US-PGPUB; USPAT; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO)	OR	ON	ON	2024/05/28 02:45 PM
L75	109	(re\$1scan\$6 re\$1acqui\$8 re\$1imag\$5) WITH (region portion area) SAME (quality optim\$5 sub\$1optim\$5 snr nois\$3) WITH image AND ultra\$1so\$9 WITH imag\$4 AND L6 AND a61b\$.cpc.	(US-PGPUB; USPAT; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL,	OR	ON	ON	2024/05/28 03:21 PM

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L76	135	(re\$1scan\$6 re\$1acqui\$8 re\$1imag\$5) WITH (region portion area) SAME (quality optim\$5 sub\$1optim\$5 snr nois\$3 sufficien\$5 in\$1sufficien\$5 reliab\$8 confiden\$5) WITH image AND ultra\$1so\$9 WITH imag\$4 AND L6 AND a61b\$.cpc.	PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO) (US-PGPUB; USPAT; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO)	OR	ON	ON	2024/05/28 03:22 PM
L77	55948569	(complet\$6 in\$1complet\$6 re\$1scan\$5 re\$1acqui\$8 re\$1imag\$5)	(US-PGPUB; USPAT; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO)	OR	ON	ON	2024/05/28 04:58 PM
L78	118	((US-20220202395-A1 OR US-20210042878- A1 OR US- 20170273669-A1 OR US-20190125298-A1 OR US-20210077068- A1 OR US- 20190130554-A1 OR US-20210217166-A1 OR US-20080097205- A1 OR US- 20180161010-A1 OR US-20180310920-A1 OR US-20200069292- A1 OR US- 20230058450-A1 OR US-20160113632-A1 OR US-20220071600- A1 OR US- 20200175732-A1 OR US-20130190600-A1 OR US-20210145410-	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/05/28 04:58 PM
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		AND FTDB.dbnm.) OR ((WO-2020041881-A1 OR CN-113397589-A OR CN-112512435-A OR KR-20220062596-A OR EP-3311752-B1).did. AND FPRS.dbnm.) OR ((US-11464490-B2 OR US-10702242-B2).did. AND USPT.dbnm.)					
L79	52	L77 AND L78	(US-PGPUB; USPAT)	OR	ON	ON	2024/05/28 04:58 PM
L80	251226	(artifact artefact) AND L77	(US-PGPUB; USPAT)	OR	ON	ON	2024/05/28 05:30 PM
L81	30	(artifact artefact) AND L78	(US-PGPUB; USPAT)	OR	ON	ON	2024/05/28 05:31 PM
L82	2290	(enlarg\$8 zoom\$5) WITH imag\$5 SAME (user input\$5 operator) AND (quality near6 (grade level value) SAME (indicat\$6 display\$5))	(US-PGPUB; USPAT)	OR	ON	ON	2024/05/29 09:46 AM
L83	153	L82 AND ultra\$1so\$9 WITH imag\$4 AND L6	(US-PGPUB; USPAT)	OR	ON	ON	2024/05/29 09:46 AM
L84	35	((enlarg\$8) WITH imag\$5 SAME (user input\$5 operator) AND (quality near6 (grade level value) SAME (indicat\$6 display\$5))) AND ultra\$1so\$9 WITH imag\$4 AND L6	(US-PGPUB; USPAT)	OR	ON	ON	2024/05/29 09:55 AM
L85	168	((enlarg\$8 (increas\$5 chang\$5 alter\$5 modif\$8) near8 size) WITH imag\$5 SAME (user input\$5 operator) AND (quality near6 (grade level value) SAME (indicat\$6 display\$5))) AND ultra\$1so\$9 WITH imag\$4 AND L6	(US-PGPUB; USPAT)	OR	ON	ON	2024/05/29 09:55 AM
L86	120	((US-20220202395-A1 OR US-20160139789-A1 OR US-20210042878-A1 OR US-20170273669-A1 OR US-20190125298-A1 OR US-20210077068-A1 OR US-20190130554-A1 OR US-20210217166-	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/05/29 10:00 AM

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		OR CN-103079473-A OR CN-103827874-A OR JP-2012143358-A OR CN-113749686-A OR JP-2019076541-A OR EP-2599443-B1 OR CN-105051784-A OR WO-2015103388-A1 OR CN-112971844-A OR CN-111166376-A OR DE-112019004104- T5 OR CN-114617579- A OR CA-3150534-A1 OR EP-3868303-A1 OR JP-2021186257-A).did. AND FTDB.dbnm.) OR ((WO-2020041881-A1 OR CN-113397589-A OR CN-112512435-A OR KR-20220062596-A OR EP-3311752- B1).did. AND FPRS.dbnm.) OR ((US- 11464490-B2 OR US- 10702242-B2).did. AND USPT.dbnm.)					
L87	6	L86 AND zoom	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/05/29 10:00 AM
L88	2193	(enlarg\$8 WITH imag\$5 SAME (user input\$5 operator)) AND ultra\$1so\$9 WITH imag\$5 AND L6	(US-PGPUB; USPAT)	OR	ON	ON	2024/05/29 10:07 AM
L89	680	(enlarg\$8 WITH imag\$5 WITH input\$5) AND ultra\$1so\$9 WITH imag\$5 AND L6	(US-PGPUB; USPAT)	OR	ON	ON	2024/05/29 10:36 AM
L90	130	L89 AND (quality WITH (metric level value grade) WITH image)	(US-PGPUB; USPAT)	OR	ON	ON	2024/05/29 10:40 AM
L91	127	L89 AND (quality WITH (metric level value grade) WITH image) SAME (indicat\$5 display\$5)	(US-PGPUB; USPAT; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO)	OR	ON	ON	2024/05/29 10:40 AM

PE2E SEARCH - Search History (Interference)

There are no Interference searches to show.

Doc code: IDS

Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (02-18)
Approved for use through 11/30/2020. OMB 0651-0031
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Application Number	17558271
Filing Date	2021-12-21
First Named Inventor	Pei, Liye
Art Unit	2861
Examiner Name	
Attorney Docket Number	602209-US-2

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UBC-2006

Caption Health, Inc. v. Univ. of British Columbia

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Name/Print	Jacob Groethe	Registration Number	45,694

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UBC-2006

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(10) International Publication Number
WO 2012/073164 A1

(43) International Publication Date
7 June 2012 (07.06.2012)

- (51) **International Patent Classification:**
A61B 8/00 (2006.01) **G06T 19/00** (2011.01)
A61B 19/00 (2006.01)
- (21) **International Application Number:**
PCT/IB2011/055300
- (22) **International Filing Date:**
25 November 2011 (25.11.2011)
- (25) **Filing Language:** English
- (26) **Publication Language:** English
- (30) **Priority Data:**
61/419,287 3 December 2010 (03.12.2010) **US**
- (71) **Applicant (for all designated States except US):**
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(81) **Designated States (unless otherwise indicated, for every kind of national protection available):** AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) **Designated States (unless otherwise indicated, for every kind of regional protection available):** ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

— as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(H))

[Continued on next page]

(54) **Title:** DEVICE AND METHOD FOR ULTRASOUND IMAGING

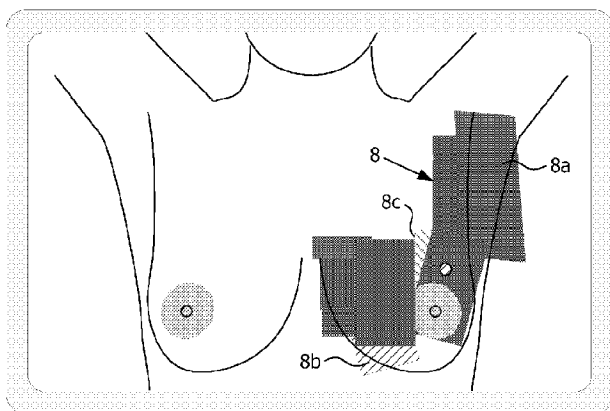


FIG. 2

(57) **Abstract:** A device and method for ultrasound imaging wherein ultrasound scanning of a selected body part of a patient is spatially indicated, as corresponding to a video image of a selected body part of a patient.

WO 2012/073164 A1

Published:

— with international search report (Art. 21(3))

— before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))

Device and method for ultrasound imaging

FIELD OF THE INVENTION

The invention relates to the field of medical ultrasound imaging. In particular, the invention relates to the field of the acquisition of ultrasound images of selected regions of the human body by freehand ultrasound scanning of a selected body part of a patient.

5 The invention further relates to a medical imaging system comprising:

- a camera, arranged to provide a video image of a selected body part of a patient, the video image being displayed on a patient image display,

- an ultrasound system comprising a transducer,

10 - the transducer capable of being used to ultrasonically scan the selected body part of the patient, and arranged in cooperation with,

- a transducer position tracker, for determination of a position of the transducer during an ultrasound scan,

- the transducer position tracker further providing an output of the position of the transducer during the ultrasound scan to,

15 - a video/data integration processor, such means being responsive to the transducer position tracker and the video image of the selected body part and arranged to locate a visual indicator of the path scanned by the transducer in the video image of the selected body part.

and to a method of operating a medical imaging system comprising the steps of:

20 - Imaging a selected body part of a patient to produce a video image,

- Displaying the video image,

- Scanning a portion of the selected body part with an ultrasound transducer,

- Determining the position and/or movement of the transducer over the scanned portion,

25 - Comparing the position and/or movement of the transducer with the video image of the selected body part.

BACKGROUND OF THE INVENTION

Ultrasound is used extensively in the medical field as a means of non-invasive imaging of various parts of the human body. The ultrasound images produced by scanning, or surveying, a region of the body can be used by medical professionals for investigative and diagnostic purposes. Ultrasound imaging can be used independently of other imaging techniques, or complementary to other imaging techniques such as X-ray or MRI imaging.

As an example, consider the use of ultrasound imaging as a means for screening of breast cancers. In many screening programs, 40% to 60% of mammograms, the current default examination in many regions for the early detection of breast cancer, are performed on dense breasts. A significant number of these examinations result in ambiguous or non-specific X-ray mammogram results. Further information is needed by the clinician, which preferably should be available via a reliable and complementary method. One option is the use of whole breast imaging using ultrasound. In some geographical regions, ultrasound imaging has proved so effective it has become the option of choice, used instead of X-ray mammography as a primary screening modality.

The technical equipment required to produce the ultrasound images is designed to transmit sound into the body and analyse the echoes returning as the sound is reflected by different materials and structures within the body. In order to make the process effective, contact between the patient and the transducer emitting the ultrasound pulses for imaging is optimized as much as possible because ultrasound pulses do not travel effectively through the air. Some areas of the body are easier to image with ultrasound than others, due to, for example, body topography or composition.

Continuing with the example of whole breast imaging, solutions for covering the entire region of interest have included apparatus that requires the patient to lie prone, with a breast hanging into a water bath, or supine, with the breast being scanned using an apparatus that mechanically translates the transducer across the surface of the breast. Some of the challenges in imaging the breast with ultrasound include providing effective acoustic coupling, dealing with the mechanical properties of the breast, the significant size variation from patient to patient, and access to key anatomical components. For a whole breast scan, for example, the most comprehensive examination covers a survey of the region of the breast tissue and the region towards the underarm containing the lymph nodes and axilla. Commercial solutions have been provided but these remain limited in their application, and some have not been accepted in the clinical environment.

An alternative form of ultrasound imaging to mechanical translation of the transducer includes a freehand scan of the body by an operator who manually translates an ultrasound transducer over the region of interest or selected body part. The transducer usually consists of an array of elements, which may be extend in 2 or 3 dimensions, each element producing an ultrasound beam which is cooperatively combined with the output from other elements to facilitate formation of a desired beam profile. The returning reflections are detected by the transducer elements and processed to form an ultrasound image, the ultrasound image usually being displayed to the operator. The positioning of the transducer can be monitored e.g. by means of a transducer position tracker. It is possible to formulate an image with a required quality level - with different parameters, which may be quantified for comparison with the acquired data and images, or with the transducer operation. The integrity if the data set comprising multiple ultrasound images is affected, for example, by the speed of movement of the transducer during scanning, and also by the effectiveness of the acoustic coupling provided by the contact maintained with the body part being surveyed.

Operation of the ultrasound equipment used for freehand scanning is carried out by trained personnel, who tailor their expertise in the use of the equipment to produce the best possible ultrasound images. Such optimization is done in real time while the operator or technician is manipulating the transducer across the selected body part of the patient. Some technicians are more capable than others, leading to a situation whereby a scan or survey may not be carried out correctly or may be incomplete. In the example of whole breast scanning for cancer detection, an incomplete scan or survey can be seriously misleading.

A known problem with this type of ultrasound scanning is that the quality or completeness of the scan or survey is heavily dependent on the skill and expertise of the operator.

SUMMARY OF THE INVENTION

It is an object of the present invention to overcome this problem by improving the quality and completeness of the ultrasound scan or survey being performed on a selected body part.

This object is fulfilled according to the present invention by provision of a medical imaging system, such that

- the visual indicator is arranged to be displayed superimposed on a corresponding portion of the selected body part of the video image on the patient image display.

Such a medical imaging system comprises an ultrasound imaging system having an ultrasound transducer for scanning a patient; a video imaging device for creating an image of a selected body part of the patient to be scanned; a transducer position tracker (or sensor) which identifies the location of the ultrasound transducer in relation to the selected body part being scanned; and a video/data integration processor, responsive to the image of the selected body part and the position of the ultrasound transducer, which overlays a visual indicator over the image which indicates the path travelled by the transducer during the scanning of the patient. The visual indicator thus indicates to the operator areas of the selected body part which have been scanned and areas of the selected body part which have yet to be scanned or were missed during the previous scanning of the body part.

In accordance with a further aspect of the present invention, the visual indicator can depict information about the quality of scanning of a particular region, such as poor acoustic coupling or regions that were completely scanned.

An advantage of the invention is that the selected body part of the patient is visible to the technician or clinician on a display, and the scan area surveyed using the ultrasound transducer is made visible in that context by use of a visual indicator. The visual indicator is superimposed on the video image of the region of the selected body part which has just been investigated by the ultrasound. The area actually covered is highlighted with respect to the total area of the selected body part, and only a glance is required to see which part of the patient has been scanned previously.

Further, the scan can be checked for selected quality parameters. A decision on how well the scan or survey meets a chosen quality parameter can be displayed in the same manner using other visual indicators, which are also immediately visible to the technician or clinician. For example, a scan which is performed with too much speed can be detected from the output of the transducer position tracker. Such a scan should be repeated to obtain better ultrasound data over that particular area. A visual indicator representing the excess speed can be displayed and may comprise a colour, e.g. red for a scan which has been effected too fast or a shading pattern, or an outline, or text warning. (In addition, an audible warning can be given - such an audible warning would prompt the operator to look at the display to make sure that the visual indicators are noticed or could indicate a particular kind of problem with the scan). This problem is then immediately evident to the operator who can reposition the transducer and repeat the scan movement more slowly. The operator is aware of the precise region to scan again due to the display images and can more accurately scan the correct area again.

The ultrasound transducer moves in multiple degrees of freedom, often classed into linear and rotational motion. A theoretically good scan moves steadily and linearly across a target area and data is collected from adjacent equally spaced regions which are used to form an overall image. If a rotational movement is introduced then the effect of this movement is not equal at all depths accessed by the ultrasound beam. Rotation introduces quality issues which may be more apparent at a depth of 6cm below the skin surface of the patient than at the skin surface itself. This is also influenced by the speed of the scan, the image again being more compromised at depth than at the skin surface.

In a further embodiment of the invention there is provided a medical imaging system, wherein a second visual indicator relating to a second ultrasound scan on a second portion is further superimposed on a second corresponding portion of the video image.

When a survey of a selected body part of a patient is being conducted, it is often necessary to make several sweeps with the transducer in order to cover the entire region of interest. It is thus advantageous to be able to combine information from a second ultrasound scan with the information already obtained from a first ultrasound scan and to display both sets of information simultaneously to the operator. In a simple example, the first and second visual indicators may both represent the quality of the scan speed over two spatially distinct areas of the region of interest. This gives the operator the opportunity to observe exactly which parts of the region of interest have been scanned correctly and thus decide what part or parts to scan next.

In a traditional approach to breast screening with ultrasound, volumetric data has been acquired in sets. Spatially registered image data can be reviewed during (or after) the ultrasound examination and may be used to subsequently locate a region of concern. Such a region can be highlighted by means of the invention.

In a further embodiment of the invention there is provided a medical imaging system, wherein the visual indicator comprises a first visual characteristic signifying a first quality parameter, and/or a second visual characteristic signifying a second quality parameter, and/or a third visual characteristic signifying a third quality parameter.

In a further embodiment of the invention there is provided a medical imaging system, wherein the first quality parameter relates to properly acquired ultrasound data in relation to an acquisition protocol, and/or the second quality parameter relates to incorrect acquisition of ultrasound data and/or the third quality parameter relates to areas of the selected body part of the patient missed by the ultrasound scan.

The information required by the technician or clinician can be dependent on the purpose of the ultrasound scan. Basic information such as scan coverage and correct scan implementation may be supplemented by other visual identifiers for quality parameters chosen by the user. A particularly important quality parameter for freehand ultrasound scanning is the identification of areas of the selected body part of the patient which have not been scanned.

For whole breast examinations, missing a small region of the breast or associated tissue can lead to serious consequences. By means of the present invention, the scanned regions are identified and displayed, and analysis can be provided to determine missed regions (or the operator can see the missed regions on the display), and the missed region can be very visibly highlighted to indicate to the operator that a further sweep with the ultrasound transducer is required in that area. Thus it is ensured that the entire breast and associated tissue is scanned.

In a further embodiment of the invention there is provided a medical imaging device wherein the transducer position tracker comprises an accelerometer, or an electromagnetic location means, or optical location means.

The transducer position tracker is a device which monitors the position of the ultrasound transducer and movement of the transducer. During a single ultrasound scan or sweep the trajectory of the transducer can be monitored. This allows the ultrasound data and trajectory of the ultrasound transducer to be correlated with the associated parts of the video image of the patient.

In a further embodiment of the invention there is provided a medical imaging system, wherein an ultrasound image produced from the ultrasound scan is also displayed on the patient image display.

In a further embodiment of the invention there is provided a medical imaging system wherein the medical imaging system further comprises an ultrasound image display for display of the ultrasound image.

An ultrasound technician is trained to look at the ultrasound images produced by use of the ultrasound transducer. In order to facilitate ease of use of the medical imaging system, the invention provides for the possibility that the normal ultrasound image can be displayed such that both the ultrasound image and the image on patient image display can be viewed simultaneously. This can be achieved either by allocating a section of the patient image display for the ultrasound image or by providing a separate display for the ultrasound image located conveniently adjacent to the patient image display. Use of the invention thus

lowers the threshold of operator skill required to perform an exam of a patient. Less training is required while maintaining, or even improving, the consistency and quality of the data obtained from the patient.

In a further embodiment of the invention there is provided a medical imaging system, wherein the ultrasound scan performed is a whole breast scan.

Whole breast imaging has been an area of interest for many years. The solutions provided in the clinical environment have so far not fully addressed the specific issues associated with this type of examination, such as mechanical properties of the breast, size variation from patient to patient, and access to the associated regions of the body (e.g. axilla and lymph nodes) which should be scanned as part of a complete examination. The invention, although applicable to many kinds of ultrasound examination, is particularly effective in dealing with the challenges presented by whole breast imaging through quality controlled use of the freehand scanning technique. Optical means provide feedback on the completeness of the breast image acquisition and the clinician is provided with a photographic image of the breast being scanned. The photograph is overlaid with colour or shading showing the past position of the transducer and the breast while being scanned and the visual information provided can be augmented with other indicators showing tissue deformation or missed regions.

In another aspect of the invention there is provided a method of operating a medical imaging system comprising the step of:

- Superimposing a visual indicator of the position and/or movement of the ultrasound transducer over the scanned portion of the selected body part in the video image.

An advantage of the invention is that the selected body part of the patient is visible to the technician or clinician on a display, and the scan area surveyed using the ultrasound transducer is made visible in that context by use of a visual indicator. The visual indicator is superimposed on the video image of the region of the selected body part which has just been investigated by the ultrasound. The area actually covered is highlighted with respect to the total area of the selected body part, and only a glance is required to see which part of the patient has been scanned previously.

Further, the scan can be checked for selected quality parameters. A decision on how well the scan or survey meets a chosen quality parameter can be displayed in the same manner using other visual indicators, which are also immediately visible to the technician or clinician. For example, a scan which is performed with too much speed can be detected from the output of the transducer position tracker. Such a scan should be repeated to

obtain better ultrasound data over that particular area. A visual indicator representing the excess speed can be displayed and may comprise a colour, e.g. red for a scan which has been effected too fast or a shading pattern, or an outline, or text warning. (In addition, an audible warning can be given - such an audible warning would prompt the operator to look at the display to make sure that the visual indicators are noticed or could indicate a particular kind of problem with the scan). This problem is then immediately evident to the operator who can reposition the ultrasound transducer and repeat the scan movement more slowly. The operator is aware of the precise region to scan again due to the display images and can more accurately scan the correct area again.

The ultrasound transducer moves in multiple degrees of freedom, often classed into linear and rotational motion. A theoretically good scan moves steadily and linearly across a target area and data is collected from adjacent equally spaced regions which are used to form an overall image. If a rotational movement is introduced then the effect of this movement is not equal at all depths accessed by the ultrasound beam. Rotation introduces quality issues which may be more apparent at a depth of 6cm below the skin surface of the patient than at the skin surface itself. This is also influenced by the speed of the scan, the image again being more compromised at depth than at the skin surface.

In a further embodiment of the invention there is provided a method of operating a medical imaging system, comprising the further step of:

- Retaining a first result of a visual indicator for first ultrasound scan on the video image while displaying a second result of a visual indicator of a second ultrasound scan.

When a survey of a selected body part of a patient is being conducted, it is often necessary to make several sweeps with the ultrasound transducer in order to cover the entire region of interest. It is thus advantageous to be able to combine information from a second ultrasound scan with the information already obtained from a first ultrasound scan and to display both sets of information simultaneously to the operator. In a simple example, the first and second visual indicators may both represent the quality of the scan speed over two spatially distinct areas of the region of interest. This gives the operator the opportunity to observe exactly which parts of the region of interest have been scanned correctly and thus decide what part or parts to scan next.

In a traditional approach to breast screening with ultrasound, volumetric data has been acquired in sets. Spatially registered image data can be reviewed during (or after)

the ultrasound examination and may be used to subsequently locate a region of concern. Such a region can be highlighted by means of the invention.

In a further embodiment of the invention there is provided a method of operating a medical imaging system, comprising the further steps of:

- Determining an area of the selected body part of the patient missed by the ultrasound scan by analysis of the first and second results,
- Representing the area by means of a third visual indicator,
- Displaying the third visual indicator on a corresponding area of the video image.

The information required by the technician or clinician can be dependent on the purpose of the ultrasound scan. Basic information such as scan coverage and correct scan implementation may be supplemented by other visual identifiers for quality parameters chosen by the user. A particularly important quality parameter for freehand ultrasound scanning is the identification of areas of the selected body part of the patient which have not been scanned.

For whole breast examinations, missing a small region of the breast or associated tissue can lead to serious consequences. By means of the present invention, the scanned regions are identified and displayed, and analysis can be provided to determine missed regions (or the operator can see the missed regions on the display), and the missed region can be very visibly highlighted to indicate to the operator that a further sweep with the ultrasound transducer is required in that area. Thus it is ensured that the entire breast and associated tissue is scanned.

In a further aspect of the invention there is provided a method of operating a medical image system, comprising the further steps of:

- Obtaining an ultrasound image of the selected body part by means of the ultrasound transducer,
- Displaying the ultrasound image.

An ultrasound technician is trained to look at the ultrasound images produced by use of the ultrasound transducer. In order to facilitate ease of use of the medical imaging system, the invention provides for the possibility that the normal ultrasound image can be displayed such that both the ultrasound image and the image on patient image display can be viewed simultaneously. This can be achieved either by allocating a section of the patient image display for the ultrasound image or by providing a separate display for the ultrasound image located conveniently adjacent to the patient image display. Use of the invention thus

lowers the threshold of operator skill required to perform an exam of a patient. Less training is required while maintaining, or even improving, the consistency and quality of the data obtained from the patient.

In a further aspect of the invention there is provided a method of operating a medical imaging system, comprising the further step of:

- Selecting the whole breast region as the selected body part.

Whole breast imaging has been an area of interest for many years. The solutions provided in the clinical environment have so far not fully addressed the specific issues associated with this type of examination, such as mechanical properties of the breast, size variation from patient to patient, and access to the associated regions of the body (e.g. axilla and lymph nodes) which should be scanned as part of a complete examination. The invention, although applicable to many kinds of ultrasound examination, is particularly effective in dealing with the challenges presented by whole breast imaging through quality controlled use of the freehand scanning technique. Optical means provide feedback on the completeness of the breast image acquisition and the clinician is provided with a photographic image of the breast being scanned. The photograph is overlaid with colour or shading showing the past position of the ultrasound transducer and the breast while being scanned and the visual information provided can be augmented with other indicators showing tissue deformation or missed regions.

BRIEF DESCRIPTION OF THE FIGURES :

The invention will be further elucidated by reference to the following figures:

Fig. 1 shows a schematic drawing of a device according to the invention

Fig. 2 shows a schematic drawing of the patient image display of the invention

Fig. 3 shows a flowchart of a method according to the invention

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

The invention will be described here in terms of ultrasound scanning as applied to whole breast imaging, but it should be understood that the principles of the invention can be applied to the ultrasound investigation of any part of the human body.

Fig. 1 illustrates a medical imaging system 1. This medical imaging system 1 comprises an ultrasound system 2 comprising an ultrasound transducer 3 which can be applied to a patient in order to form an ultrasound image of a selected body part of the patient. A camera 5 is placed above the selected body part of the patient and operated so as

to produce a video image of the selected body part on a patient image display 6. The transducer 3 is monitored in terms of its position by a transducer position tracker 4, incorporating a spatial field generator 9.

A suitable transducer position tracker 4 is the Percunav™ system available

from the Traxtal division of Philips Healthcare of Andover, MA, USA. The Percunav system uses a magnetic field transmitter as a spatial field generator 9 to envelop the body part being scanned with an r.f. or magnetic field. A sensor (not shown) attached to the ultrasound transducer 3 locates the position of the ultrasound transducer in the three dimensional coordinates of the magnetic field and this position information is transmitted to the integration processor 7. A sensor (not shown), cooperating with the transducer position tracker 4, attached to the patient examination table locates the patient in the magnetic field. It is usual to register specific anatomical landmarks by placing the ultrasound transducer 3 on those landmarks and instructing the system that the ultrasound transducer 3 position and a specific landmark correspond. A possible means of achieving this would be to highlight targets on the video screen or patient image display to and ask the operator to place the transducer at that point and indicate that point to the system. An obvious landmark would be the nipple, for example, but there is no reason to constrain the choice to that point - landmarks can be arbitrary. The position of the transducer 3 is thereby capable of being related to the part of the patient being imaged by the camera 5 by a video/data integration processor 7.

The technique of registration depends on the ultrasound system being used. Manual registration is not always necessary, some systems having a method of automatic registration. In an optical approach, for example, it is possible that anatomical landmarks and manual registration may not be needed - the video capture of the ultrasound transducer position being sufficient. Registration is often particularly important where the ultrasound images are being related to data from another imaging technique. For example, CT scanning data must be correctly related to ultrasound scanning data when the ultrasound images are used to guide procedures involving ablation of tissue.

Alternatively it is possible to track an ultrasound transducer, in multiple degrees of freedom, for example by means of the ultrasound images captured. According to patent applications WO2009/147620 A2 and WO2009/147621 A2, the ultrasound transducer motion and position can be determined during a freehand ultrasound scan, when multiple planar ultrasound images are available in an extended field of view or volume, these images

resulting from acquisition using electronic beam steering from a 2D transducer array probe (i.e. matrix or checkerboard arrangement of the transducer probe elements). The transducer array probe can steer an ultrasound beam in a number of arbitrary directions. Images from the different directions are used to form an extended field of view ultrasound image but can also be utilized to track the motion of the ultrasound transducer in several directions.

Matching of successively acquired images can be used to estimate the transducer motion, including the velocity, distance travelled, or path covered. The applications go on further to describe that the techniques applied to 2D images (panoramic ultrasound imaging) can also be applied to 3D images (bi-plane ultrasound imaging, freehand 3D imaging) by considering images from different planar orientations. Thus the transducer motion in 3D is determined.

Such a means for tracking the position and motion of the ultrasound transducer is highly compatible with the present invention.

The operator or technician conducting the ultrasound procedure receives feedback on the ultrasound scanning and positioning of the transducer in two ways. The internal anatomy of the breast being scanned is shown in an ultrasound image 10 on the ultrasound system image display 11. Also shown on the display 11 or on a separate patient display monitor 6, *e.g.*, the Percunav system display, is the video image of the body part being scanned, in this example, the patient's breast. According to the invention, the device is arranged so that visual indicators 8 of the region(s) of the body part which have been scanned are superimposed on corresponding parts of the video image of the patient displayed on the patient display monitor 6. As the ultrasound transducer 3 is moved over the patient's body in acoustic contact with the skin of the patient, the path over which the ultrasound transducer 3 has travelled is indicated on the patient display monitor 6 of the body part by a build-up of the visual indicators 8 over the image of the body part. As the transducer 3 scans more and more of the patient's anatomy, the anatomy in the video display is increasingly overlaid by visual indicators 8. Feedback, by these visual means on the progress and completeness of the scanning is thus available to the operator or technician.

The quality and completeness of the scanning can be measured against predetermined criteria. Comparison of the area of the body part covered by visual indicators 8 against the appropriate areas to be scanned during a particular procedure is made using the video/data integration processor 7. The video/data integration processor 7 may thereby detect regions or areas of the body part which have been missed during scanning, such as spaces between adjacent sweeps with the transducer 3. The operator can thus be alerted to

rescan areas that have been missed so that a collection of images which fully cover the body part are obtained.

Fig. 2 further illustrates an example of the patient image display 6 of the invention in greater detail. The video image of the patient is overlaid in this example by rectangular visual indicators 8, each rectangle depicting a sweep of the ultrasound transducer over the area of the body part covered by the indicator. Three visual indicators can be seen at 8a, 8b, 8c, each of which conveys different information about the quality of the scanning performed at that region of the body part. Visual characteristic 8a, here shaded gray, indicates a good quality ultrasound scan. Visual characteristic 8b, here shown with right-slanting stripes, indicates a particular scan region where the scan was not properly acquired. This may be detected by ultrasound signal dropout at that region, such as may occur when the acoustic contact with the skin is poor. Visual characteristic 8c, here shown with left-slanting stripes, indicates a region missed by the ultrasound scan. This can be detected by the occurrence of gaps or spaces between the visual indicators laid down by adjacent scanning paths of the transducer, for instance. In this way the visual indicators 8 not only show the operator the regions of the body part which have been scanned, but also the quality of the scanning performed at those regions.

Fig. 3 illustrates a method of operating a medical imaging system according to the invention. The method involves imaging a selected body part of a patient to produce a video image 101 and displaying the video image 102. This is followed by scanning a portion of the selected body part with an ultrasound transducer 103. By determining the position and/or movement of the transducer over the scanned portion 104, the next step of locating the position and/or movement of the transducer with the video image of the body part is facilitated 105. Superimposing a visual indicator of the position and/or movement of the ultrasound transducer over the scanned portion, the visual indicator being optionally representative of the local quality of the ultrasound scan, on a corresponding portion of the video image 106 is the final method step.

It will be appreciated by those skilled in the art that the ultrasonic scanning can be performed by freehand manual scanning with an ultrasound probe, or by mechanical translation of an ultrasound transducer 3 over a selected body part of a patient. It will also be appreciated that the transducer position tracker 4 can be implemented as an accelerometer, or an electromagnetic location device, or an optical locating device.

List of reference numerals :

- | | | |
|----|-----|--|
| | 1. | medical imaging system |
| | 2. | ultrasound system |
| 5 | 3. | ultrasound transducer |
| | 4. | transducer position tracker |
| | 5. | camera |
| | 6. | patient image display |
| | 7. | video/data integration processor |
| 10 | 8. | visual indicator |
| | a. | first visual characteristic |
| | b. | second visual characteristic |
| | c. | third visual characteristic |
| | 9. | spatial field generator |
| 15 | 10. | ultrasound image of selected body part |
| | 11. | ultrasound image display |

101 to 106 method steps according to the invention

CLAIMS:

1. A medical imaging system (1) comprising:

- a camera (5), arranged to provide a video image of a selected body part of a patient, the video image being displayed on a patient image display (6),

- an ultrasound system (2) comprising a transducer (3),

5 - the transducer (3) capable of being used to ultrasonically scan the selected body part of the patient, and arranged in cooperation with,

- a transducer position tracker (4), for determination of a position of the transducer (3) during an ultrasound scan,

10 - the transducer position tracker further providing an output of the position of the transducer (3) during the ultrasound scan to,

- a video/data integration processor (7), such means being responsive to the transducer position tracker (4) and the video image of the selected body part and arranged to locate a visual indicator (8) of the path scanned by the transducer in the video image of the selected body part.

15 wherein,

- the visual indicator (8) is arranged to be displayed superimposed on a corresponding portion of the selected body part of the video image on the patient image display (6).

20 2. A medical imaging system as claimed in claim 1, wherein a second visual indicator relating to a second ultrasound scan on a second portion is further superimposed on a second corresponding portion of the video image.

25 3. A medical imaging system as claimed in claims 1 and/or 2, wherein the visual indicator (8) comprises a first visual characteristic (8a) signifying a first quality parameter, and/or a second visual characteristic (8b) signifying a second quality parameter, and/or a third visual characteristic (8c) signifying a third quality parameter.

4. A medical imaging system as claimed in claim 3, wherein the first quality parameter relates to properly acquired ultrasound data in relation to an acquisition protocol, and/or the second quality parameter relates to incorrect acquisition of ultrasound data and/or the third quality parameter relates to areas of the selected body part of the patient missed by the ultrasound scan.

5. A medical imaging device as claimed in claim 1, wherein the transducer position tracker comprises an accelerometer, or an electromagnetic location means, or optical location means.

6. A medical imaging system as claimed in any of the above claims, wherein an ultrasound image produced from the ultrasound scan is also displayed on the patient image display.

7. A medical imaging system as claimed in any of the above claims further comprising an ultrasound image display (11) for display of the ultrasound image.

8. A medical imaging system as claimed in any of the above claims, wherein the ultrasound scan performed is a whole breast scan.

9. A method of operating a medical imaging system comprising steps of:

- Imaging a selected body part of a patient to produce a video image (101),
- Displaying the video image (102),
- Scanning a portion of the selected body part with an ultrasound transducer

- (103),
- Determining the position and/or movement of the transducer over the scanned portion (104),
- Comparing the position and/or movement of the transducer with the video image of the selected body part (105),

wherein the method further comprises the step of:

- Superimposing a visual indicator of the position and/or movement of the ultrasound transducer over the scanned portion of the selected body part in the video image (106).

10. A method of operating a medical imaging system according to claim 9, comprising the further step of:

- Retaining a first result of a visual indicator for first ultrasound scan on the video image while displaying a second result of a visual indicator of a second ultrasound scan.

11. A method of operating a medical imaging system according to claim 10, comprising the further steps of:

- Determining an area of the selected body part of the patient missed by the ultrasound scan by analysis of the first and second results,

- Representing the area by means of a third visual indicator,
- Displaying the third visual indicator on a corresponding area of the video image.

12. A method of operating a medical image system according to claims 9 or 10 or 11, comprising the further steps of:

- Obtaining an ultrasound image of the selected body part by means of the ultrasound transducer,
- Displaying the ultrasound image.

13. A method of operating a medical imaging system according to any of the above claims 9 to 12, comprising the further step of:

Selecting the whole breast region as the selected body part.

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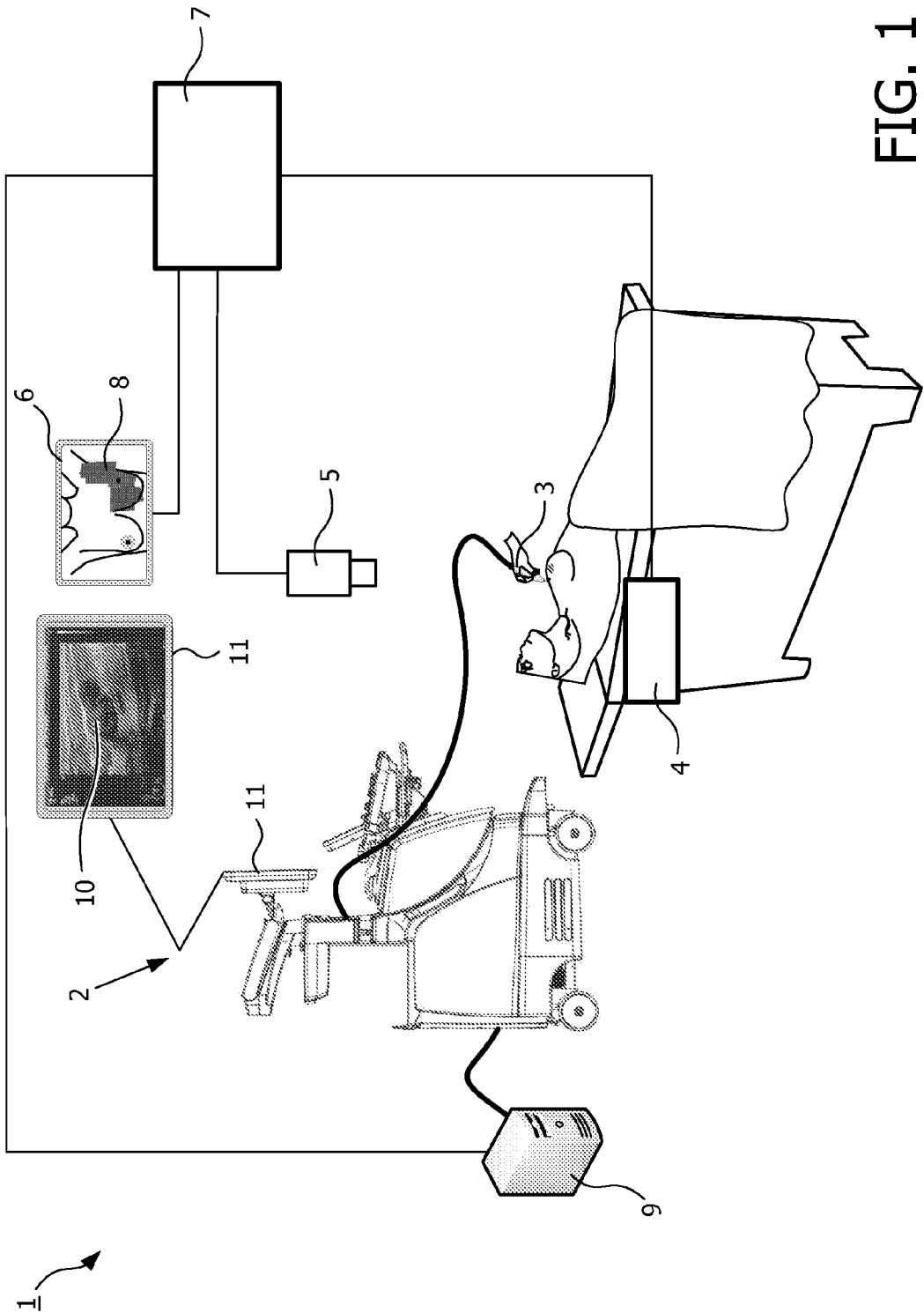


FIG. 1

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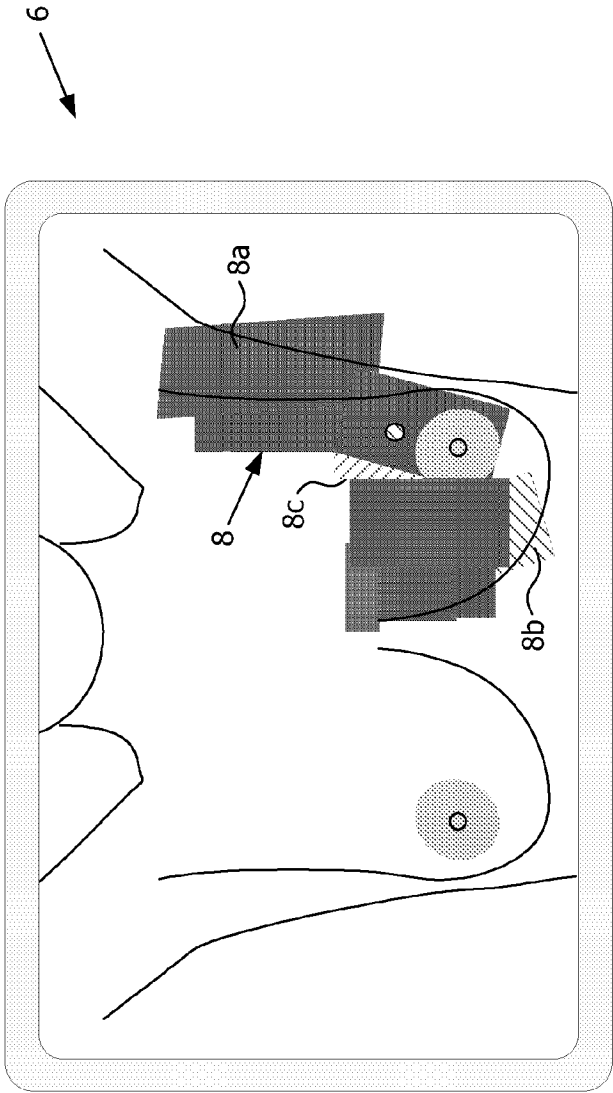


FIG. 2

3/3

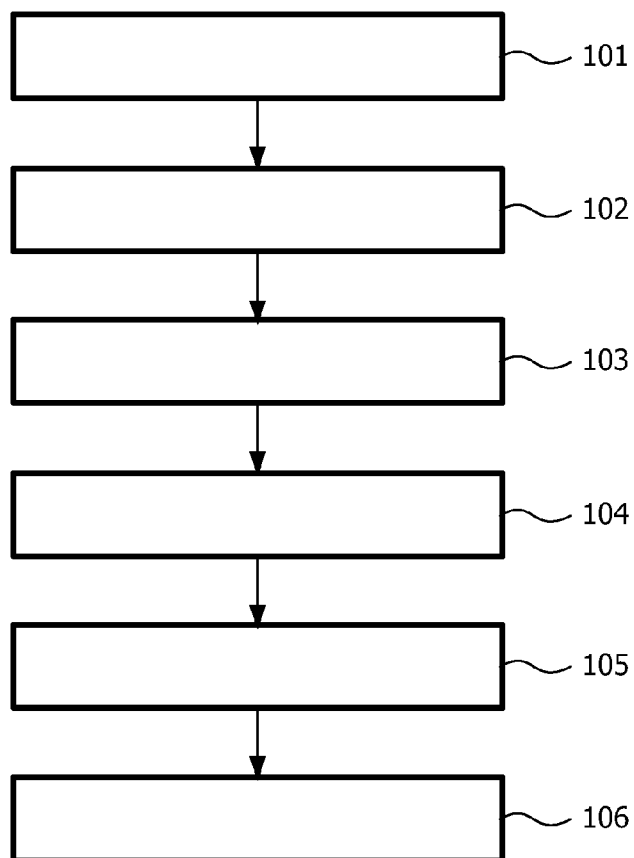


FIG. 3

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2011/055300

A. CLASSIFICATION OF SUBJECT MATTER INV. A61B8/00 A61B19/00 G06T19/00 ADD.		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) A61B G06T Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Electronic data base consulted during the international search (name of data base and, where practical, search terms used) EPO-Internal , WPI Data		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2010/286518 AI (LEE WARREN [US] ET AL) 11 November 2010 (2010-11-11) the whole document -----	1-13
A	US 2009/024030 AI (LACHAINE MARTIN [CA] ET AL) 22 January 2009 (2009-01-22) abstract -----	1-13
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A	WO 2009/051847 AI (CALUSER CALIN [US]) 23 April 2009 (2009-04-23) abstract figures 5, 6 -----	1-13
☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.		
* Special categories of cited documents : "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art. "G" document member of the same patent family		
Date of the actual completion of the international search 2 April 2012		Date of mailing of the international search report 17/04/2012
Name and mailing address of the ISA/ European Patent Office, P.B. 5618 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016		Authorized officer Willig, Hendrik

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