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GEORGII et al.

(54) **METHOD AND DEVICE FOR RECORDING AN ULTRASOUND IMAGE OF A DEFORMED OBJECT, IN PARTICULAR THE HUMAN BREAST**

(71) Applicant: **SIEMENS AKTIENGESELLSCHAFT**, München (DE)

(72) Inventors: **JOACHIM GEORGII**, BREMEN (DE); **MARCUS RADICKE**, VEITSBRONN (DE); **FABIAN ZOEHRER**, BREMEN (DE)

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(57) **ABSTRACT**

A relationship is established between points or regions in images of objects deformed in different ways, for example images of the human chest in a mammography and 3D ultrasound process. While a plurality of recording parameters which can be used for such an automatic image registration are often known in X-ray and other imaging methods, precise recording parameters, in particular for the position of the chest, are usually not available in ultrasound processes. The object is to additionally detect the position, in particular the tilt, of the chest and the ultrasound transducer in a chest ultrasound. A linking of multiple ultrasound recordings to one another or a comparably more precise automatic image registration using other modalities can then be carried out using the position of the ultrasound transducer relative to the chest. The position is detected in a manner that is specific to the case.

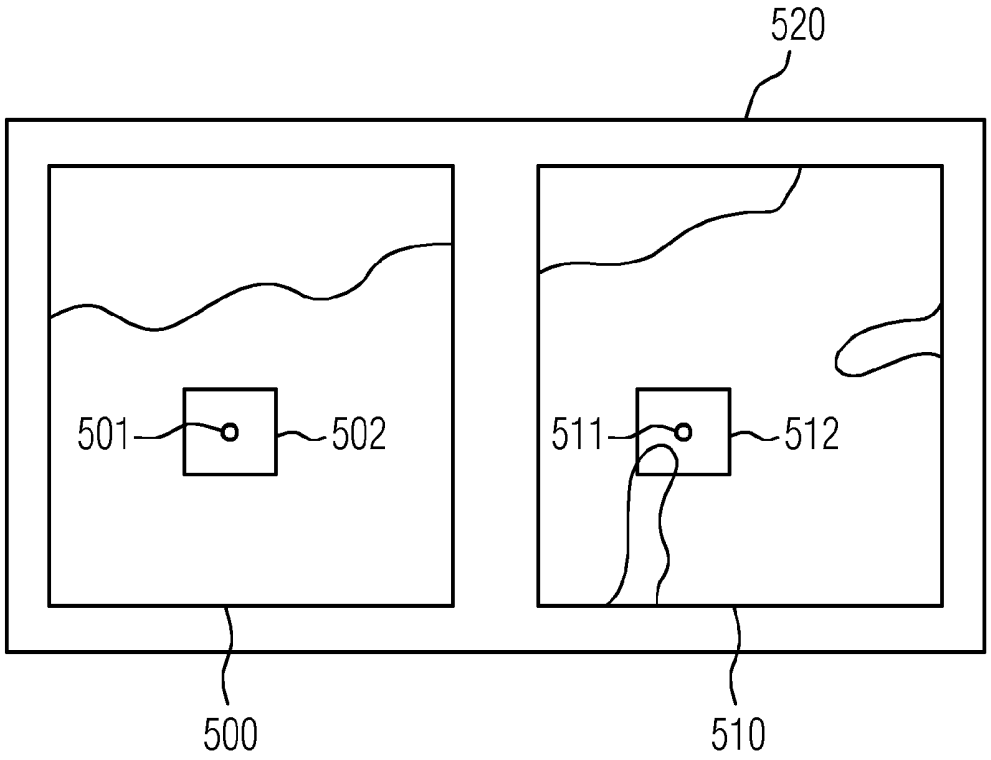
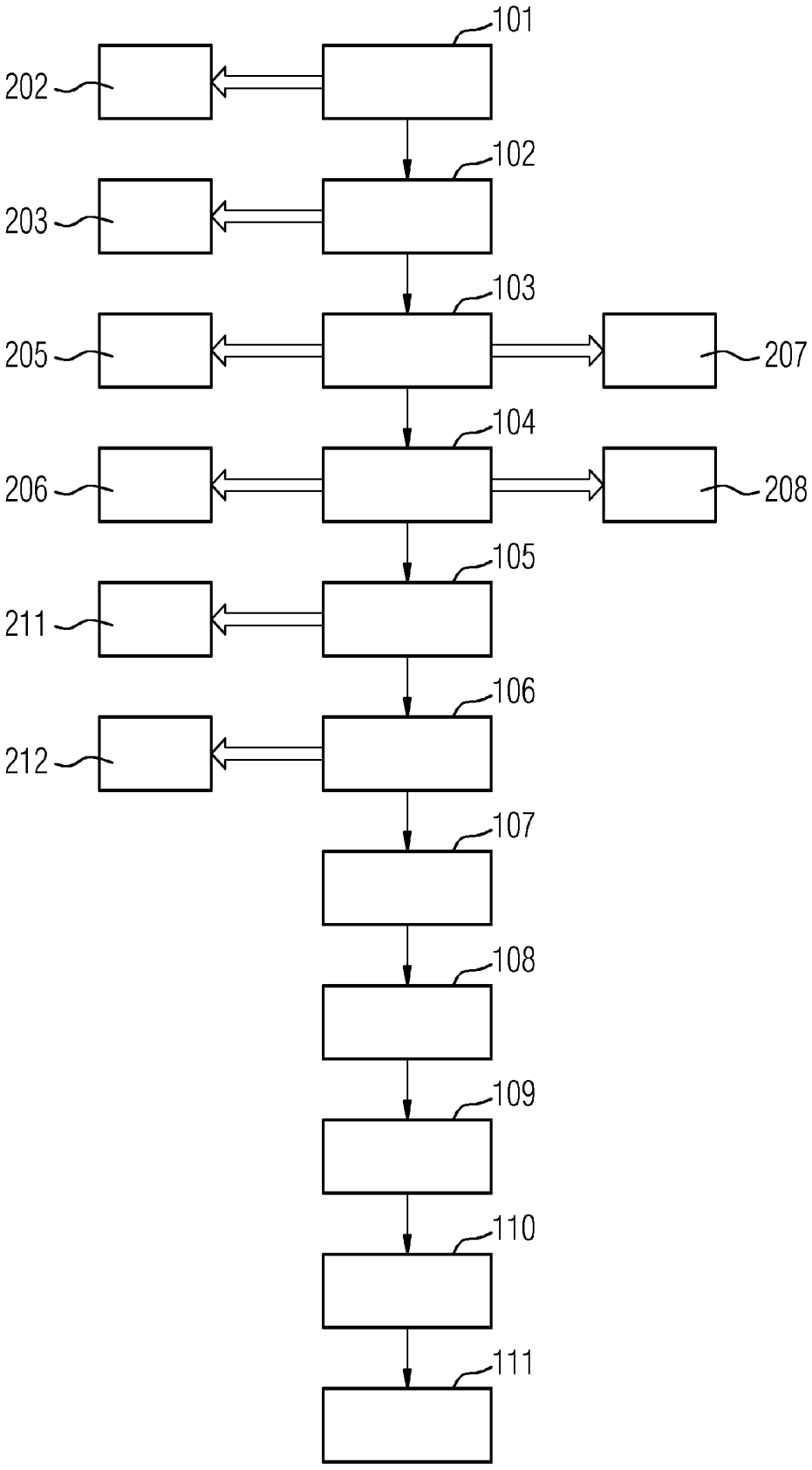


FIG 1


101
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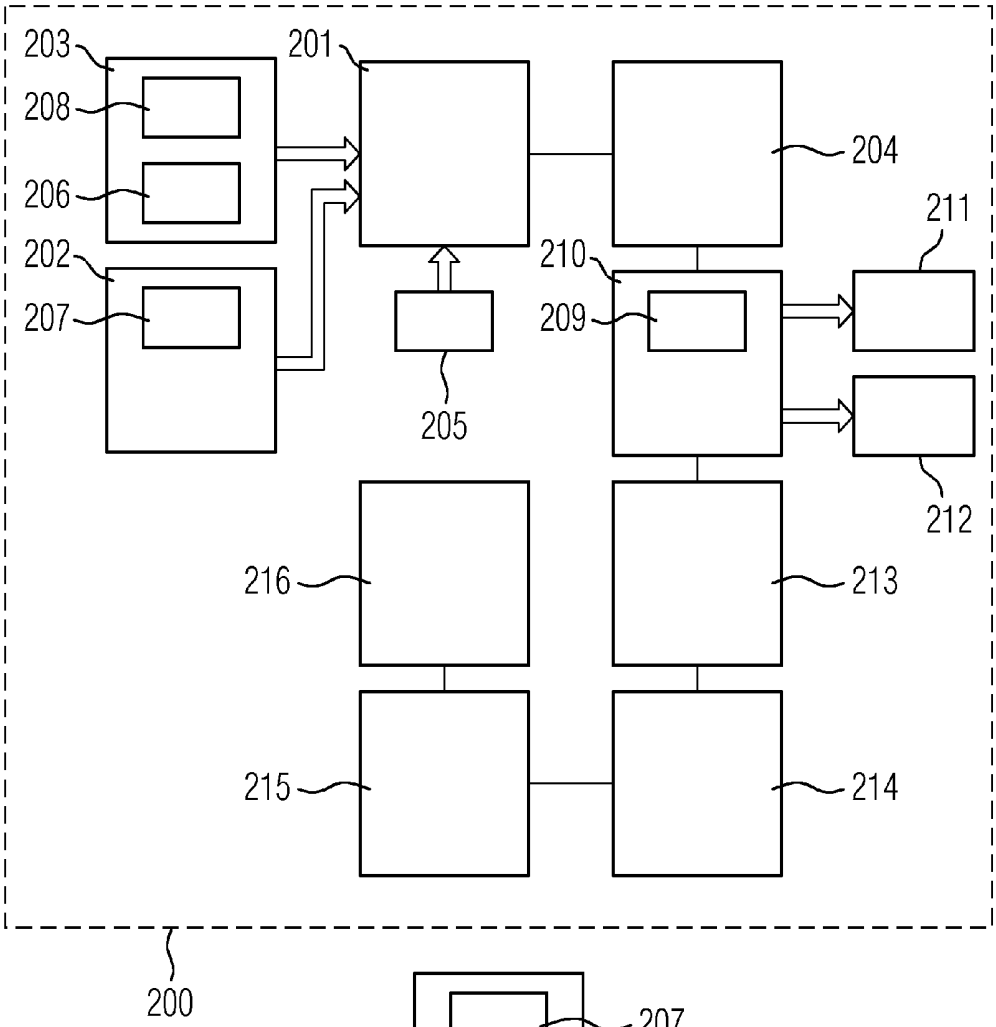
111

FIG 2


203
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211
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214
200

FIG 3

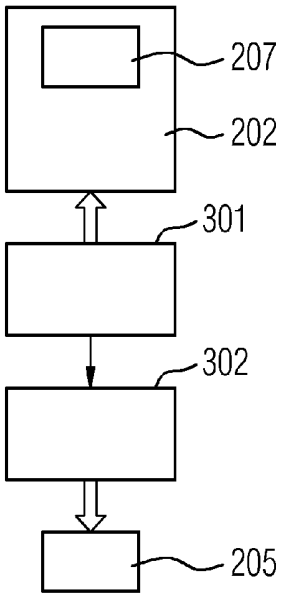

207
202
301
302
205

FIG 4

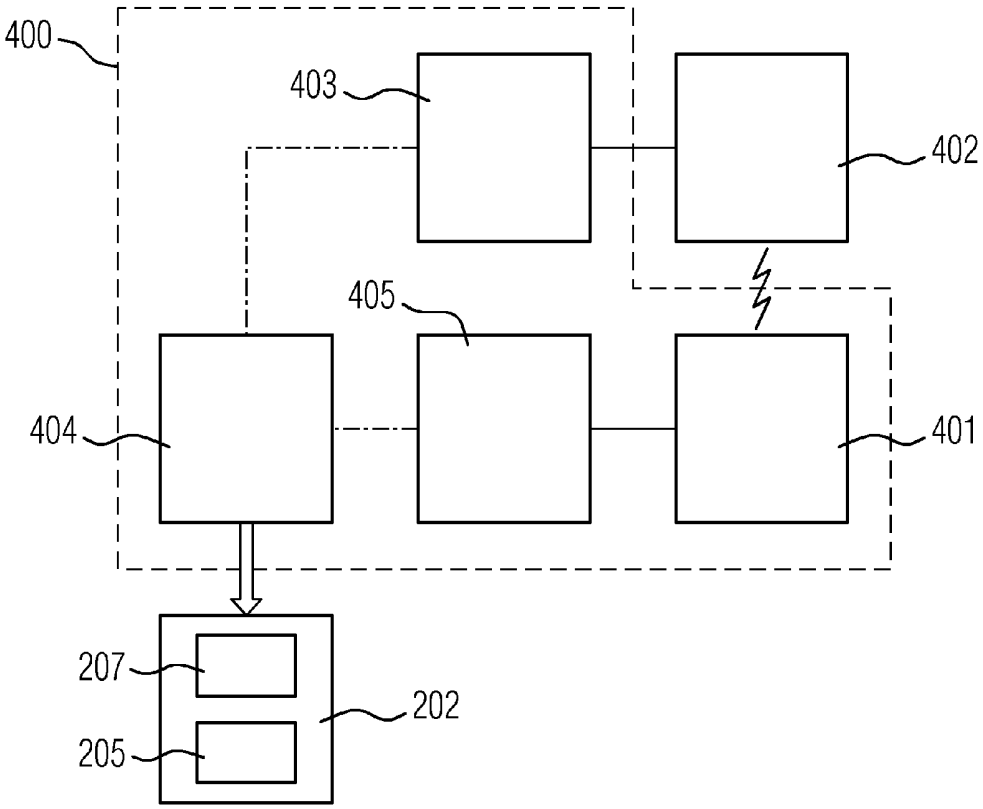
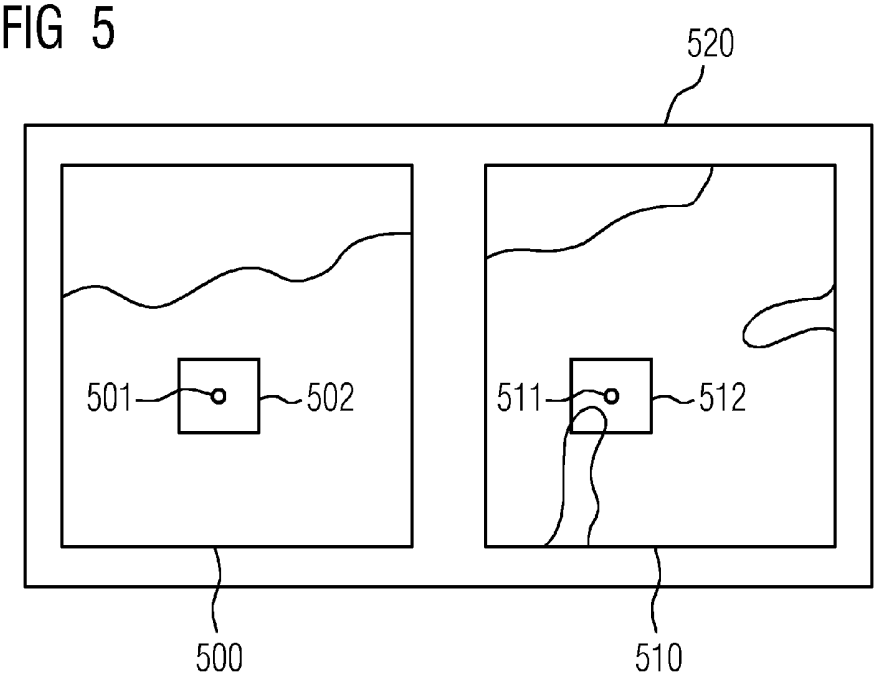


FIG 5



METHOD AND DEVICE FOR RECORDING AN ULTRASOUND IMAGE OF A DEFORMED OBJECT, IN PARTICULAR THE HUMAN BREAST

[0001] The invention relates to a method and a device for recording an ultrasound image of a deformed object, in particular the human breast. Moreover, the invention relates to a method and a device for determining selected points and/or regions in medical recordings of an object deformed in various ways, in particular the human breast.

[0002] Early detection of breast cancer is a huge challenge for all currently existing medical imaging methods. There is large agreement in the whole medical research sector that a diagnosis with high sensitivity and specificity at the same time can only be obtained by the skillful combination of various imaging methods. Therefore, an object consists of bringing together various measurement techniques in order thus to be able to superpose the obtained images as exactly as possible or link said images to one another.

[0003] Until now, software-assisted image superposition has failed as a result of the breast experiencing different deformations in the various recordings. By way of example, the breast is clamped between two plates in mammography and therefore typically compressed in the craniocaudal and/or mediolateral/mediolateral oblique direction. By contrast, in an automated breast ultrasound, the breast is pressed against the rib cage by the ultrasound head. It is therefore conventional practice for the images obtained by the individual modalities only to be superposed "in the head" of the radiologist. In general, only very experienced radiologists succeed therein with a sufficiently good result.

[0004] It is an object of the present invention to simplify the evaluation of medical image data. This object is achieved by methods according to claim **1** or **8** and by a device according to claim **6** or **9**. Advantageous embodiments of the invention are specified in the dependent claims. The advantages and embodiments explained below in conjunction with the method also apply correspondingly to the devices according to the invention, and vice versa.

[0005] Below, exemplary terms are sometimes used instead of superordinate terms, without this being intended to be understood in a restrictive manner. Thus, the human breast is sometimes referred to as an example for an object to be recorded and an x-ray recording is referred to as an example for recording that is different from an ultrasound recording.

[0006] The invention proceeds from the recognition that it is important to know the respective recording locations at least approximately for software-assisted superposition or registration of ultrasound and x-ray images (2D/3D). While x-ray recordings are implemented using similar recording locations in each case and the corresponding geometric parameters of the recording, such as e.g. compression direction, compression force and plate distance, are stored in the DICOM text of the image, the position, in particular the tilt of the patient can however vary strongly in ultrasound recordings in a manner dependent on the patient and/or the examiner carrying out the recording. Therefore, a core concept of the invention lies in recording this examiner-specific and patient-specific position and tilt of the breast during ultrasound recordings and using these for an automated image registration with recordings from other imaging methods. Here, it is not the object of the invention to carry out a real superposition within the meaning of image fusion. Rather, there should be an identification in a different representation of a point or region that was located in one representation. To this end, a correlation is established between coordinates in models of the differently deformed object, cf. patent application DE 10 2012 213 923 ("Apparatus and method for position correlation in medical recordings"). This is implemented by virtue of a relationship being established between the coordinates of a selected point or region in a first deformation model and the corresponding coordinates in a second deformation model using the non-deformed initial model of the object. Such a coordinate correlation means that the coordinates of the first deformation model, which correspond to the selected point or region, are correlated with the corresponding coordinates in the second deformation model. Expressed differently, the selected point or region from the first deformation model is mapped into the second deformation model. Here, the first deformation model represents the deformed object during the first recording, with the recording data record from the first recording being linked to the first deformation model, and the second deformation model represents the deformed object during the second recording, with the recording data record of the second recording being linked to the second deformation model. Therefore, selecting a specific point or region in one of the deformation models is always implemented on the basis of the image information of the corresponding recording that is mapped there. Therefore, with the aid of the invention, it is possible to display the point or region selected in one recording, for example in an x-ray recording, in the other recording, for example an ultrasound recording. Expressed differently, the coordinates which correspond to the point or region in one of the recordings can be displayed in the other recording. As a result of the proposed acquisition of location and/or orientation of the breast, a comparatively exact, automated and software-assisted assignment of individual points or regions in recordings of differently deformed objects is made possible for the first time, with the invention being applicable both to an automated breast volume ultrasound (ABVS) and a manual breast ultrasound. Instead of a superposition of the images "in the head" of the radiologist, an accurate software-assisted determination of mutually corresponding images or image portions is possible.

[0007] The information about the position of the object and/or the position of the ultrasound recording instrument during the recording, which are required for linking the data, preferably comprises information about the location and/or orientation of the object, in particular information about the tilt of the object relative to an initial location. Moreover, it may be advantageous for an even more precise and/or quicker image registration if the information about the position of the object and/or the ultrasound recording instrument during the recording comprises information about the location and/or orientation of the ultrasound recording instrument, in particular information about a tilt of the ultrasound recording instrument relative to an initial location, and/or information about a movement of the ultrasound recording instrument during the recording. Information about a movement of the object is usually not required since the patient does not move during the recording. With the aid of this information it is possible to implement the identification of the corresponding points or regions in a patient-specific and examiner-specific manner, even in the case of ultrasound recordings. Here, the case-specific acquisition of the rib cage alignment of the patient and the position of the ultrasound head, in particular, leads to an increase in the accuracy during the automated software registration of ultrasound and x-ray images of the breast.

[0008] What is particularly advantageous is that no complicated and expensive measurement apparatuses or sensors are required for acquiring information about the position of the object and/or the ultrasound recording instrument during the recording since a few items of position information, in particular in relation to the tilt of the rib cage, already suffice for a significantly improved registration. The corresponding information can instead be obtained with the aid of simple, cost-effective sensors, in particular by using gyro sensors.

[0009] A further core concept of the invention lies in recording the examiner-specific and patient-specific position and tilt of the breast during ultrasound recordings and using these for an automatic image registration with other ultrasound recordings of this object. A simplified evaluation of medical image data is therefore already possible with the aid of the present invention by virtue of it being possible to relate a plurality of ultrasound recordings of an object to one another with the aid of the position information established during the ultrasound recordings. By way of example, a plurality of individual recordings can be automatically superposed or aligned in relation to one another on the basis of the position information such that an overall volume describing the object more comprehensively emerges. In other words, the present invention is not restricted to bringing together data which were required by the application of different modalities. The invention is also applicable to ultrasound recordings only. If ultrasound recordings should moreover also be linked with recordings from other imaging methods, it is moreover particularly advantageous if these ultrasound recordings were previously linked to one another in a manner according to the invention.

[0010] In conclusion, the invention therefore firstly describes the bringing together or registration of ultrasound recordings and, secondly, the automated registration of ultrasound recordings with recordings from other imaging methods, such as 2D or 3D x-ray and/or magnetic resonance imaging methods, by using additional orientation information of the ultrasound volume in relation to the object.

[0011] The device according to the invention is embodied to carry out the above-described method. Preferably the device comprises a data processing unit, which is embodied to carry out all steps corresponding to the method described here, which steps are associated with the processing of data. The data processing unit preferably has a number of functional modules, wherein each functional module is embodied to carry out a specific function or a number of specific functions in accordance with the above-described method. The functional modules can be hardware modules or software modules. In other words, to the extent that it relates to the data processing unit, the invention can be implemented in the form of computer hardware or in the form of computer software or in a combination of hardware and software. To the extent that the invention is realized in the form of software, i.e. as a computer program product, all described functions are implemented by computer program instructions when the computer program is executed on a computer with a processor. The computer program instructions are implemented in this case in a manner known per se in any programming language and can be provided on the computer in any form, for example in the form of data packets that are transmitted over a computer network, or in the form of a computer program product stored on a disk, a CD-ROM or any other data medium.

[0012] The above-described properties, features and advantages of this invention and the manner in which they are achieved will become clearer and more easily understandable in conjunction with the following description of exemplary embodiments, which are explained in more detail in conjunction with the drawings. In detail:

[0013] FIG. **1** shows the progress of a method according to the invention for determining selected points or regions,

[0014] FIG. **2** shows a device according to the invention for determining selected points or regions,

[0015] FIG. **3** shows the progress of a method according to the invention for ultrasound recording,

[0016] FIG. **4** shows a device according to the invention for ultrasound recording,

[0017] FIG. **5** shows illustrations of the corresponding points or regions in different deformation models.

[0018] All figures show the invention merely schematically and with the essential constituents thereof. Here, the same reference signs correspond to elements with the same or a comparable function.

[0019] A method, implemented by an appropriate device **200**, for determining selected points and/or regions in medical recordings of a human breast **402** that is deformed in different ways is described on the basis of an example, in which a first recording of the breast **402** is carried out in the form of an ultrasound recording and a second recording of the breast **402** is carried out in the form of an x-ray recording. Here, the ultrasound recording is implemented with the aid of an automated three-dimensional breast ultrasound system comprising an ultrasound head **401**, and the x-ray recording is implemented with the aid of an x-ray mammography system. Here, the breast **402** is deformed in a first way during the ultrasound recording and deformed in a different way during the x-ray recording.

[0020] In a first step **101** of the method according to the invention, the recording data record **202** of the ultrasound recording is obtained by means of an obtaining apparatus **201**. In a further step **102**, the recording data record **203** of the x-ray recording is obtained by means of the obtaining apparatus **201**. To this end, the recording data records **202** are made available to the obtaining apparatus **201**. The recording data record **201** of the ultrasound recording was obtained in advance by a method, carried out with the aid of an ultrasound recording device **400**, for ultrasound recording of a human breast **402**, in which the recording data record **202** is recorded with the aid of an ultrasound head **401** in a step **301** and information about the position of the breast **402** and/or the position of the ultrasound head **401** is acquired during the recording in a step **302** by way of suitable sensors.

[0021] Here, the acquisition **302** of information about the position of the breast **402** comprises an acquisition with the aid of a movement sensor **403**, preferably a simple gyro sensor, of the tilt or twist of the breast **402** during the recording **301** relative to an initial location. To this end, the sensor **403** is attached to the rib cage **402** of the patient, in particular to the sternum or a different body region securely connected to the ribs; by way of example, it is adhesively bonded to the body. The sensor **403** has a wireless contact with a base station **404** and it reports the rotations of the rib cage **402** of the patient to the base station **404**. Before the ultrasound recording is started, the sensor **403** is calibrated to an initial location, with this advantageously being the supine position of the patient.

[0022] The use of a simple two-axis motion sensor is sufficient in this case for measuring the position of the rib cage of the patient or for determining the changes in the rib cage

alignment between the various ultrasound measurements, since the cranial-caudal patient axis always remains the same under the condition that the patient lies on an examination couch and the feet always point to the same end of the examination couch. It is optionally possible to detect all three angle axes, as result of which the accuracy of the measurement can be slightly increased.

[0023] Since the case described here in an exemplary manner relates to an ultrasound head **401** guided on a defined trajectory in a defined movement direction, the movement of said ultrasound head is predetermined by a stepper motor during the recording and therefore known, the acquisition **302** of information about the position of the ultrasound head **401** merely comprises an acquisition of the movement of the ultrasound head **401** during the recording **301** with the aid of a single further two-axis motion sensor **405**, co-moving with the ultrasound head **401**, under the condition that, during the displacement of the ultrasound head **401**, the sensor data are stored at at least two defined times. The position can then be calculated on the basis of the measurement data and the known spatial distance of the ultrasound head **401** between the two measurement points. The further sensor is likewise preferably a simple gyro sensor, which is attached at or on the ultrasound head **401**.

[0024] In the case of a manually guided ultrasound system, in which no trajectories are predetermined, i.e. the ultrasound head **401** of which can be aligned freely in space, one or more movement sensors **405**, with the aid of which the movement of the ultrasound head **401** can be recorded along all three spatial axes, are provided. Here, use is made, for example, of a number of sensors attached to the ultrasound head **401** and/or to a stationary support or any other suitable reference system, which sensors are able to acquire both a tilt or rotation of the ultrasound head **401** and a translational movement of the ultrasound head **401** during the recording, for example a centrifugal-force sensor and a distance sensor.

[0025] In both cases, the object of the sensors **405** attached to the ultrasound head **401** lies in acquiring the position of the ultrasound head **401** relative to the breast **402** and making this usable for the subsequent image registration. Instead of fastening the further sensor **405** directly to the ultrasound head **401**, this sensor **405** can also be attached to a region of the ultrasound system, which is connected in a defined manner with the spatial alignment of the recorded ultrasound volume.

[0026] The position information of the breast **402** and the position information of the ultrasound head **401** provide recording parameters **205** characterizing the ultrasound recording, which recording parameters can be used for subsequent further processing of the data in addition to the actual image information **207**.

[0027] Additionally, further sensors can be used for increasing the accuracy of the position acquisition, for example sensors for measuring the distance between the sensors **403**, **405**, attached to the rib cage **402** and the ultrasound head **401**, during the recording **301** or sensors which establish the distance between these sensors **403**, **405** and a spaced apart fixed point, for example the base station **404**, during the recording **301**.

[0028] If a plurality of ultrasound recordings are carried out, the recording data record **201** of the ultrasound recording preferably then comprises the data of all these ultrasound recordings. By way of example, three to five individual measurements of the breast **402** are established. The volumes recorded within the scope of these individual measurements generally overlap in the region of the nipple, but are rotated relative to one another about an angle because the patient is reoriented between the individual measurements in each case. Then, there is a correlation between the three to five volumes with the aid of the position information, that is to say information about the position of the rib cage **402** and/or the ultrasound head **401** during the recording **301**. This means that the individual volumes are superposed or aligned in respect of one another by way of the base station **404**. Therefore, image information **207** and recording parameters **205** are available for all individual recordings after the ultrasound recording.

[0029] In a further step **103** of the method according to the invention, these recording parameters **205** and the image information **207** of the ultrasound recording are acquired with the aid of an acquisition apparatus **204**. In a further step **104**, recording parameters **206** and image information **208** of the x-ray recording are acquired with the aid of the acquisition apparatus **204**.

[0030] As already described above, the recording parameters **205** of the ultrasound recording are at least one item of information about the position of the breast **402** and/or the ultrasound head **401** during the recording **301**. The recording parameters **206** of the x-ray recording are, in particular, DICOM data relating to recording angle, plate distances and compression forces. These recording parameters **205**, **206** are either contained in the recording data records **202**, **203** themselves or are made available separately.

[0031] The image information **208** from the x-ray recording and the image information **207** from the ultrasound recording relate, in particular, to individual features and/or areas, as are determinable by means of the acquisition apparatus **204** in a preferably automatic manner, for example by way of segmentation, such as the breast contour, the location of the nipple, which can be used as fixed point in the imaging, or the pectoral muscle. Suitable image information **207**, **208** is provided with landmarks by the acquisition apparatus **204** for the purposes of subsequent use during the registration of the recording data records **202**, **203** with the deformation models.

[0032] In a further step **105**, a first deformation model **211** of the breast **402**, which was deformed during the ultrasound recording, is produced with the aid of a production apparatus **209** on the basis of an initial model **210** of a non-deformed breast **402** using the recording parameters **205** and/or image information **207** of the ultrasound recording.

[0033] In a further step **106**, a second deformation model **212** of the breast **402**, which was deformed differently during the x-ray recording, is produced with the aid of the production apparatus **209** on the basis of the same initial model **210** using the recording parameters **206** and/or image information **208** of the x-ray recording.

[0034] There is no need to record the breast **402** in the non-deformed, i.e. substantially gravity-free state in the two steps **105**, **106** mentioned last. Instead, suitable deformed models are produced by the production apparatus **209** in a case-specific manner, proceeding from a non-deformed initial model. This is carried out by simulating or calculating the compression and hence the deformation of the breast **402** during the respective recording or by resorting to compressions already calculated previously. In the process, there is a case-specific adaptation of the breast models **211**, **212** to the real recording data record **202**, **203**.

[0035] The initial model **210** is a standardized, in particular generic breast model or an initial model selected from a number of stored initial models on the basis of specific, in particular patient-specific selection criteria. Here, the initial model **201** can also be based on a real measurement. Typically, the same initial model **210** is used for both deformation models **211**, **212**. However, it is also possible to use different initial models if the relationship between the employed initial models is set in such a way that a reciprocal unique coordinate transform is possible.

[0036] Once deformation models **211**, **212** are produced, they can be stored in a model catalog, from where they can be selected again as a suitable model and used by the production apparatus **209** if defined conditions are present.

[0037] The recording parameters that are used for producing the deformation model **211** for the ultrasound recording are, in particular, the parameters already described above, such as tilt angle of the rib cage **402** and position of the ultrasound head **401** relative to the rib cage **402**. The recording parameters that are used for producing the deformation model **212** for the x-ray recording are, in particular, recording angle, plate distances and compression forces. The image information **207**, **208** already listed above is used both for producing the deformation model **211** for the ultrasound recording and for producing the deformation model **212** for the x-ray recording.

[0038] In a further step **107**, there is a registration of the ultrasound deformation model **211** to the representation of the breast **402** in the ultrasound recording data record **202** with the aid of a registration apparatus **213**. In a further step **208**, there is a registration of the x-ray deformation model **212** to the representation of the breast in the x-ray recording data record **203** with the aid of the registration apparatus **213**. These registrations **107**, **108** correspond to the conventional manner of image registrations, as are known to a person skilled in the art. Therefore, there is no need to discuss this in any more detail here. Using the recording parameters **205**, **206** and/or image information **207**, **208** for the purposes of this registration may be advantageous.

[0039] Once these preparation steps have been completed, the practical application of the invention can be implemented within the scope of the work of the radiologist. To this end, a point **501** and/or region **502** from the ultrasound representation **500** of the breast **402** are selected in the ultrasound deformation model **211** with the aid of a selection apparatus **214** in a further step **109**. Here, the selection can be implemented either manually, for example by the radiologist, or else automatically, for example on the basis of an automatic pattern recognition of medically relevant points **501** or regions **502**. By way of example, the selection apparatus **214** can be a mouse pointer, which marks a point **501** or a region **502** in a representation **500** of the ultrasound image data.

[0040] In a subsequent step **110**, there is automatic determination of a point **511** and/or region **512**, corresponding to the selected point **501** and/or region **502**, in the other representation **510** of the breast **402** in the x-ray deformation model **212** by way of a coordinate correlation using the initial model **210** of the non-deformed breast **402** with the aid of a determination apparatus **215**. Since the non-deformed breast model **210** is the initial point for all deformation simulations or calculations underlying the deformed breast models **211**, **212**, the coordinate system of the non-deformed breast model **210** can be used here to establish a very exact coordinate correlation between the deformed breast models **211**, **212**.

[0041] In a concluding step **111**, the point **501** and/or region **502** selected in the ultrasound recording is displayed using a display apparatus **216** in the representation **510** of the x-ray recording of the breast as point **511** and/or region **512**, for example on adjacent monitors or in adjacent windows of a monitor **520**.

[0042] The described method can also be carried out in another way by virtue of a point **511** or region **512** being selected in the x-ray representation **510** with the aid of the selection apparatus **214**, which point or region is subsequently displayed in the ultrasound representation **500** as point **501** or region **502** with the aid of the display apparatus **216** after it was previously determined in an automatic manner with the aid of the determination apparatus **215**.

[0043] The device **200** for carrying out the method according to the invention comprises a data processing unit, wherein, in particular, the obtaining apparatus **201**, the acquisition apparatus **204**, the production apparatus **209**, the registration apparatus **213**, the selection apparatus **214**, the determination apparatus **215** and the display apparatus **216** are configured as functional modules of this data processing unit.

[0044] The invention proceeds from the concept of relating points **501**, **511** and/or regions **502**, **512** in images, obtained by imaging methods, of differently deformed objects (e.g. the human breast **402** in mammography and 3D ultrasound) to one another. While a multiplicity of recording parameters **206** are often known in x-ray and other imaging methods, which can be used for such an automated image registration, precise recording parameters, in particular in relation to the position of the breast **402**, are usually not available in the case of ultrasound. The core concept of the invention lies in also registering the position (tilt) of the rib cage **402** and of the ultrasound head **401** during a breast ultrasound. Using the position of the ultrasound head **401** relative to the rib cage **402**, which is then known in a case-specific manner, a plurality of ultrasound recordings can be linked to one another or a comparatively exact or automatic image registration with other modalities can be carried out.

[0045] Although the invention has been more specifically illustrated and described in detail by means of the preferred exemplary embodiment, nevertheless the invention is not restricted by the examples disclosed and other variations can be derived therefrom by the person skilled in the art, without departing from the scope of protection of the invention.

LIST OF REFERENCE SIGNS

[0046] **101** Obtaining the ultrasound recording
[0047] **102** Obtaining the x-ray recording
[0048] **103** Acquiring the recording parameters of the ultrasound recording
[0049] **104** Acquiring the recording parameters of the x-ray recording
[0050] **105** Producing the ultrasound deformation model
[0051] **106** Producing the x-ray deformation model
[0052] **107** Registering the ultrasound deformation model
[0053] **108** Registering the x-ray deformation model
[0054] **109** Selecting a point
[0055] **110** Determining a corresponding point
[0056] **111** Displaying the corresponding point
[0057] **200** Determination device
[0058] **201** Obtaining apparatus
[0059] **202** Ultrasound recording data record
[0060] **203** X-ray recording data record
[0061] **204** Acquisition apparatus

[0062] **205** Ultrasound recording parameter
[0063] **206** X-ray recording parameter
[0064] **207** Ultrasound image information
[0065] **208** X-ray image information
[0066] **209** Production apparatus
[0067] **210** Initial model
[0068] **211** Ultrasound deformation model
[0069] **212** X-ray deformation model
[0070] **213** Registration apparatus
[0071] **214** Selection apparatus
[0072] **215** Determination apparatuses
[0073] **216** Display apparatus
[0074] **301** Recording step
[0075] **302** Acquisition step
[0076] **401** Ultrasound head
[0077] **402** Breast, rib cage
[0078] **403** Movement sensor on the rib cage
[0079] **404** Base station
[0080] **405** Movement sensor on the ultrasound head
[0081] **500** Ultrasound representation
[0082] **501** Point in the ultrasound representation
[0083] **502** region in the ultrasound representation
[0084] **510** X-ray representation
[0085] **511** Point in the ultrasound representation
[0086] **512** Region in the ultrasound representation
[0087] **520** Monitor

1-10. (canceled)

11. A method for recording an ultrasound image of a deformed object, the method comprising the following steps:
- recording a recording data record of the deformed object with an ultrasound recording instrument;
- during the recording step, acquiring information about a position of the object and/or of the ultrasound recording instrument by way of at least one sensor.

12. The method according to claim **11**, wherein the deformed object is a human breast.

13. The method according to claim **11**, wherein the acquiring step comprises acquiring one or both of a location or an orientation of the object during the recording.

14. The method according to claim **13**, wherein the acquiring step comprises acquiring a tilt of the object relative to an initial location.

15. The method according to claim **11**, wherein the step of acquiring information about the position of the ultrasound recording instrument comprises an acquisition of location and/or orientation of the ultrasound recording instrument during the recording.

16. The method according to claim **15**, wherein the acquisition of location and/or orientation of the ultrasound recording instrument during the recording comprises acquiring a tilt of the ultrasound recording instrument relative to an initial location, and/or acquiring a movement of the ultrasound recording instrument.

17. The method according to claim **11**, wherein the deformed object is a human breast and the process is an automated breast volume ultrasound.

18. The method according to claim **11**, which comprises aligning a plurality of ultrasound recordings with respect to one another with the aid of the information about the position of the object and/or of the ultrasound recording instrument.

19. A device for recording an ultrasound image of a deformed object, the device comprising:
- an ultrasound recording instrument for recording a recording data record;
- at least one sensor configured for acquiring information about a position of one or both of the object or the ultrasound recording instrument during the recording of the recording data record.

20. The device according to claim **19**, wherein said at least one sensor is a motion sensor.

21. The device according to claim **20**, wherein said at least one sensor is a gyro sensor.

22. A method for determining selected points and/or regions in medical recordings of an object deformed in various ways, the method comprising the following steps:
- performing the method according to claim **11** for obtaining a first recording data record;
- acquiring recording parameters of, and/or image information from, the first recording, the recording parameters including at least one item of information about a position of the object and/or of the ultrasound recording instrument during the recording;
- producing a first deformation model of the deformed object on the basis of an initial model of a non-deformed object using the recording parameters and/or image information of the first recording or selecting a first deformation model from a model catalog using the recording parameters and/or image information of the first recording;
- registering the first recording data record with the first deformation model;
- obtaining a second recording data record of the object, but differently deformed, recorded by way of a different imaging method;
- acquiring recording parameters and/or image information of the second recording;
- producing a second deformation model of the deformed object on the basis of an initial model of a non-deformed object using the recording parameters and/or image information of the second recording or selecting a second deformation model from a model catalog using the recording parameters and/or image information of the second recording;
- registering the second recording data record with the second deformation model;
- selecting at least one of a point or region in the first deformation model of the object;
- automatically determining at least one of a point or region in the second deformation model of the object, which corresponds to the selected point and/or region, by coordinate correlation using the initial model of the non-deformed object; and
- displaying the determined point and/or region in the second deformation model of the object.

23. The method according to claim **22**, wherein the object is a human breast, and the different imaging method is selected from the group consisting of x-ray mammography, tomosynthesis, and magnetic resonance imaging.

24. A device for determining selected points and/or regions in medical recordings of an object deformed in various ways, the device comprising:
- an obtaining apparatus for obtaining a first recording data record, recorded by a method according to claim **11**;
- an acquisition apparatus for acquiring recording parameters of, and/or image information from, the first recording, wherein the recording parameters include at least one item of information about a position of at least one of the object or the ultrasound recording instrument during the recording;

a production apparatus for producing a first deformation model of the deformed object on the basis of an initial model of a non-deformed object using the recording parameters and/or image information of the first recording or selecting a first deformation model from a model catalog using the recording parameters and/or image information of the first recording;

a registration apparatus for registering the first recording data record with the first deformation model;

an obtaining apparatus for obtaining a second recording data record of the same, but differently deformed object, recorded by way of a different imaging method;

an acquisition apparatus for acquiring recording parameters and/or image information of the second recording;

a production apparatus for producing a second deformation model of the deformed object on the basis of an initial model of a non-deformed object using the recording parameters and/or image information of the second recording or selecting a second deformation model from a model catalog using the recording parameters and/or image information of the second recording;

a registration apparatus for registering the second recording data record with the second deformation model;

a selection apparatus for selecting a point and/or region in the first deformation model of the object;

a determination apparatus for automatically determining a point and/or region in the second deformation model of the object, which corresponds to the selected point and/or region, by coordinate correlation using the initial model of the non-deformed object; and

a display apparatus for displaying the determined point and/or region in the second deformation model of the object.

25. The method according to claim **24**, wherein the object is a human breast, and the different imaging method is selected from the group consisting of x-ray mammography, tomosynthesis, and magnetic resonance imaging.

26. A computer program, comprising computer program instructions stored in non-transitory form for executing the steps of a method according to claim **22** when the computer program is executed on a computer.

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专利名称(译)	用于记录变形对象，特别是人乳房的超声图像的方法和设备		
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摘要(译)

在以不同方式变形的对象的图像中的点或区域之间建立关系，例如在乳房摄影和3D超声处理中的人体胸部的图像。虽然可以用于这种自动图像配准的多个记录参数通常在X射线和其他成像方法中是已知的，但是精确的记录参数，特别是对于胸部的位置，通常在超声过程中不可用。目的是另外检测胸部超声中胸部和超声换能器的位置，特别是倾斜。然后可以使用超声换能器相对于胸部的位置来执行多个超声记录彼此的链接或使用其他模态的相对更精确的自动图像配准。以特定于该情况的方式检测位置。