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(54) **Adaptive image filtering in an ultrasound imaging device**

Adaptive Bildfilterung in einer Ultraschallbildgebungsvorrichtung

Filtrage d'image adaptatif dans un dispositif d'imagerie à ultrasons

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EP-A2- 0 543 386
US-A- 5 050 226
US-A1- 2003 097 068
US-B1- 6 468 218

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Description

BACKGROUND OF THE INVENTION

[Technical Field]

[0001] The present invention generally relates to an ultrasound imaging device, and more particularly to an ultrasound imaging device and a method of forming a 3-dimensional ultrasound image using an adaptive filter.

[Background Art]

[0002] An ultrasound imaging device has become an important and popular diagnostic tool due to its non-invasive and non-destructive nature. The ultrasound imaging device may form an ultrasound image by using ultrasound characteristics such as reflection, scattering and absorption when the ultrasound signals are propagated into tissues of a human body. Since the reflection and scattering of the ultrasound signals simultaneously occur in the target object, speckle noises may be included in forming ultrasound image data. The speckle noises may degrade a 3-dimensional ultrasound image. Also, boundaries between the organs and a background, which are important portions for diagnosis, may not be correctly displayed due to the speckle noises. Thus, the speckle noises may be burdensome in analyzing the 3-dimensional ultrasound image and examining the organs in the 3-dimensional ultrasound image.

[0003] Recently, various types of filters have been introduced to reduce the speckle noises in the 3-dimensional ultrasound image. However, the conventional filters may filter the 3-dimensional ultrasound data without considering an amount of data in data acquisition directions (i.e., axial, lateral and elevation directions) to reduce the speckle noises. As such, a loss of the ultrasound image data may occur during the filtering. Thus, the 3-dimensional ultrasound image may be distorted due to the data loss.

[0004] An ultrasound imaging device according to the preamble of claim 1 and a method of forming an ultrasound image according to the preamble of claim 3 are known from US 6,468,218 B1.

[0005] A method and a system for reducing speckle for two and three-dimensional images is disclosed in US 2003/0097068 A1. For two-dimensional imaging, a one and a half or a two-dimensional transducer is used to obtain sequential, parallel or related frames of elevation spaced data.

[0006] US 5,050,226 describes an ultrasonic echographic imaging device for two dimensions including an adaptive filter for reducing the interference noise in the images obtained.

[0007] In view of the prior art the present invention provides an ultrasound imaging device with the features of claim 1 as well as a method of forming an ultrasound image with the features of claim 3 to reduce loss of ultrasound image data occurring during filtering.

[0008] Accordingly, there is provided an ultrasound imaging device, comprising a data acquiring unit configured to acquire 3-dimensional ultrasound image data based on receive signals formed based on ultrasound echoes reflected from a target object, and a filtering unit configured to calculate a data acquisition ratio of amounts of the 3-dimensional ultrasound image data in predetermined data in an axial direction, a lateral direction and an elevation direction, and to determine a size of a filtering mask of an adaptive 3-dimensional filter in the axial direction, the lateral direction and the elevation direction ac-cording to the data acquisition ratio. The filtering mask comprises a first filtering mask and a second filtering mask, and the filtering unit is configured to determine the second filtering mask to have a larger size than the first filtering mask and to filter the 3-dimensional ultrasound image data with the first filtering mask to thereby output a first filtered ultrasound image data and to filter the 3-dimensional ultrasound image data with the second filtering mask to thereby output a second filtered ultrasound image data. The ultrasound imaging device further comprises a scan converting unit configured to scan-convert the first and second filtered 3-dimensional ultrasound image data, a 3-dimensional rendering unit configured to perform 3-dimensional rendering upon the first and second scan-converted 3-dimensional ultrasound image data to form first and second 3-dimensional ultrasound images, and a mixing unit configured to mix the first and second 3-dimensional ultrasound images to form a single 3-dimensional ultrasound image.

[0009] Moreover, there is provided a method of forming an ultrasound image, comprising the steps of: (a) acquiring 3-dimensional ultrasound image data based on ultrasound echoes reflected from a target object; (b) calculating a data acquisition ratio of amounts of the 3-dimensional ultrasound image data in an axial direction, a lateral direction and an elevation direction; and (c) determining a size of a filtering mask of an adaptive 3-dimensional filter in the axial direction, the lateral direction and the elevation direction according to the data acquisition ratio. The method is characterized in that the filtering mask comprises a first filtering mask and a second filtering mask; and in that the method of forming an ultrasound image further comprises the steps of: (d) determining the second filtering mask of the 3-dimensional filter to have a larger size than the first filtering mask; (e) filtering the 3-dimensional ultrasound image data with the first filtering mask to thereby output a first filtered ultrasound image data; (f) filtering the 3-dimensional ultrasound image data with the second filtering mask to thereby output a second filtered ultrasound image data; (g) scan-converting the filtered first and second 3-dimensional ultrasound image data; (h) performing 3-dimensional rendering upon the first and second scan-converted 3-dimensional ultrasound image data to form first and second 3-dimensional ultrasound images; and (i) mixing the first and second 3-dimensional ultrasound images to form a single 3-

dimensional ultrasound image.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010]

FIG. 1 is a block diagram showing one embodiment of the ultrasound imaging device.

FIG. 2 is a schematic diagram showing an example of 3-dimensional ultrasound image data acquired in axial, lateral and elevation directions.

FIG. 3 is a schematic diagram showing an example of a filtering mask set in 3-dimensional ultrasound image data.

FIG. 4 is a flowchart showing an example of mixing ultrasound images filtered by filters with different filtering masks.

DETAILED DESCRIPTION OF THE INVENTION

[0011] FIG. 1 is a block diagram of an illustrative embodiment of an ultrasound imaging device. Referring to FIG. 1, a probe 110 includes a plurality of elements 112. The elements 112 transmit ultrasound signals along scan lines set in a target object in response to transmit pulse signals applied thereto. The elements 112 then output electrical receive signals based on ultrasound echoes reflected from the target object.

[0012] A data acquiring unit 120 performs signal processing upon the receive signals to thereby form ultrasound image data. The ultrasound image data includes a 3-dimensional ultrasound image data such as volume data, as illustrated in FIG. 2. Reference planes A, B and C are set in the volume data. The reference planes A, B and C are determined based on a scanning direction. A resolution of reference plane images may depend on the amount of ultrasound image data, which are acquired during the scanning. Generally, a larger amount of ultrasound image data may be acquired in the order of an axial direction, a lateral direction and an elevation direction.

[0013] A filtering unit 130 filters the ultrasound image data to reduce speckle noises in the ultrasound image data. In one embodiment, the filtering unit 130 adopts an adaptive 3-dimensional filter. The adaptive 3-dimensional filter uses a filtering mask, the size of which is determined according to a data acquisition ratio of the ultrasound image data in data acquisition directions. The filter unit 130 calculates a data acquisition ratio of amounts of the ultrasound image data in axial, lateral and elevation directions. The filtering unit 130 determines a size of the filtering mask of the adaptive 3-dimensional filter in the axial, lateral and elevation directions to obtain the same ratio as the data acquisition ratio. For example, assuming that the data acquisition ratio is 7:5:3 in the axial, lateral and elevation directions, the filtering unit 130 determines the filtering mask having a size of $7 \times 5 \times 3$.

[0014] FIG. 3 is a schematic diagram showing an example of a filtering mask set on the 3-dimensional ultrasound image data 300. As shown in FIG. 3, a length of the filtering mask 310 in an axial direction, for which a relatively more amount of ultrasound image data may be obtained, is set to be relatively long. Also, a length of the filtering mask 310 in an elevation direction, for which a relatively less amount of ultrasound image data is obtained, is set to be relatively short. Thus, data loss is reduced during the filtering. In one embodiment, the filter is an average filter or a Gaussian filter. That is, the filtering unit 130 is configured to smooth the ultrasound image through the filtering to thereby reduce the speckle noises.

[0015] A user input unit 140 receives an instruction from a user. The user input unit 140 may be an input device such as a keyboard, a mouse, a track ball and the like. As mentioned above, the size of the filtering mask is determined according to the amount of the ultrasound data for the respective data acquisition directions in accordance with one embodiment. Also, in another embodiment, the size of the filtering mask is determined by the instruction inputted through the user input unit 140. That is, the user may adjust the size of the filtering mask so that a desirable ultrasound image is obtained.

[0016] The scan converting unit 150 scan-converts the filtered ultrasound image data into a data format suitable for display. The scan converting unit 150 performs 3-dimensional scan conversion. A 3-dimensional rendering unit 160 performs volume rendering upon the scan-converted ultrasound image data to thereby form a 3-dimensional ultrasound image. The volume rendering is carried out with a ray casting method. The 3-dimensional ultrasound image data obtained through the volume rendering may be interpolated to form a 3-dimensional ultrasound image. The 3-dimensional ultrasound image is displayed on a display unit (not shown).

[0017] In another embodiment, the 3-dimensional ultrasound image data is filtered at least twice with the filtering masks having different sizes. The filtered 3-dimensional ultrasound image data is scan-converted and rendered. This is so that a plurality of 3-dimensional ultrasound images obtained by using different filtering masks is obtained. The plurality of 3-dimensional ultrasound images is mixed to obtain a desirably smoothened 3-dimensional ultrasound image. To this end, the ultrasound imaging device 100 further comprises a mixing unit 170 for mixing the 3-dimensional ultrasound images produced by the 3-dimensional rendering unit 160.

[0018] FIG. 4 is a flowchart showing a procedure of forming an ultrasound image by mixing ultrasound images filtered with different sizes of the filtering masks. Referring to FIG. 4, the data acquiring unit 120 acquires the ultrasound image data based on the receive signals outputted from the probe 110 at step S410. The filtering unit 130 filters the ultrasound image data with a first filtering mask to thereby output a first filtered ultrasound image data at step S420. In such a case, the size of the first filtering mask is determined according to a ratio of amounts of the ultrasound image data in the axial, lateral and elevation directions. That is, the size of the first filtering mask is determined to have the same ratio as the data acquisition ratio in the axial, lateral and elevation directions. Also, in another embodiment, the size of the filtering mask is determined by the user instruction inputted through the user input unit 140.

[0019] The scan converting unit 150 scan-converts the first filtered ultrasound image data to output a first scan-converted ultrasound image data at step S430. The 3-dimensional rendering unit 160 performs the volume rendering upon the first scan-converted ultrasound image data to thereby form a first ultrasound image data at step S440.

[0020] Subsequently, the filtering unit 130 filters the ultrasound image data with a second filtering mask to thereby output a second filtered ultrasound image data at step S450. In such a case, the size of the filtering mask is determined to have a larger size than the first filtering mask. The size of the second mark filter is also determined to have the same ratio as the data acquisition ratio in the axial, lateral and elevation directions. Moreover, the size of the second filtering mask is determined by the user instruction inputted through the user input unit 140.

[0021] The scan converting unit 150 scan-converts the second filtered ultrasound image data to output a second scan-converted ultrasound image data at step S460. The 3-dimensional rendering unit 160 performs the volume rendering upon the second scan-converted ultrasound image data to thereby form a second ultrasound image at step S470.

[0022] The mixing unit 170 mixes the first and second ultrasound images to thereby form a final 3-dimensional ultrasound image at step S480. A mixing ratio of the first and second ultrasound images is determined by a user instruction inputted through the user input unit 140. For example, if the mixing ratio of the first ultrasound image is higher, then a relatively sharper ultrasound image is obtained. Also, if the mixing ratio of the second ultrasound image is higher, then a relatively more smoothened ultrasound image is obtained. The mixed 3-dimensional ultrasound image is displayed through the display unit at step S490. According to another embodiment, the more smoothened 3-dimensional ultrasound image is obtained.

[0023] As mentioned above, since the size of the filtering mask is adaptively adjusted according to the data acquisition ratio in the axial, lateral and elevation directions, the data loss is reduced with a reduction of the speckle noise. Thus, an enhanced 3-dimensional ultrasound image is obtained. Further, as the adaptive filtering mask is adopted, filtering calculation is reduced.

[0024] Any reference in this specification to "one embodiment," "an embodiment," "example embodiment," etc. means that a particular feature, structure or characteristic described in connection with the embodiment is included in at least one embodiment of the present invention. The appearances of such phrases in various places in the specification are not necessarily all referring to the same embodiment. Further, when a particular feature, structure or characteristic is described in connection with any embodiment, it is submitted that it is within the purview of one skilled in the art to effect such feature, structure or characteristic in connection with other ones of the embodiments.

Claims

1. An ultrasound imaging device (100), comprising:

a data acquiring unit (120) configured to acquire 3-dimensional ultrasound image data based on receive signals formed based on ultrasound echoes reflected from a target object; and
a filtering unit (130) configured to calculate a data acquisition ratio of amounts of the 3-dimensional ultrasound image data in predetermined data in an axial direction, a lateral direction and an elevation direction, and to determine a size of a filtering mask of an adaptive 3-dimensional filter in the axial direction, the lateral direction and the elevation direction according to the data acquisition ratio,
characterized in that the filtering mask comprises a first filtering mask and a second filtering mask, wherein the filtering unit (130) is configured to determine the second filtering mask to have a larger size than the first filtering mask and to filter the 3-dimensional ultrasound image data with the first filtering mask to thereby output first filtered ultrasound image data and to filter the 3-dimensional ultrasound image data with the second filtering mask to thereby output second filtered ultrasound image data; and **in that** the ultrasound imaging device (100) further comprises:

a scan converting unit (150) configured to scan-convert the first and second filtered 3-dimensional ultrasound image data;
a 3-dimensional rendering unit (160) configured to perform 3-dimensional rendering upon the first and second scan-converted 3-dimensional ultrasound image data to form first and second 3-dimensional ultrasound images;
a mixing unit (170) configured to mix the first and second 3-dimensional ultrasound images to form a single 3-dimensional ultrasound image.

2. The ultrasound imaging device (100) of Claim 1, further comprising a user input unit (140) operable to an instruction for setting the size of the filtering mask.

3. A method of forming an ultrasound image, comprising:

acquiring 3-dimensional ultrasound image data based on ultrasound echoes reflected from a target object;
calculating a data acquisition ratio of amounts of the 3-dimensional ultrasound image data in an axial direction, a lateral direction and an elevation direction;
determining a size of a filtering mask of an adaptive 3-dimensional filter in the axial direction, the lateral direction and the elevation direction according to the data acquisition ratio,
characterized in that the filtering mask comprises a first filtering mask and a second filtering mask; and **in that** the method of forming an ultrasound image further comprises:

determining the second filtering mask of the 3-dimensional filter to have a larger size than the first filtering mask; filtering the 3-dimensional ultrasound image data with the first filtering mask to thereby output first filtered ultrasound image data;
filtering the 3-dimensional ultrasound image data with the second filtering mask to thereby output second filtered ultrasound image data;
scan-converting the filtered first and second 3-dimensional ultrasound image data;
performing 3-dimensional rendering upon the first and second scan-converted 3-dimensional ultrasound image data to form first and second 3-dimensional ultrasound images; and
mixing the first and second 3-dimensional ultrasound images to form a single 3-dimensional ultrasound image.

Patentansprüche

1. Ultraschallbildgebungsvorrichtung (100), aufweisend:

- eine Einheit zum Sammeln von Daten (120), die ausgebildet ist, um drei - dimensionale Ultraschallbilddaten basierend auf empfangenen Signalen zu sammeln, die auf Ultraschallechos basieren, welche von einem Zielobjekt reflektiert werden; und
- eine Filtereinheit (130), die dazu ausgebildet ist, um ein Datensammelverhältnis zu berechnen von Mengen der drei-dimensionalen Ultraschallbilddaten in vorgegebenen Daten in einer axialen Richtung, einer lateralen Richtung und einer Hochrichtung, und dazu, eine Größe einer Filtermaske eines adaptiven drei-dimensionalen Filters in der axialen Richtung, der einer lateralen Richtung und der Hochrichtung gemäß dem Datensammelverhältnis zu bestimmen,
dadurch gekennzeichnet, dass
die Filtermaske eine erste Filtermaske und eine zweite Filtermaske aufweist, wobei die Filtereinheit (130) dazu ausgebildet ist, die zweite Filtermaske in der Weise zu bestimmen, dass sie eine größere Größe als die erste Filtermaske hat, und dazu, die dreidimensionalen Ultraschallbilddaten mit der ersten Filtermaske zu filtern, um dabei erste gefilterte Ultraschallbilddaten auszugeben, und dazu, die dreidimensionalen Ultraschallbilddaten mit der zweiten Filtermaske zu filtern, um dabei zweite gefilterte Ultraschallbilddaten auszugeben; und dadurch dass
die Ultraschallbildgebungsvorrichtung (100) ferner aufweist:

- eine Scan-Umwandlungseinheit (150), die dazu ausgebildet ist, die ersten und zweiten gefilterten drei-dimensionalen Ultraschalldaten zu scan-konvertieren;
- eine drei-dimensionale Renderungseinheit (160), die dazu ausgebildet ist, um ein drei-dimensionales Rendering an den ersten und zweiten scankonvertierten drei-dimensionalen Ultraschallbilddaten durchzuführen, um erste und zweite drei-dimensionale Ultraschalldaten zu formen;
- eine Mischeinheit (170), die dazu ausgebildet ist, die ersten und zweiten drei-dimensionalen Ultraschallbilder zu mischen, um ein einziges drei-dimensionales Ultraschallbild zu bilden.

2. Die Ultraschallbildgebungsvorrichtung (100) nach Anspruch 1, die ferner eine Benutzereingabeeinheit (140) aufweist, die mittels eines Befehls betätigbar ist, um die Größe der Filtermaske einzustellen.

3. Verfahren zum Bilden eines Ultraschallbildes, das die Schritte aufweist:

- Sammeln drei-dimensionaler Ultraschallbilddaten basierend auf Ultraschallechos, die von einem Zielobjekt reflektiert werden;
- Berechnen eines Datensammelverhältnisses der Mengen an dreidimensionalen Ultraschallbilddaten in einer axialen Richtung, einer lateralen Richtung und einer Hochrichtung;
- Bestimmen einer Größe einer Filtermaske eines adaptiven dreidimensionalen Filters in der axialen Richtung, der lateralen Richtung und der Hochrichtung gemäß dem Datensammelverhältnis; **dadurch gekennzeichnet, dass**
die Filtermaske eine erste Filtermaske und eine zweite Filtermaske aufweist; und dadurch, dass

das Verfahren zum Bilden eines Ultraschallbildes ferner die Schritte aufweist:

- Bestimmen, dass die zweite Filtermaske des drei-dimensionalen Filters eine größere Größe als die erste Filtermaske hat;
- Filtern der drei-dimensionalen Ultraschallbilddaten mit der ersten Filtermaske, um dabei erste gefilterte Ultraschallbilddaten auszugeben;
- Filtern der drei-dimensionalen Ultraschallbilddaten mit der zweiten Filtermaske um dabei zweite gefilterte Ultraschallbilddaten auszugeben;
- Scan-konvertieren der gefilterten ersten und zweiten Ultraschallbilddaten;
- Durchführen eines drei-dimensionalen Renderings an den ersten und zweiten scan-konvertierten drei-dimensionalen Ultraschallbilddaten, um ein erstes und ein zweites Ultraschallbild zu bilden; und
- Mischen der ersten und zweiten drei-dimensionalen Ultraschallbilder, um ein einziges drei-dimensionales Ultraschallbild zu bilden.

Revendications

1. Dispositif d'imagerie ultrasonique (100) comportant:

une unité d'acquisition de données (120) configurée pour acquérir des données d'images ultrasoniques tridimensionnelles basées sur des signaux reçus formés sur la base d'échos ultrasoniques réfléchis par un objet cible; et
une unité de filtrage (130), configurée pour calculer un ratio d'acquisition de données de la quantité de données des images ultrasoniques tridimensionnelles parmi des données prédéterminées selon une direction axiale, une direction latérale et une direction en élévation, et pour déterminer une taille d'un masque de filtrage d'un filtre tridimensionnel adaptatif dans la direction axiale, la direction latérale et la direction en élévation, en fonction du ratio d'acquisition de données,
caractérisé en ce que le masque de filtrage comprend un premier masque de filtrage et un second masque de filtrage, dans laquelle l'unité de filtrage (130) est configurée pour définir que le second masque de filtrage aura une taille plus grande que le premier masque de filtrage et pour filtrer les données d'images ultrasoniques tridimensionnelles avec le premier masque de filtrage afin de filtrer les données d'images ultrasoniques tridimensionnelles avec le premier masque de filtrage pour ainsi émettre des premières données d'images ultrasoniques filtrées et pour filtrer les données d'images ultrasoniques tridimensionnelles avec le second masque de filtrage afin d'émettre ainsi des secondes données d'images ultrasoniques filtrées;
et **en ce que** le dispositif d'imagerie ultrasonique (100) comporte en outre ;
une unité de balayage (150) configurée pour scanner-convertir les premières et les secondes données d'images ultrasoniques tridimensionnelles filtrées ;
une unité de restitution tridimensionnelle (160) configurée pour réaliser une restitution tridimensionnelle des premières et secondes données d'images ultrasoniques tridimensionnelles scannées-converties pour former des premières et secondes images tridimensionnelles ultrasoniques ;
une unité de mixage (170) configurée pour mixer les premières et secondes images ultrasoniques tridimensionnelles pour former une image ultrasonique tridimensionnelle unique.

2. Dispositif d'imagerie ultrasonique (100) selon la revendication 1, comportant en outre une unité d'introduction de données utilisateur (140) obéissant à une instruction pour régler la taille du masque de filtrage.

3. Procédé pour former une image ultrasonique, comprenant;
l'acquisition de données d'images ultrasoniques tridimensionnelles basées sur des échos ultrasoniques réfléchis par un objet cible ;
le calcul d'un ratio d'acquisition de données de quantité de données d'images ultrasoniques tridimensionnelles selon une direction axiale, une direction latérale et une direction en élévation en fonction du ratio d'acquisition de données;
la détermination d'une taille d'un masque de filtrage d'un filtre tridimensionnel adaptatif dans la direction axiale, la direction latérale et la direction en élévation, en fonction du ratio d'acquisition,
caractérisé en ce que le masque de filtrage comprend un premier et un second masque de filtrage, et **en ce que** le procédé de formation d'une image ultrasonique comprend en outre;
la détermination que le second masque de filtrage du filtre tridimensionnel a une taille plus grande que le premier masque de filtrage; le filtrage des données d'images ultrasoniques tridimensionnelles avec le premier masque de filtrage pour émettre ainsi des premières données d'images ultrasoniques filtrées ;
le filtrage des données d'images ultrasoniques tridimensionnelles avec le second masque afin d'émettre ainsi des secondes données d'images ultrasoniques filtrées;
le scannage-conversion des premières et les secondes données d'images ultrasoniques tridimension-

nelles filtrées ;
la réalisation d'une restitution tridimensionnelle des premières et secondes données d'images ultrasoniques tridimensionnelles scannées-converties pour former des premières et secondes images tridimensionnelles ultrasoniques; et
le mixage des premières et secondes images ultrasoniques tridimensionnelles pour former une image ultrasonique tridimensionnelle unique.

FIG. 1

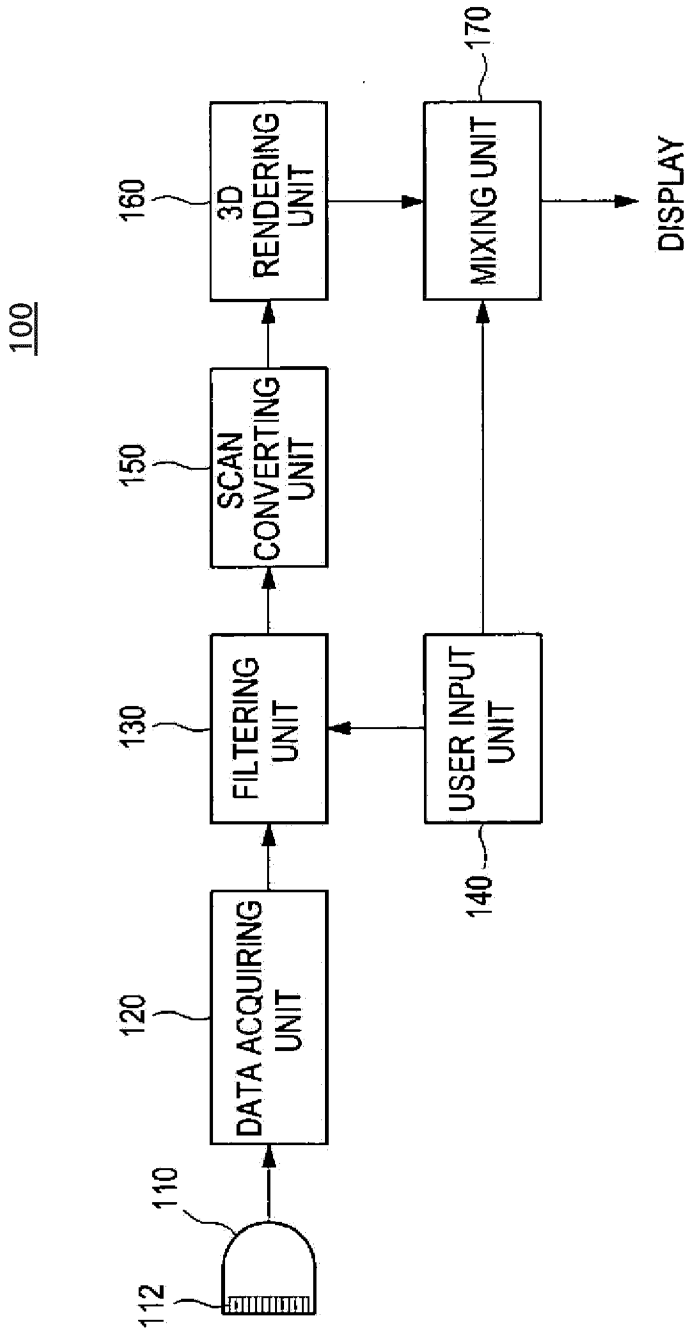

100
110
112
120
DATA ACQUIRING UNIT
130
FILTERING UNIT
140
USER INPUT UNIT
150
SCAN CONVERTING UNIT
160
3D RENDERING UNIT
170
MIXING UNIT
DISPLAY

FIG. 2

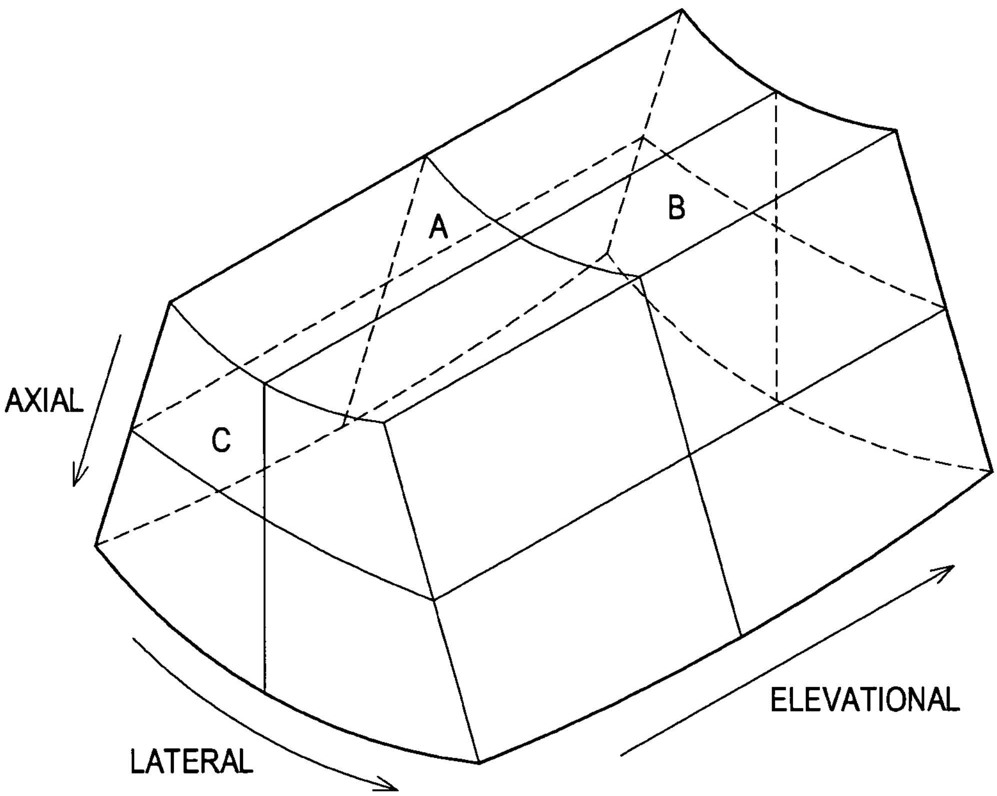


FIG. 3

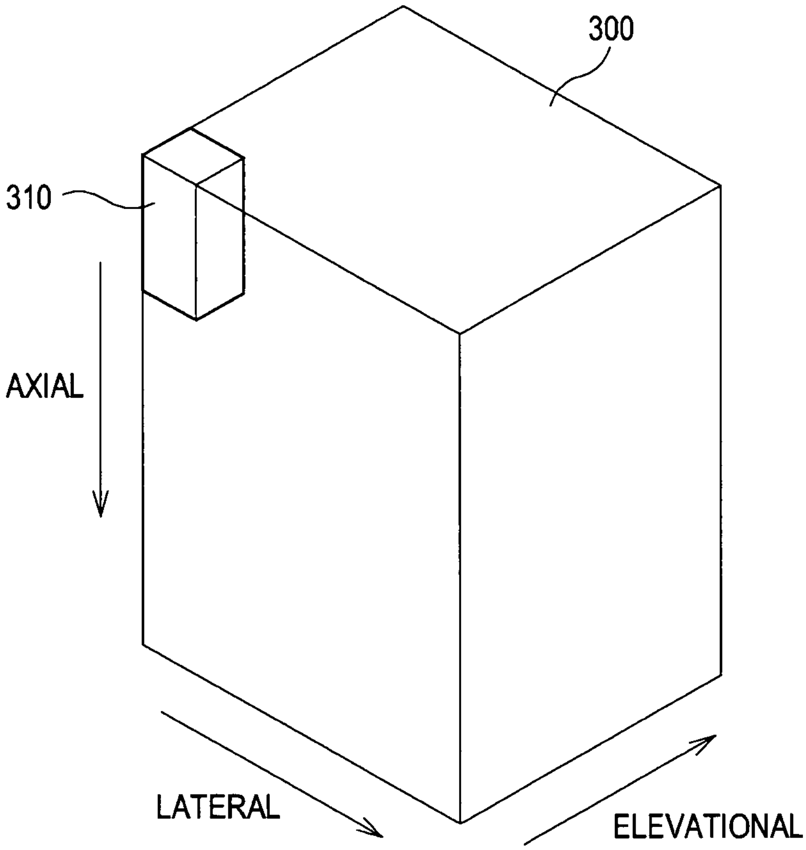
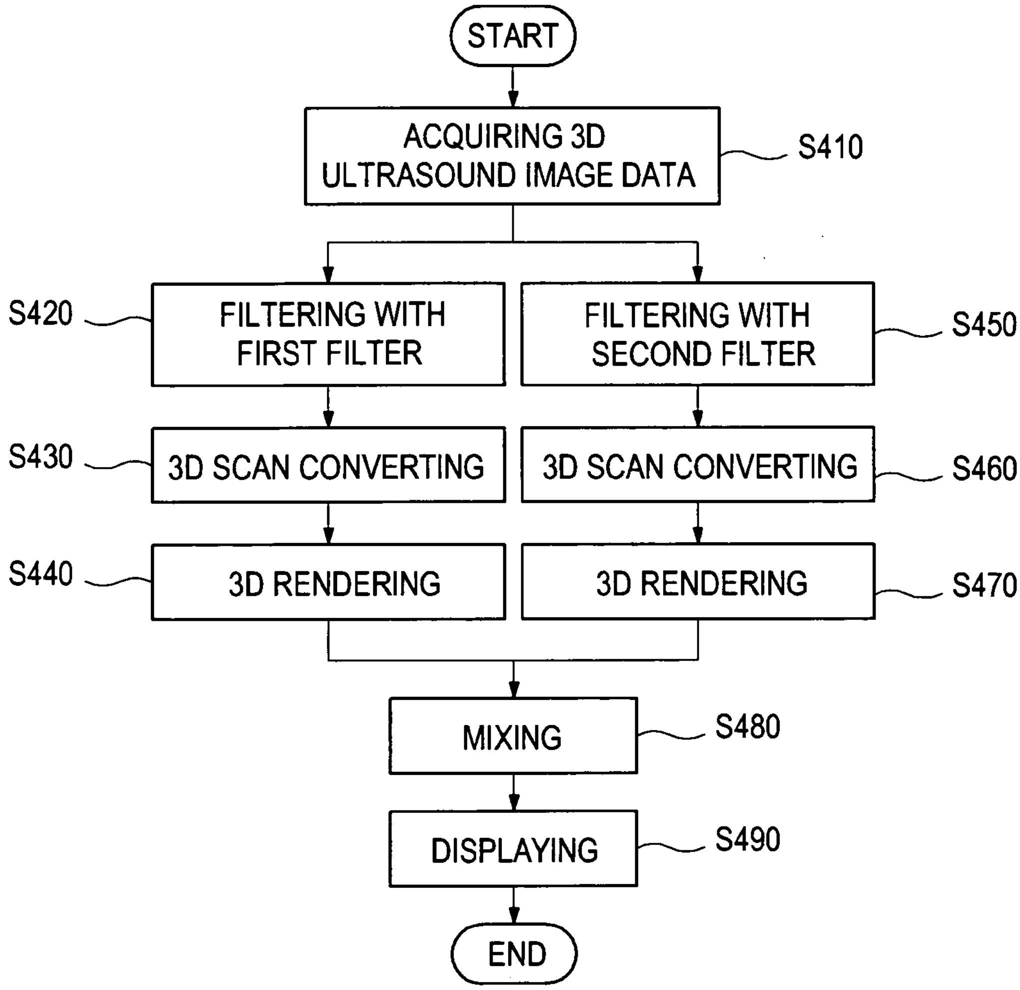


FIG. 4


START
ACQUIRING 3D ULTRASOUND IMAGE DATA
S410
FILTERING WITH FIRST FILTER
S420
FILTERING WITH SECOND FILTER
S450
3D SCAN CONVERTING
S430
3D SCAN CONVERTING
S460
3D RENDERING
S440
3D RENDERING
S470
MIXING
S480
DISPLAYING
S490
END

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 6468218 B1 **[0004]**
- US 20030097068 A1 **[0005]**
- US 5050226 A **[0006]**

专利名称(译)	超声成像设备中的自适应图像滤波
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申请(专利权)人(译)	MEDISON CO.，LTD.
当前申请(专利权)人(译)	三星MEDISON CO.，LTD.
[标]发明人	LEE JAE KEUN LEE SUK JIN
发明人	LEE, JAE KEUN LEE, SUK JIN
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CPC分类号	G01S15/8993 A61B8/14 A61B8/483 A61B8/5269 G01S7/52026 G01S7/52077 G06T5/50 G06T2207/10136 G06T2207/20221
代理机构(译)	SCHMID，WOLFGANG
优先权	1020070118600 2007-11-20 KR
其他公开文献	EP2063290A2 EP2063290A3
外部链接	Espacenet

摘要(译)

超声波成像装置技术领域超声成像装置包括：数据获取单元，用于基于基于从目标对象反射的超声回波形成的接收信号来获取三维超声图像数据;滤波单元，用于确定滤波器的滤波掩模的大小，所述大小根据数据采集方向上的三维超声图像数据的量自适应地确定，所述滤波单元还被配置为对三维超声进行滤波使用过滤掩码的图像数据;扫描转换单元，用于扫描转换滤波后的三维超声图像数据;和3维渲染单元，用于对扫描转换的3维超声图像数据进行3维渲染，以形成3维超声图像。

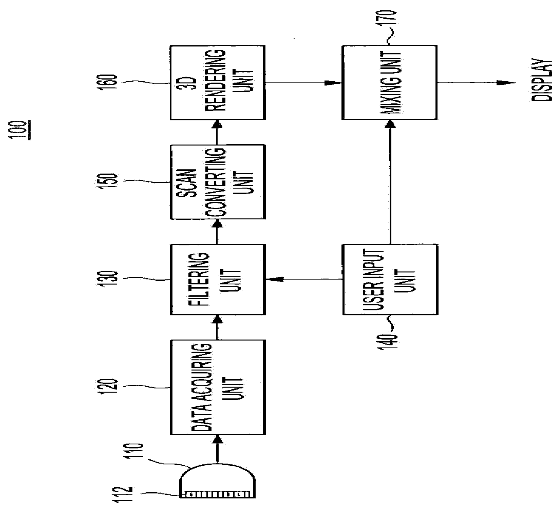

FIG. 1