

(19)



(11)

EP 1 974 671 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:

01.10.2008 Bulletin 2008/40

(51) Int Cl.:

A61B 8/00 (2006.01)

G06F 19/00 (2006.01)

G06F 3/01 (2006.01)

A61B 17/00 (2006.01)

(21) Application number: **08005569.2**

(22) Date of filing: **26.03.2008**

(84) Designated Contracting States:

**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR
HR HU IE IS IT LI LT LU LV MC MT NL NO PL PT
RO SE SI SK TR**

Designated Extension States:

AL BA MK RS

(72) Inventor: **Shin, Dong Kuk**

Seoul 135-280 (KR)

(74) Representative: **Lorenz, Markus**

Lorenz & Kollegen

Patentanwälte Partnerschaftsgesellschaft

Alte Ulmer Straße 2

89522 Heidenheim (DE)

(30) Priority: **27.03.2007 KR 20070029494**

(71) Applicant: **MEDISON CO., LTD.**

Kangwon-do 250-870 (KR)

(54) **Ultrasound system**

(57) The present invention is directed to an ultrasound system. The ultrasound system of the present invention includes an ultrasound diagnostic unit (150), a storage unit (130), an image acquisition unit (110), a pattern recognition unit (120), and a control unit (140). The ultrasound diagnostic unit forms an ultrasound image representative of a target object. The storage unit stores training sets in association with respective instructions for operating the ultrasound diagnostic unit. Each of the

training sets includes pattern samples associated with a particular action of a user. The image acquisition unit acquires an action of a user to form an action image. The pattern recognition unit recognizes an action pattern from the action image. The control unit retrieves the training sets stored in the storage unit to find a pattern sample having a match with the recognized action pattern. The control unit controls an operation of the ultrasound diagnostic unit based on an instruction associated with the training set including the found pattern sample.

FIG. 2

Action	Training sets	Instructions
	Training set I ₁	B-mode Execution
	Training set I ₂	C-mode Execution
	Training set I ₃	D-mode Execution
⋮	⋮	⋮
	Training set I _N	M-mode Execution

EP 1 974 671 A1

Description

[0001] The present application claims priority from Korean Patent Application No. 10-2007-0029494 filed on March 27, 2007, the entire subject matter of which is incorporated herein by reference.

BACKGROUND OF THE INVENTION**[Technical Field]**

[0002] The present invention generally relates to ultrasound systems, and more particularly to an ultrasound system configured to recognize the action of a user.

[Background Art]

[0003] The ultrasound system has become an important and popular diagnostic tool due to its non-invasive and non-destructive nature. Modern high-performance ultrasound imaging diagnostic systems and techniques are commonly used to produce two- or three-dimensional images of internal features of patients.

[0004] Generally, the ultrasound system includes an input unit for receiving various inputs from a user. The input unit may include a control panel for allowing the user to select a menu. The control panel may contain a touch screen displaying the menu for image optimization and providing a function of selecting the menu, a track ball for inputting a moving instruction to move a cursor on a screen of the display unit, a keyboard for inputting texts and providing shortcut keys in various measurement modes, etc. The control panel is typically mounted on the ultrasound system and may be movable in the up, down, right and left directions.

[0005] However, the control panel may be movable within a limited range in the conventional ultrasound system. Thus, the user may manipulate the control panel in an uncomfortable posture while the user grasps the probe to examine a patient. Also, when the ultrasound system is far from the user, it is difficult to manipulate the control panel.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] FIG. 1 is a block diagram showing an ultrasound system constructed in accordance with one embodiment of the present invention.

[0007] FIG. 2 is diagram showing an example of associating training sets corresponding to actions with instructions for operating the ultrasound system constructed in accordance with one embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0008] FIG. 1 is a block diagram showing an ultrasound system constructed in accordance with one embodiment

of the present invention. Referring to FIG. 1, the ultrasound system 100 includes an image acquisition unit 110, an image processing unit 120, a storage unit 130, a control unit 140 and an ultrasound diagnostic unit 150.

[0009] The image acquisition unit 110 may be operable to capture various actions of a user to acquire action images. A plurality of action images for the same action may be acquired in different angles. The action images may be a digital image. The image acquisition unit 110 may be any type of imaging devices capable of acquiring digital images such as a digital camera.

[0010] The pattern recognition unit 120 may be operable to recognize action patterns from the acquired images. The pattern recognition unit 120 may perform segmentation upon the action images to extract a specific portion (e.g., a user's hand). The pattern recognition unit 120 may simplify the extracted portion to thereby obtain pattern samples of the user actions. The simplification may be achieved by indicating boundaries in the extracted portion with chain codes or performing skeleton extraction upon the extracted portion. The pattern recognition unit 120 may generate training sets with the pattern samples for the respective actions, which may indicate gestures of the user's hand in accordance with one embodiment of the present invention. The pattern recognition unit 120 may form a table in which the training sets are associated with respective instructions for operating the ultrasound system 100, as shown in FIG. 2. The corresponding relations of the training sets and the instructions may be arbitrarily set by the user. The mapping table may be stored in the storage unit 130.

[0011] While the ultrasound system 100 operates, the image acquiring unit 120 may repeatedly acquire an action image for the user. The acquired action image is provided to the pattern recognition unit 120. The pattern recognition unit 120 may extract a portion corresponding to the user's hand through segmentation and recognize an action pattern from the extracted portion.

[0012] The control unit 140 may be operable to retrieve the training set stored in the storage unit 130 to find a pattern sample matched with the recognized action pattern in the training sets. The control unit 140 may control the ultrasound diagnostic unit 150 based on an instruction associated with the training set in which the found pattern sample is included. For example, if it is determined that the found pattern sample is included in the first training set I_1 , then the control unit 140 may detect the instruction of B-mode execution and control the ultrasound diagnostic unit 150 to operate in the B-mode.

[0013] Although the action images of the user's hand are used to form pattern samples in accordance with one embodiment of the present invention, various action images for different portions of the user (e.g., a head, a leg, etc.) may be used in accordance with another embodiment of the present invention.

[0014] The ultrasound diagnostic unit 150 may be operable to transmit ultrasound signals to a target object and receive ultrasound echo signals to thereby form an

ultrasound image of the target object under the control of the control unit 140. The ultrasound diagnostic unit 150 may include a probe, a beam former, a signal processing unit, an image processing unit, a display unit and an input unit. The probe may transmit and receive ultrasound signals. The transducer elements may generate the ultrasound signals in response to transmission pulse signals and electrical reception signals in response to ultrasound echo signals reflected from discontinuous planes of acoustic impedance in the target object. The transducer elements may individually transmit the ultrasound signals or several transducer elements may transmit the ultrasound signals at the same time.

[0015] The beam former may form a transmission pattern of the transmission pulse signals such that the ultrasound signals generated from the transducer elements are focused on a focal point. Also, the beam former may focus the electrical reception signals based on distances between the transducer elements and the focal point.

[0016] The signal processing unit may perform analog-to-digital conversion, amplification and various signal process upon the focused reception signals. The image processing unit may form an ultrasound image based on the processed signals. The display unit may display the ultrasound image.

[0017] The imaging acquisition unit 110, the image reorganization unit 120, the storage unit 130 and the control unit 140 may be configured into a computing device such as a personal computer. The computing device may be interconnected with the ultrasound diagnostic unit 150 through various communication networks. The computing device may remotely control the ultrasound diagnostic unit 150 by using the Internet.

[0018] As described above, since the ultrasound diagnostic unit may operate in response to the actions of the user, the user may comfortably operate the ultrasound diagnostic unit.

[0019] In accordance with one embodiment of the present invention, there is provided an ultrasound system, which includes the following an ultrasound diagnostic unit for forming an ultrasound image representative of a target object; a storage unit for storing training sets in association with respective instructions for operating the ultrasound diagnostic unit, each of said training sets including pattern samples associated with a particular action of a user; an image acquisition unit for capturing an action of a user to form an action image; a pattern recognition unit for recognizing an action pattern from the action image; and a control unit for retrieving the training sets stored in the storage unit to find a pattern sample having a match with the recognized action pattern, the control unit being configured to control an operation of the ultrasound diagnostic unit based on an instruction associated with the training set including the found pattern sample.

[0020] Any reference in this specification to "one embodiment," "an embodiment," "example embodiment," etc. means that a particular feature, structure or charac-

teristic 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.

[0021] Although embodiments have been described with reference to a number of illustrative embodiments thereof, it should be understood that numerous other modifications and embodiments can be devised by those skilled in the art that will fall within the spirit and scope of the principles of this disclosure. More particularly, numerous variations and modifications are possible in the component parts and/or arrangements of the subject combination arrangement within the scope of the disclosure, the drawings and the appended claims. In addition to variations and modifications in the component parts and/or arrangements, alternative uses will also be apparent to those skilled in the art.

Claims

1. An ultrasound system for displaying ultrasound images, comprising:
 - an ultrasound diagnostic unit for forming an ultrasound image representative of a target object;
 - a storage unit for storing training sets in association with respective instructions for operating the ultrasound diagnostic unit, each of said training sets including pattern samples associated with a particular action of a user;
 - an image acquisition unit for capturing an action of a user to form an action image;
 - a pattern recognition unit for recognizing an action pattern from the action image; and
 - a control unit for retrieving the training sets stored in the storage unit to find a pattern sample having a match with the recognized action pattern, the control unit being configured to control an operation of the ultrasound diagnostic unit based on an instruction associated with the training set including the found pattern sample.
2. The ultrasound system of Claim 1, wherein the pattern samples are obtained by capturing various actions of the user in different angles by the image acquisition unit.
3. The ultrasound system of Claim 2, wherein the action of the user is one of actions of a hand, a head and a leg.

- 4. The ultrasound system of Claim 1, wherein the control unit controls the ultrasound diagnostic unit through the Internet.

5

10

15

20

25

30

35

40

45

50

55

FIG. 1

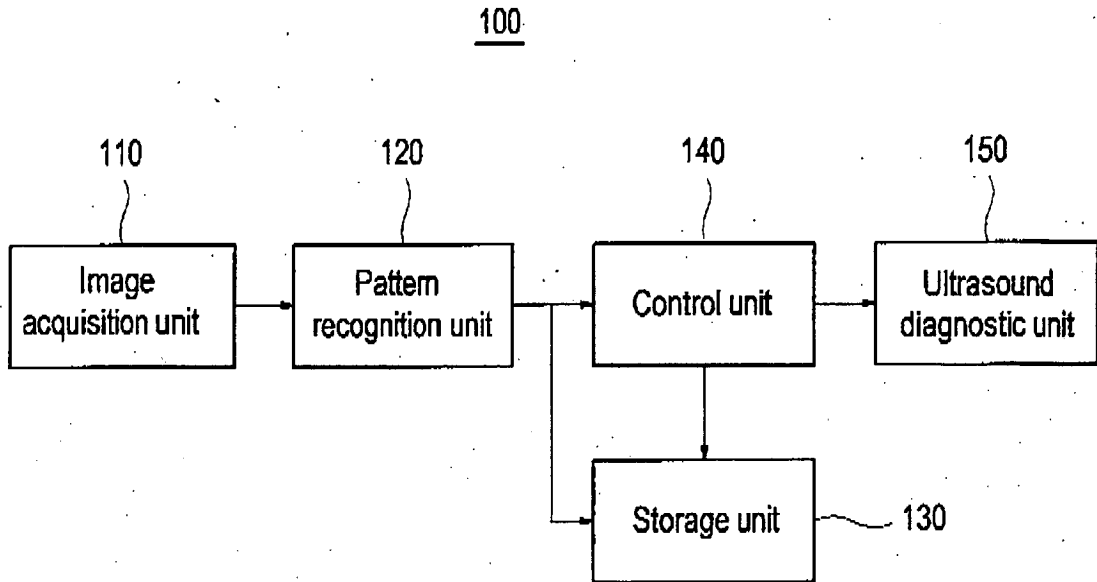






FIG. 2

Action	Training sets	Instructions
	Training set I_1	B-mode Execution
	Training set I_2	C-mode Execution
	Training set I_3	D-mode Execution
⋮	⋮	⋮
	Training set I_N	M-mode Execution



DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y	US 5 544 654 A (MURPHY SEAN [US] ET AL) 13 August 1996 (1996-08-13) * column 6, line 63 - column 9, line 14 * * column 14, line 45 - column 20, line 56 * * figures 9,9A *	1-4	INV. A61B8/00 G06F3/01 G06F19/00
Y	----- TRIESCH J ET AL: "Robust classification of hand postures against complex backgrounds" PROCEEDINGS OF THE 1996 SECOND INTERNATIONAL CONFERENCE ON AUTOMATIC FACE AND GESTURE RECOGNITION, KILLINGTON, VT, USA, 14-16 OCT. 1996, LOS ALAMITOS, CA, USA, IEEE COMPUT. SOC, US, 14 October 1996 (1996-10-14), pages 170-175, XP010200416 ISBN: 978-0-8186-7713-7 * the whole document *	1-4	ADD. A61B17/00
A	----- US 2005/025706 A1 (KAGERMEIER ROBERT [DE]) 3 February 2005 (2005-02-03) * abstract *	1-4	TECHNICAL FIELDS SEARCHED (IPC)
A	----- WO 2006/087689 A (KONINKL PHILIPS ELECTRONICS NV [NL]; BONFIGLIO SILVIO [DE]; KRAMER JOO) 24 August 2006 (2006-08-24) * abstract *	1-4	A61B G06F
		----- -/--	
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 14 July 2008	Examiner Willig, Hendrik
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

3
EPO FORM 1503 03.02 (P04C01)



DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	KOLSCH M ET AL: "Robust hand detection" AUTOMATIC FACE AND GESTURE RECOGNITION, 2004. PROCEEDINGS. SIXTH IEEE INTERNATIONAL CONFERENCE ON, IEEE, PISCATAWAY, NJ, USA, 17 May 2004 (2004-05-17), pages 614-619, XP010949501 ISBN: 978-0-7695-2122-0 * the whole document *	1-4	
A	US 2002/128846 A1 (MILLER STEVEN C [US]) 12 September 2002 (2002-09-12) * abstract *	1-4	
			TECHNICAL FIELDS SEARCHED (IPC)
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 14 July 2008	Examiner Willig, Hendrik
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

3
EPO FORM 1503 03.82 (P04001)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 08 00 5569

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

14-07-2008

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5544654	A	13-08-1996	NONE
US 2005025706	A1	03-02-2005	DE 10334073 A1 10-02-2005 JP 2005040613 A 17-02-2005
WO 2006087689	A	24-08-2006	EP 1853167 A2 14-11-2007
US 2002128846	A1	12-09-2002	DE 10210622 A1 31-10-2002 JP 2003000614 A 07-01-2003

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description





- KR 1020070029494 [0001]

专利名称(译)	超声系统		
公开(公告)号	EP1974671A1	公开(公告)日	2008-10-01
申请号	EP2008005569	申请日	2008-03-26
申请(专利权)人(译)	MEDISON CO. , LTD.		
当前申请(专利权)人(译)	MEDISON CO. , LTD.		
[标]发明人	SHIN DONG KUK		
发明人	SHIN, DONG KUK		
IPC分类号	A61B8/00 G06F3/01 G06F19/00 A61B17/00		
CPC分类号	A61B8/00 A61B8/467 A61B2017/00207 G16H40/63		
代理机构(译)	LORENZ , MARKUS		
优先权	1020070029494 2007-03-27 KR		
其他公开文献	EP1974671B1		
外部链接	Espacenet		

摘要(译)

本发明涉及一种超声系统。本发明的超声系统包括超声诊断单元 (150) , 存储单元 (130) , 图像获取单元 (110) , 模式识别单元 (120) 和控制单元 (140) 。超声诊断单元形成代表目标对象的超声图像。存储单元存储与用于操作超声诊断单元的相应指令相关联的训练集。每个训练集包括与用户的特定动作相关联的模式样本。图像获取单元获取用户的动作以形成动作图像。模式识别单元从动作图像识别动作模式。控制单元检索存储在存储单元中的训练集, 以找到与识别的动作模式匹配的模式样本。控制单元基于与包括找到的图案样本的训练集相关联的指令来控制超声诊断单元的操作。

FIG. 2

Action	Training sets	Instructions
	Training set I_1	B-mode Execution
	Training set I_2	C-mode Execution
	Training set I_3	D-mode Execution
⋮	⋮	⋮
	Training set I_N	M-mode Execution