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(54) Ultrasound diagnostic apparatus

(57) An ultrasound diagnostic apparatus which forms a three-dimensional bloodstream image by reference to volume data obtained from a three-dimensional space within a living organism. A modified maximum value detection method is applied along each ray. Search of a maximum value is sequentially executed from a search start point, and at a time point when a predetermined termination condition is satisfied, a maximum value which is being detected at this time point is regarded as a specific maximum value. The specific maximum value is then converted into a pixel value. The specific maximum value is a first peak and is specified even if a higher peak exists after the first peak. A three-dimensional bloodstream image is formed by a plurality of pixel values. In a portion of the three-dimensional bloodstream image in which two bloodstreams cross each other, a bloodstream located on the front side is preferentially displayed.

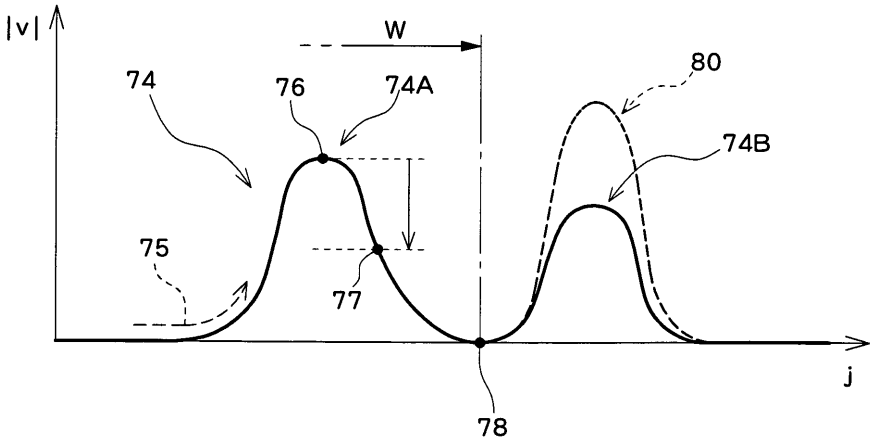

FIG. 4

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EUROPEAN SEARCH REPORT

Application Number
EP 08 01 2537

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	ELIZABETH BULLITT, STEPHEN AYLWARD: "Volume Rendering of Segmented Tubular Objects", LECTURE NOTES IN COMPUTER SCIENCE 2208, 1 January 2001 (2001-01-01), pages 161-168, XP002579462, Lecture Notes in Computer Science	1,6,10	INV. A61B8/06 A61B8/14
Y	* page 162, line 18 - page 166, line 5 *	2-5,7-9	

X	MROZ L ET AL: "Maximum intensity projection at warp speed", COMPUTERS AND GRAPHICS, ELSEVIER, GB LNKD-DOI:10.1016/S0097-8493(00)00030-3, vol. 24, no. 3, 1 June 2000 (2000-06-01), pages 343-352, XP004201697, ISSN: 0097-8493	10	
Y	* abstract *	1-5	
	* page 344, left-hand column, line 55 - right-hand column, line 36 *		
	* page 348, right-hand column, line 31 - page 349, left-hand column, line 9 *		
	* page 349, right-hand column, line 40 - line 42 *		TECHNICAL FIELDS SEARCHED (IPC) A61B G06T

Y	US 6 126 603 A (HATFIELD WILLIAM THOMAS [US] ET AL) 3 October 2000 (2000-10-03) * column 4, line 30 - column 6, line 50; figures 1,4 *	1	

Y	US 2006/184029 A1 (HAIM RONEN [IL] ET AL) 17 August 2006 (2006-08-17) * paragraph [0035] *	9	

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	15 April 2011	Daoukou, Eleni

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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A : technological background
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D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

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EUROPEAN SEARCH REPORT

Application Number
EP 08 01 2537

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 6 503 202 B1 (HOSSACK JOHN A [US] ET AL) 7 January 2003 (2003-01-07) * column 2, line 66 - column 8, line 45; figures 1,3,4 * * column 10, line 17 - line 21 * * column 12, line 35 - column 14, line 10 * -----	7,8	
A	US 6 334 847 B1 (FENSTER AARON [CA] ET AL) 1 January 2002 (2002-01-01) * column 11, line 66 - column 14, line 45 * -----	1-3	
			TECHNICAL FIELDS SEARCHED (IPC)

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	15 April 2011	Daoukou, Eleni

CATEGORY OF CITED DOCUMENTS

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Application Number
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CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing claims for which payment was due.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

☒ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

☐ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

☐ The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).

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LACK OF UNITY OF INVENTION
SHEET B

Application Number
EP 08 01 2537

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1-6, 9, 10

   First Maximum Intensity Projection technique for 3D rendering of bloodstream volume data acquired via ultrasound apparatus

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2. claims: 7, 8

   Method for denoising bloodstream volume data acquired via ultrasound apparatus, based on the size of objects identified in the data

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 08 01 2537

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
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15-04-2011

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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		IL 124170 A	10-11-2002
		JP 11028214 A	02-02-1999
		US 6102864 A	15-08-2000
US 2006184029 A1	17-08-2006	NONE	
US 6503202 B1	07-01-2003	NONE	
US 6334847 B1	01-01-2002	NONE	

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

专利名称(译)	超声诊断仪		
公开(公告)号	EP2016906A3	公开(公告)日	2011-05-25
申请号	EP2008012537	申请日	2008-07-10
[标]申请(专利权)人(译)	日立阿洛卡医疗株式会社		
申请(专利权)人(译)	ALOKA CO.，LTD.		
当前申请(专利权)人(译)	日立ALOKA MEDICAL.，LTD.		
[标]发明人	MURASHITA MASARU		
发明人	MURASHITA, MASARU		
IPC分类号	A61B8/06 A61B8/14		
CPC分类号	A61B8/14 A61B8/00 A61B8/06 A61B8/13 A61B8/463 A61B8/483		
优先权	2007185566 2007-07-17 JP		
其他公开文献	EP2016906A2 EP2016906B1		
外部链接	Espacenet		

摘要(译)

一种超声波诊断装置，其通过参考从生物体内的三维空间获得的体积数据形成三维血流图像。沿每条射线应用修改的最大值检测方法。从搜索开始点顺序执行最大值的搜索，并且在满足预定终止条件的时间点，将在该时间点检测到的最大值视为特定最大值。然后将特定最大值转换为像素值。特定最大值是第一个峰值，即使在第一个峰值之后存在更高的峰值，也会指定。通过多个像素值形成三维血流图像。在两个血流彼此交叉的三维血流图像的一部分中，优先显示位于前侧的血流。

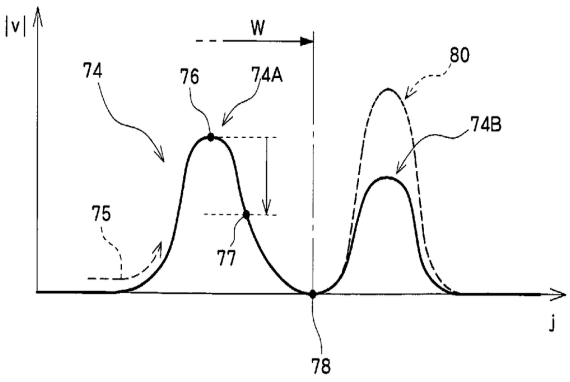

FIG. 4