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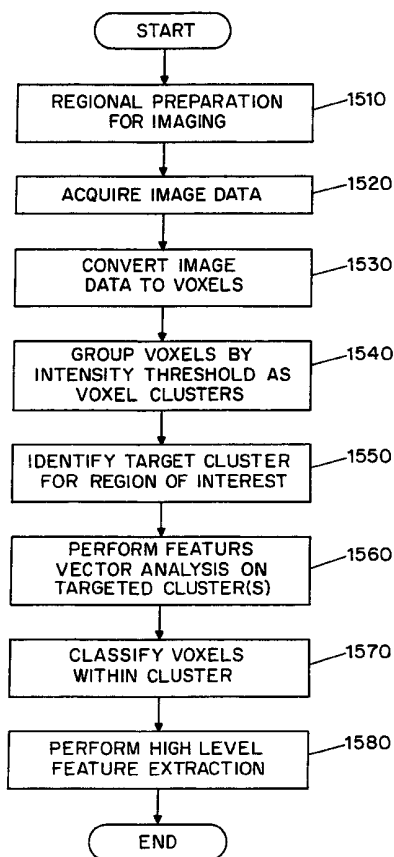
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- (71) Applicant (for all designated States except US): THE RESEARCH FOUNDATION OF STATE UNIVERSITY OF NEW YORK [US/US]; Office of Technology Licensing, State University of New York at Stony Brook, Stony Brook, NY 11794 (US).
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[Continued on next page]

(54) Title: SYSTEM AND METHOD FOR PERFORMING A THREE-DIMENSIONAL VIRTUAL SEGMENTATION AND EXAMINATION



(57) Abstract: A system and method for generating a three-dimensional visualization image of an object such as an organ using volume visualization techniques and exploring the image using a guided navigation system which allows the operator to travel along a flight path and to adjust the view to a particular portion of the image of interest in order, for example, to identify polyps, cysts or other abnormal features in the visualized organ. An electronic biopsy can also be performed on an identified growth or mass in the visualized object. Virtual colonoscopy can be enhanced by electronically removing residual stool, fluid and non-colonic tissue from the image of the colon, by employing bowel preparation followed by image segmentation operations. Methods are also employed for virtually expanding regions of colon collapse using image segmentation results.



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INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 00/07352

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 G06T17/00 G06T15/20 G06T17/40

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 G06T G09B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ, INSPEC, BIOSIS

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	LIANG Z ET AL: "Inclusion of a priori information in segmentation of colon lumen for 3D virtual colonoscopy" 1997 IEEE NUCLEAR SCIENCE SYMPOSIUM CONFERENCE RECORD (CAT. NO.97CH36135), 1997 IEEE NUCLEAR SCIENCE SYMPOSIUM CONFERENCE RECORD, ALBUQUERQUE, NM, USA, 9-15 NOV. 1997, pages 1423-1427 vol.2, XP002142928 1997, New York, NY, USA, IEEE, USA ISBN: 0-7803-4258-5 the whole document <div style="text-align: center;">--- -/--</div>	1,5-15, 20,24-27



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

° Special categories of cited documents :

- *A* document defining the general state of the art which is not considered to be of particular relevance
- *E* earlier document but published on or after the international filing date
- *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

- *T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- *G* document member of the same patent family

Date of the actual completion of the international search

15 December 2000

Date of mailing of the international search report

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INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 00/07352

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	VALEV V ET AL: "Techniques of CT colonography (virtual colonoscopy)" CRITICAL REVIEWS IN BIOMEDICAL ENGINEERING, 1999, BEGELL HOUSE, USA, vol. 27, no. 1-2, pages 1-25, XP000925023 ISSN: 0278-940X	1,5-15, 20,24-27
A	page 7, line 4 - line 10 page 12, line 17 - line 28 page 20, line 29	32
X	----- SHIBOLET O ET AL: "Coloring voxel-based objects for virtual endoscopy" IEEE SYMPOSIUM ON VOLUME VISUALIZATION (CAT. NO.989EX300), RESEARCH TRIANGLE PARK, NC, USA, 19-20 OCT. 1998, pages 15-22, 162, XP002155625 1998, New York, NY, USA, IEEE, USA ISBN: 0-8186-9180-8 section 1	19,28-31
Y	----- KAUFMAN A., WAN M.: "Disobstruction of Colon Wall Collapse" PROJECT DESCRIPTION, 'Online! January 1999 (1999-01), page 1 XP002155626 Retrieved from the Internet: <URL:www.cs.sunysb.edu/fari/523/collapse.html> 'retrieved on 2000-12-04!	32-34
A	the whole document	16-18
Y	----- HOLZAPFEL G A ET AL: "Large strain analysis of soft biological membranes: formulation and finite element analysis" COMPUTER METHODS IN APPLIED MECHANICS AND ENGINEERING, 15 MAY 1996, ELSEVIER, NETHERLANDS, vol. 132, no. 1-2, pages 45-61, XP000972573 ISSN: 0045-7825	32-34
A	abstract section 1, paragraph 1	16-18
A	----- WO 98 37517 A (WAKE FOREST UNIVERSITY SCHOOL) 27 August 1998 (1998-08-27) page 9, line 24 - line 32	8,14,27
A	----- US 4 751 643 A (LORENSEN WILLIAM E ET AL) 14 June 1988 (1988-06-14) column 2, line 61 -column 3, line 24	2-4, 21-23
A	----- US 5 095 521 A (TROUSSET YVES ET AL) 10 March 1992 (1992-03-10) claims 5,6	5,24
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INTERNATIONAL SEARCH REPORT

Inter. Appl. Application No

PCT/US 00/07352

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p>KAYE J ET AL: "A 3D virtual environment for modeling mechanical cardiopulmonary interactions" CVRMED-MRCAS '97. FIRST JOINT CONFERENCE, COMPUTER VISION, VIRTUAL REALITY AND ROBOTICS IN MEDICINE AND MEDICAL ROBOTICS AND COMPUTER-ASSISTED SURGERY PROCEEDINGS, CVRMED-MRCAS '97. FIRST JOINT CONFERENCE COMPUTER VISION, VIRTUAL REALITY AND ROBOTICS , pages 389-398, XP000933658 1997, Berlin, Germany, Springer-Verlag, Germany ISBN: 3-540-62734-0 abstract</p>	16-18
A	<p align="center">---</p> <p>BURGARD W ET AL: "Active mobile robot localization by entropy minimization" PROCEEDINGS SECOND EUROMICRO WORKSHOP ON ADVANCED MOBILE ROBOTS (CAT. NO.97TB100193), PROCEEDINGS SECOND EUROMICRO WORKSHOP ON ADVANCED MOBILE ROBOTS, BRESCIA, ITALY, 22-24 OCT. 1997, pages 155-162, XP002155627 1997, Los Alamitos, CA, USA, IEEE Comput. Soc, USA ISBN: 0-8186-8174-8 section 3</p> <p align="center">-----</p>	17,33

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 00/07352

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:

3. Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- The additional search fees were accompanied by the applicant's protest.
- No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. Claims: 1-18, 20-27

electronically cleansing a three-dimensional virtual colon representation

1.1. Claims: 1-18,20-27

bla 1

1.2. Claims: 32-34

bla 2

2. Claims: 19,28-31

mapping textures from optical 2D-images to a monochrome 3D-data set acquired by a CT-imaging scanner or a MR-imaging scanner

3. Claims: 32-34

virtually expanding a collapsed part in a colon representation

Please note that all inventions mentioned under item 1, although not necessarily linked by a common inventive concept, could be searched without effort justifying an additional fee.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US 00/07352

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9837517 A	27-08-1998	US 5920319 A AU 6180498 A EP 0961993 A	06-07-1999 09-09-1998 08-12-1999
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