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(71) Applicant *(for all designated States except US)*: **INNOVEA MEDICAL LTD.** [IL/IL]; 6 Hamalit St., 60920 Kadima (IL).

(72) Inventors; and
(75) Inventors/Applicants *(for US only)*: **MASHIACH, Adi** [IL/IL]; 5 Yosef Eliyahu St., 64074 Tel Aviv (IL). **HAY, Ori** [IL/IL]; P.O.Box 362, 37835 Moshav Aviel (IL). **FARKASH, Gil** [IL/IL]; 54 Habrosh St., 30500 Binyamina (IL).

(74) Agent: **DR. EYAL BRESSLER LTD**; 11 Tuval St., 52522 Ramat Gan (IL).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

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Declarations under Rule 4.17:

— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*

[Continued on next page]

(54) **Title**: SEGMENTATION DEVICE AND METHOD

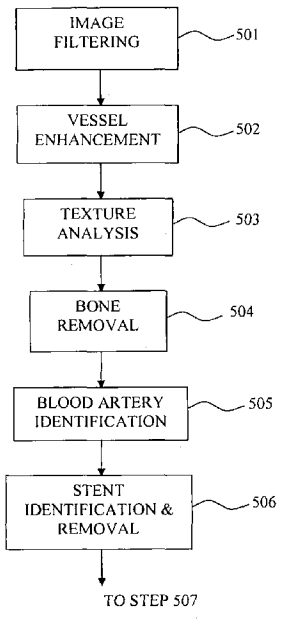


FIG. 5A

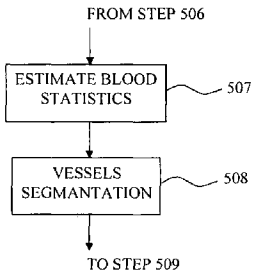


FIG. 5B

(57) **Abstract**: There is provided a method of medical imaging of a structure that includes creating a three dimensional image of the structure and processing the image to enhance image quality such that images with an attenuation value below a threshold value result in recognizable image, thereby identifying the structure.

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Published:

— *with international search report (Art. 21(3))*

— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

(88) Date of publication of the international search report:
18 March 2010

INTERNATIONAL SEARCH REPORT

International application No
PCT/IL2009/000245

A. CLASSIFICATION OF SUBJECT MATTER
INV. G06T5/00
ADD. G06T7/40

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)
G06T

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, INSPEC, COMPENDEX, EMBASE

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DENG Y ET AL: "UNSUPERVISED SEGMENTATION OF COLOR-TEXTURE REGIONS IN IMAGES AND VIDEO" IEEE TRANSACTIONS ON PATTERN ANALYSIS AND MACHINE INTELLIGENCE, IEEE SERVICE CENTER, LOS ALAMITOS, CA, US, vol. 23, no. 8, 1 August 2001 (2001-08-01), pages 800-810, XP001091620 ISSN: 0162-8828 cited in the application page 800, left-hand column, line 20, paragraph 1 - right-hand column, last line figures 1,5 page 802, right-hand column, line 1, paragraph 3 - page 804, left-hand column, last line , paragraph 3.3	1-3,8, 15-29, 34, 41-55, 60,67-78

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[X] Further documents are listed in the continuation of Box C. [ ] See patent family 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.
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
12 October 2009	22/01/2010

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Gauthier, J

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Form PCT/ISA/210 (second sheet) (April 2005)

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GABRIEL TSECHPENAKIS ET AL: "Coupling CRFs and Deformable Models for 3D Medical Image Segmentation", COMPUTER VISION, 2007. ICCV 2007. IEEE 11TH INTERNATIONAL CONFERENCE O N, IEEE, PI, 1 October 2007 (2007-10-01), pages 1-8, XP031194640 ISBN: 978-1-4244-1630-1 page 1, left-hand column, line 1, paragraph 1. - page 2, right-hand column, last line page 3, right-hand column, line 1, paragraph 3. - page 4, right-hand column, last line , paragraph 3.1 page 5, left-hand column, paragraph 4. - right-hand column	1-3,8, 15-29, 34, 41-55, 60,67-78
X	PODDA ET AL: "Texture analysis for vascular segmentation from CT images" INTERNATIONAL CONGRESS SERIES, EXCERPTA MEDICA, AMSTERDAM, NL, vol. 1281, 1 May 2005 (2005-05-01), pages 206-211, XP005081669 ISSN: 0531-5131 page 206, line 1, paragraph 1 - page 208, last line page 208, line 17, paragraph 2. - line 18	1-3,8, 15-29, 34, 41-55, 60,67-78
A	ZHANG ET AL: "Boundary delineation in transrectal ultrasound image for prostate cancer" COMPUTERS IN BIOLOGY AND MEDICINE, NEW YORK, NY, US, vol. 37, no. 11, 6 September 2007 (2007-09-06), pages 1591-1599, XP022233637 ISSN: 0010-4825 page 1592, left-hand column, line 1, paragraph 2. - page 1594, right-hand column, last line , paragraph 2.2.1	1-3,8, 15-29, 34, 41-55, 60,67-78
A	FUAN TSAI ET AL: "3D Computation of Gray Level Co-occurrence in Hyperspectral Image Cubes" ENERGY MINIMIZATION METHODS IN COMPUTER VISION AND PATTERN RECOGNITION; [LECTURE NOTES IN COMPUTER SCIENCE], SPRINGER BERLIN HEIDELBERG, BERLIN, HEIDELBERG, vol. 4679, 27 August 2007 (2007-08-27), pages 429-440, XP019097681 ISBN: 978-3-540-74195-4 page 429, paragraph 1 - page 430 page 431, paragraph 3.1 - page 432 figure 1	1-3,8, 15-29, 34, 41-55, 60,67-78

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	VASSILI A KOVALEV ET AL: "Three-Dimensional Texture Analysis of MRI Brain Datasets" IEEE TRANSACTIONS ON MEDICAL IMAGING, IEEE SERVICE CENTER, PISCATAWAY, NJ, US, vol. 20, no. 5, 1 May 2001 (2001-05-01), pages 424-433, XP011036090 ISSN: 0278-0062 page 424, left-hand column, line 1, paragraph I. - right-hand column, last line , paragraph I.A page 431, left-hand column, line 1, paragraph IV.B - page 432, right-hand column, last line figures 1,8	1-3,8, 15-29, 34, 41-55, 60,67-78
X	CHEN T ET AL: "A hybrid framework for 3D medical image segmentation" MEDICAL IMAGE ANALYSIS, OXFORD UNIVERSITY PRESS, OXOFRD, GB, vol. 9, no. 6, 1 December 2005 (2005-12-01), pages 547-565, XP025369244 ISSN: 1361-8415 [retrieved on 2005-12-01] page 548, right-hand column, line 1, paragraph 2.1 - page 550, left-hand column, last line page 551, right-hand column, line 1, paragraph 3.2 - page 552, left-hand column, last line page 553, right-hand column, line 1, paragraph 3.4 - line 11 figures 2-4,12,13,15	1-3,8, 15-29, 34, 41-55, 60,67-78
X	RUI HUANG ET AL: "A Tightly Coupled Region-Shape Framework for 3D Medical Image Segmentation" BIOMEDICAL IMAGING: MACRO TO NANO, 2006. 3RD IEEE INTERNATIONAL SYMPOS IUM ON APRIL 6, 2006, PISCATAWAY, NJ, USA,IEEE, PISCATAWAY, NJ, USA, 6 April 2006 (2006-04-06), pages 426-429, XP010912658 ISBN: 978-0-7803-9576-3 page 426, left-hand column, line 1, paragraph 1. - page 427, right-hand column, last line , paragraph 3.1 page 428, paragraph 4.2 figures 1,2 page 428; table 1	1-3,8, 15-29, 34, 41-55, 60,67-78

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CONSTANTINO CARLOS REYES ALDASORO ET AL: "Volumetric Texture Segmentation by Discriminant Feature Selection and Multiresolution Classification" IEEE TRANSACTIONS ON MEDICAL IMAGING, IEEE SERVICE CENTER, PISCATAWAY, NJ, US, vol. 26, no. 1, 1 January 2007 (2007-01-01), pages 1-14, XP011152667 ISSN: 0278-0062 page 1, left-hand column, line 8 - right-hand column, last line page 2, left-hand column, paragraph II - right-hand column page 6, right-hand column, paragraph VI.B page 8, left-hand column, paragraph VII.B - page 9, right-hand column figures 1,4a,4b,10,11b,11c,11d,16	1-3,8, 15-29, 34, 41-55, 60,67-78
X	MADABHUSHI A ET AL: "Optimal feature combination for automated segmentation of prostatic adenocareinoma from high resolution MRI" PROCEEDINGS OF THE 25TH. ANNUAL INTERNATIONAL CONFERENCE OF THE IEEE ENGINEERING IN MEDICINE AND BIOLOGY SOCIETY. CANCUN, MEXICO, SEPT. 17 20030917; 20030917 - 20030921 NEW YORK, NY : IEEE, US, vol. 1, 17 September 2003 (2003-09-17), pages 614-617, XP010693390 ISBN: 978-0-7803-7789-9 page 615, left-hand column, paragraph II.A page 615, left-hand column, paragraph II.C - right-hand column page 616, paragraph V - page 617 figure 1	1-3,8, 15-29, 34, 41-55, 60,67-78
X	RUCHANEEWAN SUSOMBOON ET AL: "Automatic Single-Organ Segmentation in Computed Tomography Images" DATA MINING, 2006. ICDM '06. SIXTH INTERNATIONAL CONFERENCE ON, IEEE, PI, 1 December 2006 (2006-12-01), pages 1081-1086, XP031003140 ISBN: 978-0-7695-2701-7 page 1081, right-hand column, line 22 - page 1082, left-hand column, line 10 page 1082, left-hand column, line 1, paragraph 2. - page 1083, left-hand column, last line , paragraph 2.1 figures 1,2	1-3,8, 15-29, 34, 41-55, 60,67-78

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	KALININ M ET AL: "A Classification Approach for Anatomical Regions Segmentation" IMAGE PROCESSING, 2005. ICIP 2005. IEEE INTERNATIONAL CONFERENCE ON GENOVA, ITALY 11-14 SEPT. 2005, PISCATAWAY, NJ, USA,IEEE, vol. 2, 11 September 2005 (2005-09-11), pages 1262-1265, XP010851290 ISBN: 978-0-7803-9134-5 page 1262, right-hand column, line 1, paragraph II - page 1263, right-hand column, last line , paragraph II table 1	1-3,8, 15-29, 34, 41-55, 60,67-78
A	CASTELLANO G ET AL: "Texture analysis of medical images" CLINICAL RADIOLOGY, LIVINGSTONE, HARLOW, GB, vol. 59, no. 12, 1 December 2004 (2004-12-01), pages 1061-1069, XP004646628 ISSN: 0009-9260 page 1061, left-hand column, line 1 - right-hand column, line 14 page 1062, left-hand column - right-hand column page 1064, right-hand column, line 34 - page 1065, left-hand column, last line page 1066, left-hand column, line 5 - page 1067, left-hand column, line 28 page 1068, right-hand column, line 16 - line 48	1-3,8, 15-29, 34, 41-55, 60,67-78

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IL2009/000245

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 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 No. III Observations where unity of invention is lacking (Continuation of item 3 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 fees, this Authority did not invite payment of additional fees.

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.:

1-3,8,15-26,27-29,34,41-52,53-55,60,67-78

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ 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: 1-3,8,15-26,27-29,34,41-52, 53-55, 60,67-78

3D texture based segmentation of volumetric medical image

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2. claims: 4-7,30-33, 56-59

3D preprocessing of volumetric medical image

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3. claims: 9-14,35-40, 61-66

3D segmentation of small and complex vessel trees
