

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
22 September 2011 (22.09.2011)

(10) International Publication Number
WO 2011/115576 A3

(51) International Patent Classification:
G06F 19/00 (2011.01)

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(21) International Application Number:
PCT/SG2011/000102

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(22) International Filing Date:
14 March 2011 (14.03.2011)

(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, CL, 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, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
61/313,822 15 March 2010 (15.03.2010) US

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(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

[Continued on next page]

(54) Title: METHOD OF PREDICTING THE SURVIVABILITY OF A PATIENT

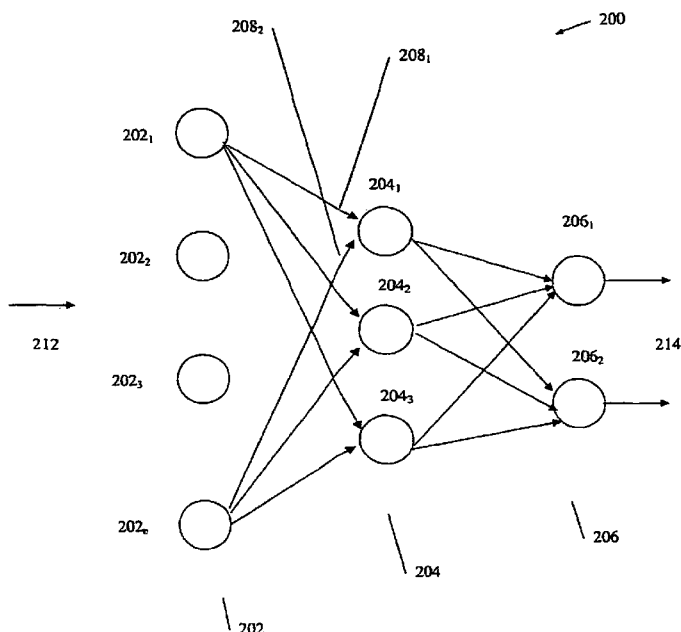


Figure 2

(57) Abstract: According to embodiments of the invention, there is provided a method of producing an artificial neural network capable of predicting the survivability of a patient, the method including: storing in an electronic database patient health data, the patient health data comprising a plurality of sets of data, each set having at least one of a first parameter relating to heart rate variability data and a second parameter relating to vital sign data, each set further having a third parameter relating to patient survivability; providing a network of nodes interconnected to form an artificial neural network, the nodes comprising a plurality of artificial neurons, each artificial neuron having at least one input with an associated weight; and training the artificial neural network using the patient health data such that the associated weight of the at least one input of each artificial neuron of the plurality of artificial neurons is adjusted in response to respective first, second and third parameters of different sets of data from the patient health data, such that the artificial neural network is trained to produce a prediction on the survivability of a patient.



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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))* — *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))*
- *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))* **(88) Date of publication of the international search report:**
12 April 2012

Published:

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

INTERNATIONAL SEARCH REPORT

International application No
PCT/SG2011/000102

A. CLASSIFICATION OF SUBJECT MATTER
INV. G06F19/00
ADD.
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)
G06F A61B

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	<p>ONG M E H ET AL: "An observational, prospective study exploring the use of heart rate variability as a predictor of clinical outcomes in pre-hospital ambulance patients", RESUSCITATION, ELSEVIER, IE, vol. 78, no. 3, 1 September 2008 (2008-09-01), pages 289-297, XP023438374, ISSN: 0300-9572, DOI: 10.1016/J.RESUSCITATION.2008.03.224 [retrieved on 2008-06-17] the whole document</p> <p style="text-align: center;">----- -/--</p>	1-42

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 18 January 2012	Date of mailing of the international search report 13/02/2012
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer Sisk, Aisling

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SG2011/000102

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.: 45-70
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:
see FURTHER INFORMATION sheet PCT/ISA/210

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.:

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.

INTERNATIONAL SEARCH REPORT

International application No
PCT/SG2011/000102

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	HARRISON ET AL: "Artificial Neural Network Models for Prediction of Acute Coronary Syndromes Using Clinical Data From the Time of Presentation", ANNALS OF EMERGENCY MEDICINE, LANSING, MI, US, vol. 46, no. 5, 1 November 2005 (2005-11-01), pages 431-439, XP005437647, ISSN: 0196-0644, DOI: 10.1016/J.ANNEMERGMED.2004.09.012 Introduction, Discussion -----	1-42
X	W BAXT ET AL: "A neural network aid for the early diagnosis of cardiac ischemia in patients presenting to the emergency department with chest pain", ANNALS OF EMERGENCY MEDICINE, vol. 40, no. 6, 1 December 2002 (2002-12-01), pages 575-583, XP55012444, ISSN: 0196-0644, DOI: 10.1067/mem.2002.129171 Introduction, Discussion -----	1-42
X	US 7 142 907 B2 (XUE JOEL Q [US] ET AL) 28 November 2006 (2006-11-28) column 2, line 19 - line 36 column 7, line 43 - line 56 claims 1,2 -----	1-42
X	WO 2007/149856 A2 (VIVOMETRICS INC [US]; DERCHAK P ALEXANDER [US]; MYERS LANCE [US]; LUCI) 27 December 2007 (2007-12-27) page 3, line 10 - line 15 page 4, line 11 - line 19 page 6, line 6 - line 14 page 7, line 3 - line 8 page 25, line 12 - line 21 -----	1-42
X	US 2009/177102 A1 (SCHNEIDER MARY [US] ET AL) 9 July 2009 (2009-07-09) paragraph [0013] - paragraph [0014] paragraph [0017] - paragraph [0019] paragraph [0022] paragraph [0027] - paragraph [0028] paragraph [0036] - paragraph [0038] paragraph [0042] ----- -/--	1-42

INTERNATIONAL SEARCH REPORT

International application No
PCT/SG2011/000102

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	"Heart rate variability: Standards of measurement, physiological interpretation, and clinical use", CIRCULATION, LIPPINCOTT WILLIAMS & WILKINS, US, vol. 93, no. 5, 1 January 1996 (1996-01-01), pages 1043-1065, XP002236874, ISSN: 0009-7322 the whole document	1-42
X	----- US 7 272 435 B2 (ROWLANDSON G I [US] ROWLANDSON G IAN [US]) 18 September 2007 (2007-09-18) column 4, line 25 - line 39 column 5, line 19 - line 41 column 7, line 15 - line 39 column 7, line 58 - column 8, line 9 column 8, line 21 - line 35 column 9, line 8 - line 11 column 9, line 23 - line 40	43,44
X	----- US 6 656 125 B2 (MISCZYNSKI DALE JULIAN [US] ET AL) 2 December 2003 (2003-12-02) column 2, line 51 - column 3, line 12 column 3, line 26 - line 41 column 7, line 17 - line 26 column 8, line 38 - line 42 column 16, line 33 - line 44 column 17, line 19 - column 18, line 18 -----	43,44

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No PCT/SG2011/000102

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 7142907	B2	28-11-2006	NONE

WO 2007149856	A2	27-12-2007	AU 2007261061 A1 27-12-2007
			CA 2656062 A1 27-12-2007
			EP 2034882 A2 18-03-2009
			JP 2009540953 A 26-11-2009
			US 2008045815 A1 21-02-2008
			WO 2007149856 A2 27-12-2007

US 2009177102	A1	09-07-2009	CN 101911083 A 08-12-2010
			DE 112008003580 T5 16-12-2010
			GB 2468810 A 22-09-2010
			JP 2011509114 A 24-03-2011
			US 2009177102 A1 09-07-2009
			WO 2009088627 A1 16-07-2009

US 7272435	B2	18-09-2007	NONE

US 6656125	B2	02-12-2003	US 2002188214 A1 12-12-2002
			US 2005101873 A1 12-05-2005

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

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

1. claims: 1-42

Claim 1 discloses a method of producing an artificial neural network capable of predicting the survivability of a patient using the input parameters of heart rate variability and vital sign data.

Claims 26 to 42 appear to disclose a corresponding method and system of predicting the survivability of a patient using the input parameters of heart rate variability and vital sign data, wherein the data is processed using an artificial neural network in order to provide a prediction.

2. claims: 43, 44

Claims 43 to 44 disclose a method of predicting the survivability of a patient using the input parameters of heart rate variability, vital sign data and data relating to patient characteristics, wherein a scoring model determines a score for each parameter and obtains a total score providing an indication on the survivability of the patient.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

Continuation of Box II.2

Claims Nos.: 45-70

1. The present application contains 70 claims, of which 9 are independent. There is no clear distinction between the independent claims because of overlapping scope. There are so many claims, and they are drafted in such a way that the claims as a whole are not in compliance with the provisions of clarity and conciseness of Article 6 PCT, as it is particularly burdensome for a skilled person to establish the subject-matter for which protection is sought. The non-compliance with the substantive provisions is to such an extent, that the search was performed taking into consideration the non-compliance in determining the extent of the search (PCT Guidelines 9.19 and 9.25). 2. As already indicated, an objection of lack of unity has been raised against the subject matter of claims 43 to 44 with respect to the subject matter of claims 1 to 42. The subject-matter of claims 45 to 70 has not been searched because of the lack of conciseness as mentioned above and the lack of clarity of the essential features of the claims. For instance, independent claims 45, 59, and 67 disclose various input parameters which do not clearly correspond to the input parameters defined either by each other or by the previous claim groups, thus rendering unclear the scope of the claimed subject-matter. 3. Furthermore, claim 63 relates to subject matter excluded from patentability according to Rule 39.1(iv) PCT as it discloses a method for treatment of the human or animal body by therapy. No International Searching Authority is required to search such subject matter.

The applicant's attention is drawn to the fact that claims relating to inventions in respect of which no international search report has been established need not be the subject of an international preliminary examination (Rule 66.1(e) PCT). The applicant is advised that the EPO policy when acting as an International Preliminary Examining Authority is normally not to carry out a preliminary examination on matter which has not been searched. This is the case irrespective of whether or not the claims are amended following receipt of the search report or during any Chapter II procedure. If the application proceeds into the regional phase before the EPO, the applicant is reminded that a search may be carried out during examination before the EPO (see EPO Guideline C-VI, 8.2), should the problems which led to the Article 17(2) declaration be overcome.