DETAILED ACTION

1. The present application is being examined under the pre-AIA first to invent provisions.

2. Applicant's amendments and remarks filed on 12/24/2014 have been fully considered.

3. According to the newly available guidance of the USPTO's 2014 Interim Eligibility Guidance", issued on December 16, 2014, 79 FR 74618, a non-final rejection is made in order to determine the subject matter eligibility under 35 U.S.C. 101 of claims involving abstract ideas in view of this decision.

Status of Claims

4. Claims 1, 3-24, and 27-53 are pending for examination. Claims 10-17, 35-38, and 45-48 are withdrawn from consideration. Claims 2 and 25-26 are cancelled.

Claim Rejections - 35 USC § 112

5. The following is a quotation of 35 U.S.C. 112(b):
(b) CONCLUSION.—The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the inventor or a joint inventor regards as the invention.

The following is a quotation of 35 U.S.C. 112 (pre-AIA), second paragraph:
The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

6. Claims 1, 3-9, 18-24, 27-34, 39-44 and 49-53 are rejected under 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA), second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventor or a joint

inventor, or for pre-AIA the applicant regards as the invention. Claims that depend directly or indirectly from claims 1, 19, 24, 39, and 44 are also rejected due to said dependency.

Claims 1, 19, 24, 39, 44 and 49 recite "... analyzing, using the device, (analyze) the physiological indicator signal **to obtain measurements of one or more physiological parameters**...". The limitation recited after "to" is considered as intended use which contains insufficient patentable weight(s). It is unclear what positive method steps is intended by the limitation because the limitation merely imply an active method steps (obtaining measurements of one or more physiological parameters) but do not explicitly require such steps. The limitation is given some patentable weights in the rejections for the purpose of compact prosecution.

Claim Rejections - 35 USC § 101- abstract idea

7. 35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

8. Claims 1, 3-24, and 27-53 are rejected under 35 U.S.C. 101 because the claimed inventions are directed to a judicial exception (i.e., a law of nature, a natural phenomenon, or an abstract idea) without significantly more. Claims 1-83 are directed to an abstract idea. The amended and new claims do not include additional elements that are sufficient to amount to significantly more than the judicial exception because the claims as a whole, considering all claim elements both individually and in combination,

do not amount to significantly more than the abstract idea of: "obtaining a value of at least one indicator of volatility of Kurtosis or Shannon entropy for the preprocessed segment and comparing the value with a predetermined threshold", which is a mathematical relation and/or fundamental data processing practice in the art (see prior art rejections below). The additional elements or combination of elements in the claims other than the abstract idea *per se* (a handheld mobile communication device; a physiological indicator signal sensing component; at least one processor) amount to no more than mere instructions to implement the abstract idea on a generic computer and/or generic computer structures that perform only well-understood, routine and conventional acts in the art (i.e. collecting data, processing data). The claims also do not recite any steps for using the information produced by the abstract idea to generate an effect outside of a computer (i.e. a real-world practical application of the data generated); and/or improvements to a technological field; and/or improvements to the functioning of the computer, which weighs against patentability.

Viewed as a whole, these additional claim elements do not provide meaningful limitations to transform the abstract idea into a patent eligible application of the abstract idea such that the claims amount to **significantly** more than the abstract idea itself. Therefore, the claims are rejected under 35 U.S.C. 101 as being directed to non-statutory subject matter.

For additional guidance, applicant is directed generally to the USPTO's 2014 Interim Eligibility Guidance", issued on December 16, 2014, 79 FR 74618. Applicant should note that if the claimed invention reads on both eligible and non-eligible subject

matter, a rejection under 35 U.S.C. 101 is necessitated over the non-eligible subject matter.

Claim Rejections - 35 USC § 103

9. The following is a quotation of pre-AIA 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

10. Claims 1, 3-5, 8-9, 24, 27-29, 33-34, and 44 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Greco et al., "Kurtosis, Renyi's Entropy and Independent Component Scalp Maps for the Automatic Artifact Rejection from EEG data". International Journal of Computer, Information, Systems and Control Engineering 2(9), January 2008: 180-184 – cited by applicant) in view of Lichter et al. (USPN 6,159,147 – cited in previous action). In regard to claims 1, 3-5, 24, 27-29 and 44, Greco discloses a method and an apparatus for physiological parameter monitoring (abstract and associated descriptions), the method comprising: providing a physiological indicator signal (electric signals, Fig. 1 and associated descriptions in page 203) obtained from a physiological indicator signal sensing component (EEG sensors and a recording machine, Fig. 1 and associated descriptions in page 203) to a device (EEGLAB, pages 206 and 207; it is inherently that the downloaded program is executed by a computer); analyzing, using the device, the physiological indicator signal (amplifier,

page 203 and Sec. IV, page 206) to obtain measurements of one or more physiological parameters (EEG signals and associated independent components/ ICs in page 206); and detecting, using the device and using only the measurements of the one or more physiological parameters (ICs in the detected EEG signals pages 205-206), effects of motion artifacts in the measurements of the one or more physiological parameters (first paragraph in the right column of page 203; Sec. IV on page 206) and deciding whether to retain the measurements based on detected effects of motion artifacts (reject an IC, Sec. IV on page 206), wherein the step of detecting effects of motion artifacts in the measurements comprises: a. preprocessing a segment from the measurement of one physiological parameter (remove noise, Sec. IV on page 206); b. obtaining a value of at least one indicator of volatility for the preprocessed segment; the at least one indicator of volatility being at least one of kurtosis and Shannon entropy for the preprocessed segment (kurtosis and Shannon entropy, Sec. III, A and B, pages 205-206). c. including the segment in analyses of physiological measurements, when comparison of the value of the at least one indicator of volatility with a predetermined threshold (threshold of ± 1.64, Sec. III, A and B, pages 205-206) indicates noise/motion artifacts are not present (reject the ICs only when the volatility exceeds the threshold, Sec. III, A and B, pages 205-206; i.e. the ICs not exceeded the threshold is included); and d. selecting another segment of the signal from the physiological measurement and proceeding to step (a) when the value of the at least one indicator of volatility is less than a predetermined threshold and another segment is available (comparing all ICs extracted from the data segments/ trials with the threshold and rejecting the IC(s) exceed the threshold, Sec. III

and IV on pages 205-207). Greco does not specifically disclose the device a handheld mobile communication device. Lichter teaches a handheld mobile communication device (personal computer 27, Figs. 2-3) which can be connected to various sensors to measure and analyze the collected data (Figs. 16) including EEG (Fig. 16). One ordinary would have recognized that a personal computer is an alternative equivalent computing device. Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention was made to substitute the device/ computer (Greco) with the handheld mobile communications device (Lichter) to yield predictable results.

In regard to claims 8-9 and 33-34, Greco as modified by Lichter discloses providing a physiological indicator signal comprises obtaining a signal from a physiological monitoring sensor (EEG sensors, Greco and EEG sensor, Fig. 16 of Lichter) which comprises a PPG sensor and an ECG sensor (Fig. 16 and associated descriptions of Lichter).

11. Claims 6 and 30 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over the combination of Greco and Lichter as applied to claims 1 and 24 above, and further in view of Maier et al. (USPGPUB 2006/0253261). In regard to claims 6 and 30, Greco as modified by Lichter discloses all the claimed limitation except the predetermined threshold is determined using receiver operator characteristic (ROC) analysis. Maier teaches a threshold value can be determined using receiver operator characteristic (ROC) analysis ([0235]) in order to have a constant false alarm rate ([0235]). Therefore, it would have been obvious to one with ordinary skill in the art at the

time of the invention was made to modify the method and the apparatus (Greco as modified by Lichter) to incorporate the ROC determined threshold (Maier) in order to find the optimal threshold values for the comparison(s).

12. Claims 7 and 31-32 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over the combination of Greco and Lichter as applied to claims 1 and 24 above, and further in view of Jacobsen et al. (USPN 6,198,394 – cited in previous action). In regard to claims 7 and 31-32, Greco as modified by Lichter discloses all the claim limitation except placing a portion of a subject's body over an objective lens of a camera in a mobile communication device; and obtaining video images of the portion of the subject's body. Jacobsen teaches placing a portion of a subject's body over an objective lens of a camera in a mobile communication device (element 376, Fig. 5A; Fig. 8; Col 13 lines 55-67); and obtaining video images of the portion of the subject's body (element 376, Fig. 5A; Fig. 8; Col 13 lines 55-67). The portable communication device taught by Jacobsen can be connected to various sensors applied to a user (Figs. 1-3, 5-7, and 8 and associated description) and provide video images associated with specific location of the user to the command center (Col 13 lines 55-67). Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention was made to modify the method and the apparatus (Greco as modified by Lichter) to incorporate the camera of the portable communication device (Jacobsen) in order to obtain video images associated with specific location of the user and transferring to a central monitoring system/ unit.

13. Claim 18 is rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over the combination of Greco and Lichter as applied to claim 1 above, and further in view of Zhang (USPGPUB 2009/0112110 – cited in previous action). In regard to claim 18, Greco as modified by Lichter discloses the measurement of ECG signals (Fig. 16 and associated descriptions of Lichter) but does not specifically discloses a measure of atrial fibrillation. Zhang teaches a measure of atrial fibrillation based on ECG signal analysis (abstract and Figs. 1-9). Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention was made to modify the method (Greco as modified by Lichter) to incorporate the ECG-based atrial fibrillation analysis (Zhang) in order to obtain more health information of the user.

Double Patenting

14. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory double patenting rejection is appropriate where the claims at issue are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir.

1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the reference application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement. A terminal disclaimer must be signed in compliance with 37 CFR 1.321(b).

The USPTO internet Web site contains terminal disclaimer forms which may be used. Please visit http://www.uspto.gov/forms/. The filing date of the application will determine what form should be used. A web-based eTerminal Disclaimer may be filled out completely online using web-screens. An eTerminal Disclaimer that meets all requirements is auto-processed and approved immediately upon submission. For more information about eTerminal Disclaimers, refer to http://www.uspto.gov/patents/process/file/efs/guidance/eTD-info-I.jsp.

15. Claims 19-23, 39-43, 49-53 are rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1-16 of U.S. Patent No. 8,755,876 in view of Greco and Lichter. In regard to claims 19-23, 39-43, 49-53 of present application, claims 1-16 of '876 recite all the limitations except a system and a method comprises providing a physiological indicator signal to a handheld mobile communication device; analyzing, using the device, the physiological indicator signal to obtain measurements

of one or more physiological parameters; and detecting, using the a handheld mobile communication device and using only the measurements of the one or more physiological parameters, effects of motion artifacts in the measurements of the one or more physiological parameters and deciding whether to retain the measurements based on effects of motion artifacts in the measurements based on detected effects of motion artifacts. Greco discloses a method and an apparatus for physiological parameter monitoring (abstract and associated descriptions), the method comprising: providing a physiological indicator signal (electric signals, Fig. 1 and associated descriptions in page 203) obtained from a physiological indicator signal sensing component (EEG sensors and a recording machine, Fig. 1 and associated descriptions in page 203) to a device (EEGLAB, pages 206 and 207; it is inherently that the downloaded program is executed by a computer); analyzing, using the device, the physiological indicator signal (amplifier, page 203 and Sec. IV, page 206) to obtain measurements of one or more physiological parameters (EEG signals and associated independent components/ ICs in page 206); and detecting, using the device and using only the measurements of the one or more physiological parameters (ICs in the detected EEG signals pages 205-206), effects of motion artifacts in the measurements of the one or more physiological parameters (first paragraph in the right column of page 203; Sec. IV on page 206) and deciding whether to retain the measurements based on detected effects of motion artifacts (reject an IC, Sec. IV on page 206). Claims 1-16 of '876 recite a processor to process data related to R-R intervals (claims 1, 2, 6, 7, 12 and 13) but do not recite the processor is in part of a computing device. Greco discloses an artifact rejection method

for biomedical signal processing (abstract and Sec. II, IV and V). Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention was made to modify the method and the apparatus (claims 1-16 of '876) to incorporate the artifact rejection method (Greco) in order to better reject artifacts contained in the signal. Claims 1-16 of '876 as modified by Greco does not specifically recite the device is a handheld mobile communication device. Lichter teaches a handheld mobile communication device (personal computer 27, Figs. 2-3) which can be connected to various sensors to measure and analyze the collected data (Figs. 16) including ECG signals obtained from ECG sensor (Fig. 15). Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention was made to substitute the computer (Claims 1-16 of '876 as modified by Greco) with the handheld mobile communications device (Lichter) to yield predictable results.

Response to Arguments

16. Applicant's arguments, see page 17 of Remarks, filed on 12/24/2014, with respect to claims 1, 3-9, 18, 24, 27-34, and 44 have been fully considered and are persuasive. The 35 USC 112 rejection of claims 1, 3-9, 18, 24, 27-34, and 44 has been withdrawn.

17. Applicant's amendment and argument with respect to claims 1, 3-9, 18-24, 27-34, 39-44 and 49-53 filed on 12/24/2014 have been fully considered but they are deemed to be moot in views of the new grounds of rejection.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to CHU CHUAN (JJ) LIU whose telephone number is (571)270-5507. The examiner can normally be reached on M-TH 8:00am~4:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tse Chen can be reached on (571)272-3672. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/CHU CHUAN (JJ) LIU/
Examiner, Art Unit 3777

/TSE CHEN/
Supervisory Patent Examiner, Art Unit 3777

Notice of References Cited	Application/Control No. 13/354,941	Applicant(s)/Patent Under Reexamination CHON ET AL.	
	Examiner CHU CHUAN (JJ) LIU	Art Unit 3777	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-2006/0253261	11-2006	Maier et al.	702/019
	B	US-			
	C	US-			
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

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Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

PTO/SB/08a (01-10)
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	13354941
Filing Date	2012-01-20
First Named Inventor	Ki H. Chon
Art Unit	3777
Examiner Name	Chu Chuan Liu
Attorney Docket Number	30210-201

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
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Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20030036685	A1	2003-02-20	Goodman	
	2	20060211930	A1	2006-09-21	Scharf et al.	
	3	20060122476	A1	2006-06-08	Van Slyke	

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	1	9932030	WO	A1	1999-07-01	BTG. Int. Ltd.		☐

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
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	Art Unit	3777
	Examiner Name	Chu Chuan Liu
	Attorney Docket Number	30210-201

	2	2009024273	WO	A1	2009-02-26	Univ. Dublin		☐

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Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
	1	KRISHNAN, R. et al. Analysis and detection of motion artifact in photoplethysmographic data using higher order statistics. IEEE International Conference on Acoustics, Speech and Signal Processing, March 2008: 613-616.	☐
	2	KRISHNAN, R. et al. Two-Stage Approach for Detection and Reduction of Motion Artifacts in Photoplethysmographic Data. IEEE Transactions on Biomedical Engineering 57(8), August 2010: 1867-1876.	☐
	3	GRECO, A. et al. Kurtosis, Renyi's Entropy and Independent Component Scalp Maps for the Automatic Artifact Rejection from EEG data. International Journal of Computer, Information, Systems and Control Engineering 2(9), January 2008: 180-184.	☐
	4	DELORME, A. et al. Enhanced detection of artifacts in EEG data using higher-order statistics and independent component analysis. Neuroimage 34(4), February 2007: 1443-1449.	☐
	5	DELORME, A. et al. Automatic Artifact Rejection for EEG Data Using High-Order Statistics and Independent Component Analysis, January 2001. Available at: www.inc2.ucsd.edu.	☐

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EXAMINER SIGNATURE

Examiner Signature	/Chu Chuan Liu/	Date Considered	02/24/2015

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

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EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L7	9	transfer$3 adj function with first with second with (data segment) same invert$3	US-PGPUB; USPAT	OR	ON	2015/02/24 14:08
L6	57	transfer$3 with function with first with second with (data segment) same invert$3	US-PGPUB; USPAT	OR	ON	2015/02/24 14:06
L5	1	coherence with first with second with (data segment) same invert$3	US-PGPUB; USPAT	OR	ON	2015/02/24 14:05
L4	16	1 and ("600".clas. A61b5/1455.cpc.)	US-PGPUB; USPAT	OR	ON	2015/02/24 13:26
L2	16	1 and "600".clas.	US-PGPUB; USPAT	OR	ON	2015/02/24 13:26
L1	96	receiver adj operator adj characteristic with ROC with threshold	US-PGPUB; USPAT	OR	ON	2015/02/24 13:26
S87	3	("20030036685" | "20060122476" | "20060211930").PN.	US-PGPUB; USPAT	OR	ON	2015/02/24 12:18
S86	142	eeg same ecg same ppg and "600".clas.	US-PGPUB; USPAT	OR	ON	2015/02/24 11:21
S85	236	eeg and ecg and ppg and "600".clas.	US-PGPUB; USPAT	OR	ON	2015/02/24 11:17
S84	32	kurtosis and Shannon with entropy	US-PGPUB; USPAT	OR	ON	2015/02/24 11:15
S83	17	(kurtosis Shannon with entropy) same (outlier motion artifact) and PPG	US-PGPUB; USPAT	OR	ON	2015/02/24 10:34
S82	3	(kurtosis and Shannon with entropy) and PPG	US-PGPUB; USPAT	OR	ON	2015/02/24 10:33
S81	147	(kurtosis Shannon with entropy) and PPG	US-PGPUB; USPAT	OR	ON	2015/02/24 10:32
S80	586	(kurtosis Shannon with entropy) and (EEG ECG PPG)	US-PGPUB; USPAT	OR	ON	2015/02/24 10:32
S79	8	S78 and (kurtosis Shannon with entropy)	US-PGPUB; USPAT	OR	ON	2015/02/24 10:10
S78	18	(Chon near2 Ki Lee near2 Jinseok Selvaraj near2 Nandakumar).in. and "600".clas.	US-PGPUB;	OR	ON	2015/02/24 10:10

			USPAT					

EAST Search History (Interference)

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Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13354941	CHON ET AL.
	Examiner	Art Unit
	CHU CHUAN (JJ) LIU	3777

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	10/24/2013	03/12/2014	09/16/2014	02/24/2015					
	1	✓	✓	✓	✓					
	2	✓	✓	-	-					
	3	✓	✓	✓	✓					
	4	✓	✓	✓	✓					
	5	✓	✓	✓	✓					
	6	✓	✓	✓	✓					
	7	✓	✓	✓	✓					
	8	✓	✓	✓	✓					
	9	✓	✓	✓	✓					
	10	N	N	N	N					
	11	N	N	N	N					
	12	N	N	N	N					
	13	N	N	N	N					
	14	N	N	N	N					
	15	N	N	N	N					
	16	N	N	N	N					
	17	N	N	N	N					
	18	✓	✓	✓	✓					
	19	✓	✓	✓	✓					
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	25	✓	✓	-	✓					
	26	✓	✓	-	✓					
	27	✓	✓	✓	✓					
	28	✓	✓	✓	✓					
	29	✓	✓	✓	✓					
	30	✓	✓	✓	✓					
	31	✓	✓	✓	✓					
	32	✓	✓	✓	✓					
	33	✓	✓	✓	✓					
	34	✓	✓	✓	✓					
	35	N	N	N	N					
	36	N	N	N	N					

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	Examiner	**Art Unit**
	CHU CHUAN (JJ) LIU	3777

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
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CLAIM		DATE								
Final	Original	10/24/2013	03/12/2014	09/16/2014	02/24/2015					
	37	N	N	N	N					
	38	N	N	N	N					
	39	✓	✓	✓	✓					
	40	✓	✓	✓	✓					
	41	✓	✓	✓	✓					
	42	✓	✓	✓	✓					
	43	✓	✓	✓	✓					
	44	✓	✓	✓	✓					
	45	N	N	N	N					
	46	N	N	N	N					
	47	N	N	N	N					
	48	N	N	N	N					
	49	✓	✓	✓	✓					
	50	✓	✓	✓	✓					
	51	✓	✓	✓	✓					
	52	✓	✓	✓	✓					
	53	✓	✓	✓	✓					

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13354941	CHON ET AL.
	Examiner	Art Unit
	CHU CHUAN (JJ) LIU	3777

CPC- SEARCHED		
Symbol	Date	Examiner
A61B5/1455	02/24/2015	CCL

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner
600	300, 301, 309, 310, 322, 323, 324, 326, 330, 336, 473, 476, 500, 501, 502, 508, 509,518	10/24/2013	CCL
600	300, 301, 309, 310, 322, 323, 324, 326, 330, 336, 473, 476, 500, 501, 502, 508, 509,518	03/12/2014	CCL
600	300, 301, 309, 310, 322, 323, 324, 326, 330, 336, 473, 476, 500, 501, 502, 508, 509,518	09/16/2014	CCL
600	300, 301, 309, 310, 322, 323, 324, 326, 330, 336, 473, 476, 500, 501, 502, 508, 509,518	02/24/2015	CCL

SEARCH NOTES		
Search Notes	Date	Examiner
Inventor Name Search (PALM and EAST)	10/23/2013	CCL
EAST Search (TEXT, USPGPUB, USPAT) See Search History	10/24/2013	CCL
Google NPL Search	10/24/2013	CCL
Updated EAST Search (TEXT, USPGPUB, USPAT) See Search History	03/12/2014	CCL
Google NPL Search	03/12/2014	CCL
Updated EAST Search (TEXT, USPGPUB, USPAT) See Search History	09/16/2014	CCL
Updated EAST Search (TEXT, USPGPUB, USPAT, CPC) See Search History	02/24/2015	CCL
Google NPL Search	02/24/2015	CCL

/CHU CHUAN (JJ) LIU/ Examiner.Art Unit 3777	

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INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner

/CHU CHUAN (JJ) LIU/ Examiner.Art Unit 3777	

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	13354941
Filing Date	2012-01-20
First Named Inventor	Ki H. Chon
Art Unit	3777
Examiner Name	Chu Chuan Liu
Attorney Docket Number	30210-201

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
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	Filing Date	2012-01-20
	First Named Inventor	Ki H. Chon
	Art Unit	3777
	Examiner Name	Chu Chuan Liu
	Attorney Docket Number	30210-201

	1	CHON, K.H. Estimation of Respiratory Rate from Photoplethysmogram Data Using Time-Frequency Spectral Estimation. IEEE Transactions of Biomedical Engineering, 56(8), August 2009: 2054-2063.	☐
	2	MIDDLETON, P.M. et al. Spectral Analysis of Finger Photoplethysmogram Waveform Variability in a Model of Mild to Moderate Haemorrhage. Journal of Clinical Monitoring and Computing (2008) 22:343-353.	☐
	3	PELEGRIS, P. et al. A Novel Method to Detect Heart Beat Rate Using a Mobile Phone. Proceeding of the IEEE 32nd Annual International Conference, August 2010: 5488-5491.	☐

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EXAMINER SIGNATURE

Examiner Signature	/Chu Chuan Liu/	Date Considered	02/24/2015

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants: Ki H. Chon et al.
Application Number: 13/354,941
Filed: January 20, 2012
Title: PHYSIOLOGICAL PARAMETER MONITORING WITH A MOBILE COMMUNICATION DEVICE

Examiner: LIU, CHU CHUAN
Group Art Unit: 3777
Confirmation No. 9133

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TO: Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450,
Alexandria, VA 22313-1450

AMENDMENT AND RESPONSE TO OFFICE ACTION

Sir:

In reply to the non-final Office Action dated March 11, 2015, Applicants submit the following amendments and remarks.

Amendments to the claims begin on page 2 of this paper.

Remarks begin on page 17 of this paper.

Amendments to the Claims:

This listing of claims replaces all prior versions and listings of the claims.

1. (Currently amended) A method for physiological parameter monitoring, the method comprising:
providing a physiological indicator signal to a handheld mobile communication device;

analyzing, using the handheld mobile communication device, the physiological indicator signal; ~~to obtain~~

obtaining, from said analyzing, measurements of one or more physiological parameters; and

detecting, using the handheld mobile communication device and using only the measurements of one or more physiological parameters, effects of motion artifacts in the measurements of the one or more physiological parameters and deciding whether to retain the measurements based on detected effects of motion artifacts;
wherein detecting effects of motion artifacts in the measurements comprises:
   a. preprocessing a segment from the measurement of one physiological parameter;
   b. obtaining a value of at least one indicator of volatility for the preprocessed segment; the at least one indicator of volatility being at least ~~one of kurtosis or~~ Shannon entropy for the preprocessed segment;
   c. including the segment in analyses of physiological measurements, ~~if~~ when comparison of the value of the at least one indicator of volatility with a predetermined threshold indicates noise/motion artifacts are not present; and
   d. selecting another segment of the signal from the physiological measurement and proceed~~ing~~ to step (a)[[,]] when ~~if~~ the value of the at least one indicator of volatility is less than a predetermined threshold and when another segment is available.

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2. (Canceled)

3. (Currently amended) The method of claim 1 wherein said at least one indicator of volatility also comprises kurtosis.

4. (Canceled)

5. (Canceled)

6. (Previously presented) The method of claim 1 wherein the predetermined threshold is determined using receiver operator characteristic (ROC) analysis.

7. (Previously presented) The method of claim 1 wherein providing a physiological indicator signal comprises:
placing a portion of a subject's body over an objective lens of a camera in a handheld mobile communication device; and

obtaining video images of the portion of the subject's body.

8. (Previously presented) The method of claim 1 wherein providing a physiological indicator signal comprises obtaining a signal from a physiological monitoring sensor.

9. (Previously presented) The method of claim 8 wherein the physiological monitoring sensor is a photoplethysmographic (PPG) sensor or an electrocardiogram sensor.

10. (Withdrawn) The method of claim 1 wherein the one or more physiological measurements comprise heart rate and heart rate variability.

11. (Withdrawn) The method of claim 10 wherein obtaining measurements of heart rate and heart rate variability comprise:

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determining beats for the physiological indicator signal;

determining beat to beat intervals; and

applying a cubic spline algorithm to obtain a substantially continuous beat to beat interval signal indicative of heart rate.

12. (Withdrawn) The method of claim 1 wherein the one or more physiological measurements comprise respiratory rate.

13. (Withdrawn) The method of claim 12 wherein measurement of respiratory rate comprises:
obtaining time–frequency spectrum of the physiological indicator signal utilizing variable frequency complex demodulation (VFCDM); and

obtaining respiratory rates by extracting a frequency component that has a largest amplitude for each time point at a heart rate frequency band.

14. (Withdrawn) The method of claim 1 wherein the one or more physiological measurements comprise a measure of oxygen saturation.

15. (Withdrawn) The method of claim 14 wherein providing a physiological indicator signal comprises:
placing a portion of a subject's body over an objective lens of a camera in a mobile communication device; and

obtaining video images of the portion of the subject's body, and

wherein obtaining the measure of oxygen saturation comprises:

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obtaining an average intensity of a red component and a blue component of the video images of the portion of the subject's body; the average intensity of the red component and the average intensity of the blue component constituting DC_{RED} and DC_{BLUE} respectively;

obtaining a standard deviation of the red component and the blue component; the standard deviation of the red component and the blue component constituting AC_{RED} and AC_{BLUE} respectively; and

obtaining the measure of oxygen saturation (SpO2) by

$$SpO2 = A - B\frac{AC_{RED}/DC_{RED}}{AC_{BLUE}/DC_{BLUE}}.$$

16. (Withdrawn) The method of claim 1 wherein the one or more physiological measurements comprise a measure of blood loss.

17. (Withdrawn) The method of claim 16 wherein obtaining the measure of blood loss comprises:
obtaining time–frequency spectrum of the physiological indicator signal utilizing variable frequency complex demodulation (VFCDM);

obtaining the amplitude modulation (AM) series from a set of the largest instantaneous amplitude at each time sample within the heart rate frequency band of the time–frequency spectrum; and

determining whether the amplitude modulation decreases; a decrease in the amplitude modulation indicating blood volume loss in subject.

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18. (Previously presented) The method of claim 1 wherein the one or more physiological measurements comprise a measure of atrial fibrillation.

19. (Currently amended) A method for physiological parameter monitoring, the method comprising:

providing a physiological indicator signal to a handheld mobile communication device;

analyzing, using the handheld mobile communication device, the physiological indicator signal; ~~to obtain~~

obtaining, from said analyzing, measurements of one or more physiological parameters; and

detecting, using the handheld mobile communication device and using only the measurements of one or more physiological parameters, effects of motion artifacts in the measurements of the one or more physiological parameters and deciding whether to retain the measurements based on effects of motion artifacts in the measurements;

wherein the one or more physiological measurements comprise a measure of atrial fibrillation;

wherein obtaining the measure of atrial fibrillation comprises:

obtaining a time-varying coherence function by multiplying two time-varying transfer functions (TVFTs), the two time-varying transfer functions obtained using two adjacent data segments, from the physiological indicator signal, one of the two adjacent data segment as an input signal and another of the two adjacent data segment as an output signal to produce a first TVTF; a second TVTF is produced by reversing the input and the output signals, using said another of the

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two adjacent data segment as the input signal and said one of the two adjacent data segment as the output signal; and

determining whether the time-varying coherence function is less than a predetermined quantity.

20. (Previously presented) The method of claim 19 wherein determining whether the time-varying coherence function is less than the predetermined quantity comprises:
obtaining one or more indicators of atrial fibrillation; and

determining whether the one or more indicators of atrial fibrillation exceed predetermined thresholds.

21. (Previously presented) The method of claim 20 wherein the one or more indicators of atrial fibrillation comprise a variance of the time-varying coherence function.

22. (Previously presented) The method of claim 21 wherein the one or more indicators of atrial fibrillation also comprise Shannon entropy.

23. (Previously presented) The method of claim 20 wherein the predetermined thresholds are determined using receiver operator characteristic (ROC) analysis.

24. (Currently amended) A system for physiological parameter monitoring, the system comprising:
a physiological indicator signal sensing component; and a handheld mobile communication device comprising:
at least one processor; and

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at least one computer usable medium, the computer usable medium having computer readable code embodied therein, the computer readable code causing the at least one processor to:

analyze the physiological indicator signal; ~~to obtain~~ obtain, from results of analyzing, measurements of one or more physiological parameters;; and

detect effects of motion artifacts in the measurements of the one or more physiological parameters;

wherein the computer readable code, in causing the at least one processor to detect effects of motion artifacts, causes the at least one processor to:

a. preprocess a segment from the measurement of one physiological parameter;

b. obtain a value of at least one indicator of volatility for the preprocessed segment; the at least one indicator of volatility being at least ~~one of kurtosis or~~ Shannon entropy for the preprocessed segment;

c. include the segment in analyses of physiological measurements[[,]] ~~if~~ when comparison of the value of the at least one indicator of volatility with a predetermined threshold indicates noise/motion artifacts are not present;

d. select another segment of the signal from the physiological measurement and proceeding to step (a) when the value of the at least one indicator of volatility is less than a predetermined threshold and another segment is available.

25-26. (Canceled)

27. (Currently amended) The system of claim 24 wherein said at least one indicator of volatility also comprises kurtosis.

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28-29. (Canceled)

30. (Previously presented) The system of claim 24 wherein the predetermined threshold is determined using receiver operator characteristic (ROC) analysis.

31. (Previously presented) The system of claim 24 wherein the physiological indicator signal sensing component comprises an image acquisition component, said acquisition component capable of acquiring a number of frames, each frame acquired at a predetermined time.

32. (Previously presented) The system of claim 31 wherein the handheld mobile communications device comprises said image acquisition component.

33. (Previously presented) The system of claim 24 wherein the physiological indicator signal sensing component comprises a physiological monitoring sensor.

34. (Previously presented) The system of claim 33 wherein the physiological monitoring sensor is a photoplethysmographic (PPG) sensor or an electrocardiogram sensor.

35. (Withdrawn) The system of claim 25 wherein the physiological indicator signal sensing component comprises an image acquisition component, said acquisition component capable of acquiring a number of frames, each frame acquired at a predetermined time; wherein said image acquisition component acquires a color image having red, green and blue components; wherein one or more physiological measurements comprise a measure of oxygen saturation; and wherein the computer readable code, in causing the at least one processor to analyze the physiological indicator signal, causes the at least one processor to:

obtain an average intensity of a red component and a blue component of the images of a portion of a subject's body; the average intensity of the red component and the average intensity of the blue component constituting DC_{RED} and DC_{BLUE} respectively;

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obtain a standard deviation of the red component and the blue component; the standard deviation of the red component and the blue component constituting AC_{RED} and AC_{BLUE} respectively; and

obtain the measure of oxygen saturation by

$$SpO2 = A - B\frac{AC_{RED}/DC_{RED}}{AC_{BLUE}/DC_{BLUE}}.$$

36. (Withdrawn) The system of claim 25 wherein the one or more physiological measurements comprise heart rate and heart rate variability; and wherein the computer readable code, in causing the at least one processor to analyze the physiological indicator signal, causes the at least one processor to:

determine beats for the physiological indicator signal;

determine beat to beat intervals; and

apply a cubic spline algorithm to obtain a substantially continuous beat to beat interval signal indicative of heart rate.

37. (Withdrawn) The system of claim 25 wherein the one or more physiological measurements comprise respiratory rate; and wherein the computer readable code, in causing the at least one processor to analyze the physiological indicator signal, causes the at least one processor to:

obtain time–frequency spectrum of the physiological indicator signal utilizing variable frequency complex demodulation (VFCDM); and

obtain respiratory rates by extracting a frequency component that has a largest amplitude for each time point at a heart rate frequency band.

38. (Withdrawn) The system of claim 25 wherein the one or more physiological measurements comprise a measure of blood loss; and wherein the computer readable code, in

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causing the at least one processor to analyze the physiological indicator signal, causes the at least one processor to:

obtain time–frequency spectrum of the physiological indicator signal utilizing variable frequency complex demodulation (VFCDM);

obtain the amplitude modulation (AM) series from set of the largest instantaneous amplitude at each time sample within the heart rate frequency band of the time–frequency spectrum; and

determine whether the amplitude modulation decreases; a decrease in the amplitude modulation indicating blood volume loss in subject.

39. (Currently amended) A system for physiological parameter monitoring, the system comprising:

a physiological indicator signal sensing component; and a handheld mobile communication device comprising:

at least one processor; and

at least one computer usable medium, the computer usable medium having computer readable code embodied therein, the computer readable code causing the at least one processor to:

analyze the physiological indicator signal; ~~to obtain~~ obtain, from results of analyzing, measurements of one or more physiological parameters; and

detect effects of motion artifacts, using only the measurements of one or more physiological parameters, in the measurements of the one or more physiological parameters;

wherein the one or more physiological measurements comprise a measure of atrial fibrillation; and wherein the computer readable code, in causing the at least one processor to analyze the physiological indicator signal, causes the at least one processor to:

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obtain a time-varying coherence function by multiplying two time-varying transfer functions (TVFTs), the two time-varying transfer functions obtained using two adjacent data segments , from the physiological indicator signal, one of the two adjacent data segment as an input signal and another of the two adjacent data segment as an output signal to produce a first TVTF; a second TVTF is produced by reversing the input and the output signals, using said another of the two adjacent data segment as the input signal and said one of the two adjacent data segment as the output signal; and

determine whether the time-varying coherence function is less than a predetermined quantity.

40. (Previously presented) The system of claim 39 wherein the computer readable code, in causing the at least one processor to determine whether the time-varying coherence function is less than the predetermined quantity, causes the at least one processor to:

obtain one or more indicators of atrial fibrillation; and

determine whether the one or more indicators of atrial fibrillation exceed predetermined thresholds.

41. (Previously presented) The system of claim 40 wherein the one or more indicators of atrial fibrillation comprise a variance of the time-varying coherence function.

42. (Previously presented) The system of claim 41 wherein the one or more indicators of atrial fibrillation also comprise Shannon entropy.

43. (Previously presented) The system of claim 41 wherein the predetermined thresholds are determined using receiver operator characteristic (ROC) analysis.

44. (Currently amended) A non-transitory computer usable medium having computer readable code embodied therein, the computer readable code causing at least one processor to:

analyze the physiological indicator signal; ~~to~~

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obtain, from said analyzing, measurements of one or more physiological parameters; and

detect, using only the measurements of one or more physiological parameters, effects of motion artifacts in the measurements of the one or more physiological parameters;

wherein the computer readable code, in causing the at least one processor to detect effects of motion artifacts, causes the at least one processor to:

e. preprocess a segment from the measurement of one physiological parameter;

f. obtain a value of at least one indicator of volatility for the preprocessed segment; the at least one indicator of volatility being at least ~~one of kurtosis or~~ Shannon entropy for the preprocessed segment;

g. include the segment in analyses of physiological measurements[[,]]~~if~~ when comparison of the value of the at least one indicator of volatility with a predetermined threshold indicates noise/motion artifacts are not present;

h. select another segment of the signal from the physiological measurement and proceeding to step (a) when the value of the at least one indicator of volatility is less than a predetermined threshold and another segment is available.

45. (Withdrawn) The computer usable medium of claim 44 wherein the physiological indicator signal comprises a video color image having red, green and blue components, the video color image being an image obtained from of a portion of a subject's body; wherein the measurements of one or more physiological parameters comprise a measure of oxygen saturation; and wherein the computer readable code, in causing the at least one processor to analyze the physiological indicator signal, causes the at least one processor to:

obtain an average intensity of the red component and a blue component of the video color image of a portion of a subject's body; the average intensity of the red component and the average intensity of the blue component constituting DC_{RED} and DC_{BLUE} respectively;

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obtain a standard deviation of the red component and the blue component; the standard deviation of the red component and the blue component constituting AC_{RED} and AC_{BLUE} respectively; and

obtain the measure of oxygen saturation by

$$SpO2 = A - B\frac{AC_{RED}/DC_{RED}}{AC_{BLUE}/DC_{BLUE}}.$$

46. (Withdrawn) The computer usable medium of claim 44 wherein the one or more physiological measurements comprise heart rate and heart rate variability; and wherein the computer readable code, in causing the at least one processor to analyze the physiological indicator signal, causes the at least one processor to:

determine beats for the physiological indicator signal;

determine beat to beat intervals; and

apply a cubic spline algorithm to obtain a substantially continuous beat to beat interval signal indicative of heart rate.

47. (Withdrawn) The computer usable medium of claim 44 wherein the one or more physiological measurements comprise respiratory rate; and wherein the computer readable code, in causing the at least one processor to analyze the physiological indicator signal, causes the at least one processor to:

obtain time–frequency spectrum of the physiological indicator signal utilizing variable frequency complex demodulation (VFCDM); and

obtain respiratory rates by extracting a frequency component that has a largest amplitude for each time point at a heart rate frequency band.

48. (Withdrawn) The computer usable medium of claim 44 wherein the one or more physiological measurements comprise a measure of blood loss; and wherein the computer

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readable code, in causing the at least one processor to analyze the physiological indicator signal, causes the at least one processor to:

obtain time–frequency spectrum of the physiological indicator signal utilizing variable frequency complex demodulation (VFCDM);

obtain the amplitude modulation (AM) series from set of the largest instantaneous amplitude at each time sample within the heart rate frequency band of the time–frequency spectrum; and

determine whether the amplitude modulation decreases; a decrease in the amplitude modulation indicating blood volume loss in subject.

49. (Currently amended) A non-transitory computer usable medium having computer readable code embodied therein, the computer readable code causing at least one processor to:

analyze the physiological indicator signal; ~~to~~
obtain, from said analyzing, measurements of one or more physiological parameters; and

detect, using only the measurements of one or more physiological parameters, effects of motion artifacts in the measurements of the one or more physiological parameters; wherein the one or more physiological measurements comprise a measure of atrial fibrillation; and wherein the computer readable code, in causing the at least one processor to analyze the physiological indicator signal, causes the at least one processor to:

obtain a time-varying coherence function by multiplying two time-varying transfer functions (TVFTs), the two time-varying transfer functions obtained using two adjacent data segments, from the physiological indicator signal, one of the two adjacent data segment as an input signal and another of the two adjacent data segment as an output signal to produce a first TVTF; a second TVTF is produced by reversing the input and the output signals, using said another of the two adjacent data segment as the input signal and said one of the two adjacent data segment as the output signal; and

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determine whether the time-varying coherence function is less than a predetermined quantity.

50. (Previously presented) The non-transitory computer usable medium of claim 44 wherein the computer readable code, in causing the at least one processor to determine whether the time-varying coherence function is less than the predetermined quantity, causes the at least one processor to:

obtain one or more indicators of atrial fibrillation; and

determine whether the one or more indicators of atrial fibrillation exceed predetermined thresholds.

51. (Previously presented) The non-transitory computer usable medium of claim 50 wherein the one or more indicators of atrial fibrillation comprise a variance of the time-varying coherence function.

52. (Previously presented) The non-transitory computer usable medium of claim 51 wherein the one or more indicators of atrial fibrillation also comprise Shannon entropy.

53. (Previously presented) The computer usable medium of claim 50 wherein the predetermined thresholds are determined using receiver operator characteristic (ROC) analysis.

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REMARKS

Applicants have carefully reviewed the non-final Office Action dated March 11, 2015, and this response addresses the Examiner's concerns. Applicants respectfully request reconsideration of the application.

I. STATUS OF THE CLAIMS

Claims 1, 3-24, and 27-53 are pending for examination.

Claims 10-17, 35-38, and 45-48 are withdrawn from consideration.

Claims 2 and 25-26 are cancelled.

II. THE 35 U.S.C. 112 REJECTIONS

Claims 1, 3-9, 18-24, 27-34, 39-44 and 49-53 are rejected under 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA), second paragraph, as being indefinite.

Applicants have amended claims 1, 19, 24, 39, 44 and 49 so that the claims recite two steps: "analyzing, using the handheld mobile communication device, the physiological indicator signal; obtaining, from said analyzing, measurements of one or more physiological parameters."

Applicants respectfully state that the claims, as amended, are definite.

III. THE 35 U.S.C. 101 REJECTIONS

Claims 1, 3-24, and 27-53 are rejected under 35 U.S.C. 101 because the claimed inventions are directed to a judicial exception.

Applicants respectfully state that the claims(s), as a whole, are not directed to an abstract idea.

The Examiner, in the Office Action, states that the claims are directed to the abstract idea of: "obtaining a value of at least one indicator of volatility of Kurtosis or Shannon entropy for the preprocessed segment and comparing the value with a predetermined threshold."

The Applicants' claims are comparable to those in *Diamond v Diehr* (U.S. Patent No. 4,344,142), example 3 in section III of USPTO's 2014 Interim Eligibility Guidance", issued on December 16, 2014, 79 FR 74618. In Diamond v Diehr, the claim included the use of the Arrhenius equation, a known mathematical relationship, in a process for molding rubber into

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precision products. In the Applicants' claimed invention, a method and systems for physiological parameter monitoring are recited, including acquiring a physiological indicator signal, analyzing the signal and obtaining, from the analysis, measurements of a physiological parameter, such as heart rate, heart rate variability, respiratory rate, oxygen saturation, blood loss, and atrial fibrillation, and detecting motion artifacts in the measurements using the Shannon entropy of the preprocessed segment of the measurement of the one physiological parameter, where the segment is included in the analysis is motion artifacts are not present.

As in Diehr, analyzing the claim as a whole, the specifically disclosed and claimed analysis of the physiological indicator signal and obtaining, from the analysis, measurements of one or more physiological parameters are additional elements that provide "something more" than mere computer implementation of calculation of the Shannon entropy. Further, the claimed steps act in concert to transform the physiological indicator signal into measurement of one or more physiological parameters. The combination of steps recited in addition are used in determining the health status of a subject. The combination of steps recited in addition to the mathematical formula show that the claim is not to the formula in isolation, but rather that the steps impose meaningful limits that apply the formula to improve an existing technological process, the measurement of heart rate, heart rate variability, respiratory rate, oxygen saturation, blood loss, and atrial fibrillation. Thus, the claim amounts to significantly more than the judicial exception (Step 2B of the Alice/Mayo test results in YES). The claims are **more than a drafting effort designed to monopolize the exception (2014 Interim Guidance on Patent Subject Matter Eligibility, pages 20-21;)**. The claim is eligible subject matter.

Furthermore, the practice of the method requires a particular system and, assuming arguendo that the method is directed to one of the judicial exceptions, **the judicial exception is applied by use of a particular machine** (see slide 21 in USPTO Training on **2014 Interim Guidance on Patent Subject Matter Eligibility; 2014 Interim Guidance on Patent Subject Matter Eligibility, page 22)** . The handheld mobile communication device in claims 1, 24, 39 is not a generic computer since the processor is programmed to perform the steps necessary to achieve the desired new and useful end. "Such programming creates a new machine because a general purpose computer, in effect, becomes a special purpose computer once it is programmed to perform particular functions pursuant to instructions from program software. *In re Alappat,* 33

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F.3d 1526, 1545, 31 USPQ 1545, 1558 (Fed. Cir. 1994)." MPEP 2106. The method of claim 1 transforms transform the physiological indicator signal into measurement of one or more physiological parameters and, therefore, "**Effects a transformation or reduction of a particular article to a different thing**" (see slide 21 in USPTO Training on **2014 Interim Guidance on Patent Subject Matter Eligibility; 2014 Interim Guidance on Patent Subject Matter Eligibility, page 22).**

Applicants also respectfully state that the claimed invention does not preempt others from applying the concept of Shannon entropy.

Since the claim amounts to significantly more than the judicial exception, the claims are **more than a drafting effort designed to monopolize the exception, the claimed invention Effects a transformation or reduction of a particular article to a different thing, and the judicial exception is applied by use of a particular machine**, Applicants respectfully state that the claims recite patentable subject matter.

IV. THE 35 U.S.C. 103 REJECTIONS

Claims 1, 3-5, 8-9, 24, 27-29, 33-34, and 44 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Greco et al., "Kurtosis, Renyi's Entropy and Independent Component Scalp Maps for the Automatic Artifact Rejection from EEG data," International Journal of Computer, Information, Systems and Control Engineering 2(9), January 2008: 180-184 in view of Lichter et al. (USPN 6,159,147).

Applicant respectfully state that a *prima facie* case of obviousness has not been established for Claims 1, 3-5, 8-9, 24, 27-29, 33-34, and 44.

The factual inquiries set forth in *Graham v. John Deere Co.,* 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

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Claim Construction

The first step in determining whether a claim is anticipated, or is obvious in view of prior art, is to interpret the claim. ("It is elementary in patent law that, in determining whether a patent is valid ……., the first step is to determine the meaning and scope of each claim in suit." *Lemelson v. Gen. Mills, Inc.*, 968 F.2d 1202, 1206, 23 U.S.P.Q.2D (BNA) 1284, 1287 (Fed. Cir. 1992).) When not defined by applicant in the specification, the words of a claim must be read as they would be interpreted by those of ordinary skill in the art. (MPEP 2111.01) (*Rexnord Corp. v. Laitram Corp.*, 274 F.3d 1336, 1342, 60 USPQ2d 1851, 1854 (Fed. Cir. 2001) ("explaining the court's analytical process for determining the meaning of disputed claim terms")). The US Patent and Trademark Office ("USPTO") determines the scope of claims in patent applications not solely on the basis of the claim language, but upon giving claims their broadest reasonable construction "in light of the specification as it would be interpreted by one of ordinary skill in the art." *In re Am. Acad. of Sci. Tech. Ctr.,* 367 F.3d 1359, 1364[, 70 USPQ2d 1827, 1830] (Fed. Cir. 2004). MPEP 2111.

One skilled in the art, upon reading the specification, would interpret kurtosis for the preprocessed segment and Shannon entropy for the preprocessed segment has been computed using the segment and equations (1) and (2) in paragraphs 48 and 49 of the specification.

The level of ordinary skill in the pertinent art

One skilled in the art has knowledge of signal processing, at an equivalent graduate-level, and knowledge of biomedical applications.

Determining the scope and contents of the prior art

Greco teaches a technique for the automatic artifact rejection, based on the Independent Component Analysis (ICA) for the artifact extraction and on the joint use of kurtosis and Renyi's entropy, rather than Shannon's entropy (Greco, p. 181, col. 1, lines 10-14). Greco teaches extracting a number of data segments of EEG data, removing electrical line noise, performing independent component analysis (ICA) on the data to extract the independent components (ICs) and computing the kurtosis and Renyi's entropy for each independent component (IC). Greco teaches that using Shannon entropy instead of Renyi's entropy does not result in all the artifact being detected (Greco, p. 183, section IV-Results).

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Lichter teaches a real-time biological data processing PC card that is lightweight, cost effective, and portable. The real-time biological data processing PC card is capable of converting a host personal computer system into a powerful diagnostic instrument. Each real-time biological data processing PC card is adapted to input and process biological data from one or more biological data sensors, and is interchangeable with other real-time biological data processing PC cards.

The differences between the prior art and the claims at issue

The Applicants' claimed invention recites detecting effects of motion artifacts in the measurements by preprocessing a segment from the measurement of one physiological parameter, and obtaining a value of at least one indicator of volatility for the preprocessed segment; the at least one indicator of volatility being at least Shannon entropy for the preprocessed segment. In contrast, Greco teaches preprocessing segments of measurements of EEG data, performing Independent Component Analysis on the preprocessed data in order to obtain independent components and obtaining a value of at least one indicator of volatility for the **independent component** (not the preprocessed data segment) where the indicator of volatility is the Renyi's entropy. Lichter is silent as to indicators of volatility.

Greco teaches away from the use of the Shannon entropy as the indicator of volatility, showing that the use of the Shannon entropy results in a number of artifacts not being detected.

Applicants respectfully state that neither Greco nor Lichter teach or suggest detecting effects of motion artifacts in the measurements by preprocessing a segment from the measurement of one physiological parameter, and **obtaining a value of at least one indicator of volatility for the preprocessed segment; the at least one indicator of volatility being at least Shannon entropy for the preprocessed segment**, a limitation of each of the independent claims.

To establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974).

Applicants respectfully state that neither Greco nor Lichter teach or suggest all the limitations of each of the independent claims.

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Greco teaches away from the combination.

One skilled in the art, after the teachings of Greco, would be discouraged from using Shannon entropy as an indicator of volatility, therefore the reference teaches away. *In re Gurley,* 27 F.3d 551, 553 (Fed. Cir. 1994).

In *KSR International Co. v. Teleflex Inc.*, 127 S. Ct. 1727, 1740 (2007), the Court identified "teaching away" as a strong indicator of nonobviousness.

Since neither Greco nor Lichter teach or suggest all the limitations of each of the independent claims and since Greco teaches away from the combination, Applicants respectfully state that a prima facie case of obviousness has not been established for the independent claims.

Applicants respectfully state that a *prima facie* case of obviousness has not been established for Claims 1, 3-5, 8-9, 24, 27-29, 33-34, and 44.

Claims 6 and 30 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over the combination of Greco and Lichter as applied to claims 1 and 24 above, and further in view of Maier et al. (USPGPUB 2006/0253261).

Claim 6 is dependent on claim 1 and claim 30 is dependent on claim 24.

As stated above, neither Greco nor Lichter teach or suggest all the limitations of each of the independent claims and Greco teaches away from the combination. Applicant respectfully state that Maier also does not teach the limitations of the independent claims that are not taught by either Greco or Lichter and Maier does not correct Greco's teaching away from the combination.

Applicants respectfully state that a *prima facie* case of obviousness has not been established for claim 6 and claim 30.

Claims 7 and 31-32 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over the combination of Greco and Lichter as applied to claims 1 and 24 above, and further in view of Jacobsen et al. (USPN 6,198,394 — cited in previous action).

Claim 7 depends on claim 1 and claims 31-32 depend on claim 24.

As stated above, neither Greco nor Lichter teach or suggest all the limitations of each of the independent claims and Greco teaches away from the combination. Applicant respectfully

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state that Jacobsen also does not teach the limitations of the independent claims that are not taught by either Greco or Lichter and Jacobsen does not correct Greco's teaching away from the combination.

Applicants respectfully state that a *prima facie* case of obviousness has not been established for claims 7 and 31-32.

Claim 18 is rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over the combination of Greco and Lichter as applied to claim 1 above, and further in view of Zhang (USPGPUB 2009/0112110 — cited in previous action).

Claim 18 is dependent on claim 1.

As stated above, neither Greco nor Lichter teach or suggest all the limitations of each of the independent claims and Greco teaches away from the combination. Applicant respectfully state that Zhang also does not teach the limitations of the independent claims that are not taught by either Greco or Lichter and Zhang does not correct Greco's teaching away from the combination.

Applicants respectfully state that a *prima facie* case of obviousness has not been established for claim 18.

V. DOUBLE PATENTING

Claims 19-23, 39-43, 49-53 are rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1-16 of U.S. Patent No. 8,755,876 in view of Greco and Lichter.

While Applicants are not opposed to filing a terminal disclaimer, Applicants respectfully state that nonstatutory obviousness double patenting requires a prima facie case of obviousness. U.S. Patent No. 8,755,876 only claims the detection of atrial fibrillation while claim 19 recites "detecting, using the handheld mobile communication device and using **only** the measurements of one or more physiological parameters, effects of motion artifacts in the measurements of the one or more physiological parameters and deciding whether to retain the measurements based on effects of motion artifacts in the measurements." Claims 39 and 49 also recite detecting, using the handheld mobile communication device and using **only** the

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measurements of one or more physiological parameters, effects of motion artifacts. Greco teaches performing Independent Component Analysis on the preprocessed data in order to obtain independent components and obtaining a value of at least one indicator of volatility for the **independent component in** order to detect motion artifacts. Applicants respectfully state that Greco does not teach or suggest using **only** the measurements of one or more physiological parameters to detect the effect of motion artifacts and neither does Lichter. Applicants respectfully state that a *prima facie* case of obviousness has not been established for 19-23, 39-43, 49-53 and nonstatutory obviousness double patenting is not proper.

VI. CONCLUSION

Any amendments to the claims as set forth herein, including the modification, addition, cancellation, or withdrawal of any claims, have been offered to advance this application to issue. None of the amendments made herein should be construed as an admission that the subject matter of the claims, as originally filed, is anticipated by or made obvious in light of any art of record whether considered singularly or in combinations. Applicants expressly reserve the right to pursue the originally filed claims in another co-pending application without being prejudiced by any amendments, including cancellation of claims, made herein.

The Director of Patents and Trademarks is hereby authorized to charge any underpayment of fees, or credit any overpayments, to Deposit Account 03-2410 (Order No. 30210-201).

The following information is presented in the event that a call may be deemed desirable by the Examiner:

ORLANDO LOPEZ (617) 345-3000.

Respectfully submitted,

Dated: June 11, 2015

By: /Orlando Lopez/
Orlando Lopez
Reg. No. 46,880
Attorney for Patent Application Owners

Petitioner Ex-1004, 0421

Electronic Acknowledgement Receipt

EFS ID:	22598073
Application Number:	13354941
International Application Number:	
Confirmation Number:	9133
Title of Invention:	PHYSIOLOGICAL PARAMETER MONITORING WITH A MOBILE COMMUNICATION DEVICE
First Named Inventor/Applicant Name:	Ki H. Chon
Customer Number:	26486
Filer:	Marlo Schepper Grolnic
Filer Authorized By:	
Attorney Docket Number:	
Receipt Date:	11-JUN-2015
Filing Date:	20-JAN-2012
Time Stamp:	09:52:30
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		201ROA.pdf	187604 78a6050f8b50daa0117e018fe2e6e5cc9b03	yes	24

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Amendment/Req. Reconsideration-After Non-Final Reject	1	1
	Claims	2	16
	Applicant Arguments/Remarks Made in an Amendment	17	24
Warnings:			
Information:			
	Total Files Size (in bytes):	187604	

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 13/354,941	Filing Date 01/20/2012	☐ To be Mailed

ENTITY: ☐ LARGE ☒ SMALL ☐ MICRO

APPLICATION AS FILED – PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).			
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL	

APPLICATION AS AMENDED – PART II

AMENDMENT	06/11/2015	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 46	Minus	** 50	= 0	X $40 =	0
	Independent (37 CFR 1.16(h))	* 6	Minus	***6	= 0	X $210 =	0
	☐ Application Size Fee (37 CFR 1.16(s))						
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
						TOTAL ADD'L FEE	0

AMENDMENT		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =	
	☐ Application Size Fee (37 CFR 1.16(s))						
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
						TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

LIE
/BRUCE HARRISON/

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**
If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/354,941	01/20/2012	Ki H. Chon		9133

26486 7590 08/19/2015

BURNS & LEVINSON, LLP
125 SUMMER STREET
BOSTON, MA 02110

EXAMINER
LIU, CHU CHUAN

ART UNIT	PAPER NUMBER
3777	

NOTIFICATION DATE	DELIVERY MODE
08/19/2015	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

docketing@burnslev.com

Office Action Summary	Application No. 13/354,941	Applicant(s) CHON ET AL.	
	Examiner CHU CHUAN (JJ) LIU	Art Unit 3777	AIA (First Inventor to File) Status No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *06/11/2015*.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

5)☒ Claim(s) *1,3-24 and 27-53* is/are pending in the application.

5a) Of the above claim(s) *10-17,35-38 and 45-48* is/are withdrawn from consideration.

6)☐ Claim(s) _____ is/are allowed.

7)☒ Claim(s) *1, 3-9, 18-24, 27-34,39-44, and 49-53* is/are rejected.

8)☐ Claim(s) _____ is/are objected to.

9)☐ Claim(s) _____ are subject to restriction and/or election requirement.

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a)☐ All b)☐ Some** c)☐ None of the:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)

2) ☐ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date _____.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.

4) ☐ Other: _____.

DETAILED ACTION

1. The present application is being examined under the pre-AIA first to invent provisions.

2. Applicant's amendments and remarks filed on 06/11/2015 have been fully considered.

Status of Claims

3. Claims 1, 3-24, and 27-53 are pending for examination. Claims 10-17, 35-38, and 45-48 are withdrawn from consideration. Claims 2 and 25-26 are cancelled.

Claim Rejections - 35 USC § 101- abstract idea

4. 35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

5. Claims 1, 3-24, and 27-53 are rejected under 35 U.S.C. 101 because the claimed inventions are directed to a judicial exception (i.e., a law of nature, a natural phenomenon, or an abstract idea) without significantly more. Claims 1, 19, 24, 39, 44, and 49 are directed to an abstract idea. Instant claims 1, 19, 24, 39, 44, and 49 are drawn to "method(s) or system(s)" (prong 1 of the two-part test). In this case, the claims are directed to the judicial exception of **mathematical relationship and/ or ideas** , which is considered an abstract idea, or concepts similar to those found by the courts to be abstract, as they require mathematically relating data and/or comparing data (prong

2A of the two-part test). See also Federal Register, Vol. 79, No. 241, December 16, 2014 at 74622, column 2 and examples of Identifying Abstract Ideas in July 2015 Update: Interim Eligibility Guidance.

The claims do not include additional elements that are sufficient to amount to significantly more than the judicial exception because the claims as a whole, considering all claim elements both individually and in combination, do not amount to significantly more than the abstract idea of: "obtaining a value of at least one indicator of volatility of Kurtosis or Shannon entropy for the preprocessed segment and comparing the value with a predetermined threshold", which is a mathematical relation and/or fundamental data processing practice in the art (see prior art rejections below). The additional elements or combination of elements in the claims other than the abstract idea *per se* (a handheld mobile communication device; a physiological indicator signal sensing component; at least one processor) amount to no more than mere instructions to implement the abstract idea on a generic computer and/or generic computer structures that perform only well-understood, routine and data collection and/or insignificant extrasolution activity (i.e. collecting data, processing data). Therefore, these features when considered separately and in combination, do not add significantly more to the judicial exception. Additionally, the claims fail to recite any limitations that purport to improve the functioning of the computer itself or effect an improvement in any other technology or technical field, or provide meaningful limitations beyond generally linking the use of an abstract idea to a particular technological environment.

Viewed as a whole, these additional claim elements do not provide meaningful limitations to transform the abstract idea into a patent eligible application of the abstract idea such that the claims amount to **significantly** more than the abstract idea itself. Therefore, the claims are rejected under 35 U.S.C. 101 as being directed to non-statutory subject matter.

For additional guidance, applicant is directed generally to MPEP 2106 and to the USPTO's December 2014 Interim Guidance on Subject Matter Eligibility (Federal Register notice titled 2014 Interim Guidance on Patent Subject Matter Eligibility, 79 FR 74618) and Identifying Abstract Ideas in July 2015 Update: Interim Eligibility Guidance, as above, and http://www.uspto.gov/patent/laws-and-regulations/examination-policy/2014-interim-guidance-subject-matter-eligibility-0.

Claim Rejections - 35 USC § 103

6. The following is a quotation of pre-AIA 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

7. Claims 1, 3-5, 8-9, 24, 27-29, 33-34, and 44 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Greco et al., "Kurtosis, Renyi's Entropy and Independent Component Scalp Maps for the Automatic Artifact Rejection from EEG data". International Journal of Computer, Information, Systems and Control Engineering

2(9), January 2008: 180-184 – cited by applicant) in view of Lichter et al. (USPN 6,159,147 – cited in previous action). In regard to claims 1, 3-5, 24, 27-29 and 44, Greco discloses a method and an apparatus for physiological parameter monitoring (abstract and associated descriptions), the method comprising: providing a physiological indicator signal (electric signals, Fig. 1 and associated descriptions in page 203) obtained from a physiological indicator signal sensing component (EEG sensors and a recording machine, Fig. 1 and associated descriptions in page 203) to a device (EEGLAB, pages 206 and 207; it is inherently that the downloaded program is executed by a computer); analyzing, using the device, the physiological indicator signal (amplifier, page 203 and Sec. IV, page 206); obtaining, from said analyzing, measurements of one or more physiological parameters (EEG signals and associated independent components/ ICs in page 206); and detecting, using the device and using only the measurements of the one or more physiological parameters (ICs in the detected EEG signals pages 205-206), effects of motion artifacts in the measurements of the one or more physiological parameters (first paragraph in the right column of page 203; Sec. IV on page 206) and deciding whether to retain the measurements based on detected effects of motion artifacts (reject an IC, Sec. IV on page 206), wherein the step of detecting effects of motion artifacts in the measurements comprises: a. preprocessing a segment from the measurement of one physiological parameter (remove noise, Sec. IV on page 206); b. obtaining a value of at least one indicator of volatility for the preprocessed segment; the at least one indicator of volatility being at least one of kurtosis and Shannon entropy for the preprocessed segment (kurtosis and Shannon

entropy, Sec. III, A and B, pages 205-206). c. including the segment in analyses of physiological measurements, when comparison of the value of the at least one indicator of volatility with a predetermined threshold (threshold of ± 1.64, Sec. III, A and B, pages 205-206) indicates noise/motion artifacts are not present (reject the ICs only when the volatility exceeds the threshold, Sec. III, A and B, pages 205-206; i.e. the ICs not exceeded the threshold is included); and d. selecting another segment of the signal from the physiological measurement and proceeding to step (a) when the value of the at least one indicator of volatility is less than a predetermined threshold and another segment is available (comparing all ICs extracted from the data segments/ trials with the threshold and rejecting the IC(s) exceed the threshold, Sec. III and IV on pages 205-207). Greco does not specifically disclose the device a handheld mobile communication device. Lichter teaches a handheld mobile communication device (personal computer 27, Figs. 2-3) which can be connected to various sensors to measure and analyze the collected data (Figs. 16) including EEG (Fig. 16). One ordinary would have recognized that a personal computer is an alternative equivalent computing device. Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention was made to substitute the device/ computer (Greco) with the handheld mobile communications device (Lichter) to yield predictable results.

In regard to claims 8-9 and 33-34, Greco as modified by Lichter discloses providing a physiological indicator signal comprises obtaining a signal from a physiological monitoring sensor (EEG sensors, Greco and EEG sensor, Fig. 16 of

Lichter) which comprises a PPG sensor and an ECG sensor (Fig. 16 and associated descriptions of Lichter).

8. Claims 6 and 30 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over the combination of Greco and Lichter as applied to claims 1 and 24 above, and further in view of Maier et al. (USPGPUB 2006/0253261 -cited in previous action). In regard to claims 6 and 30, Greco as modified by Lichter discloses all the claimed limitation except the predetermined threshold is determined using receiver operator characteristic (ROC) analysis. Maier teaches a threshold value can be determined using receiver operator characteristic (ROC) analysis ([0235]) in order to have a constant false alarm rate ([0235]). Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention was made to modify the method and the apparatus (Greco as modified by Lichter) to incorporate the ROC determined threshold (Maier) in order to find the optimal threshold values for the comparison(s).

9. Claims 7 and 31-32 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over the combination of Greco and Lichter as applied to claims 1 and 24 above, and further in view of Jacobsen et al. (USPN 6,198,394 – cited in previous action). In regard to claims 7 and 31-32, Greco as modified by Lichter discloses all the claim limitation except placing a portion of a subject's body over an objective lens of a camera in a mobile communication device; and obtaining video images of the portion of the subject's body. Jacobsen teaches placing a portion of a subject's body over an

objective lens of a camera in a mobile communication device (element 376, Fig. 5A; Fig. 8; Col 13 lines 55-67); and obtaining video images of the portion of the subject's body (element 376, Fig. 5A; Fig. 8; Col 13 lines 55-67). The portable communication device taught by Jacobsen can be connected to various sensors applied to a user (Figs. 1-3, 5-7, and 8 and associated description) and provide video images associated with specific location of the user to the command center (Col 13 lines 55-67). Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention was made to modify the method and the apparatus (Greco as modified by Lichter) to incorporate the camera of the portable communication device (Jacobsen) in order to obtain video images associated with specific location of the user and transferring to a central monitoring system/ unit.

10. Claim 18 is rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over the combination of Greco and Lichter as applied to claim 1 above, and further in view of Zhang (USPGPUB 2009/0112110 – cited in previous action). In regard to claim 18, Greco as modified by Lichter discloses the measurement of ECG signals (Fig. 16 and associated descriptions of Lichter) but does not specifically discloses a measure of atrial fibrillation. Zhang teaches a measure of atrial fibrillation based on ECG signal analysis (abstract and Figs. 1-9). Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention was made to modify the method (Greco as modified by Lichter) to incorporate the ECG-based atrial fibrillation analysis (Zhang) in order to obtain more health information of the user.

Double Patenting

11. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory double patenting rejection is appropriate where the claims at issue are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the reference application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement. A terminal disclaimer must be signed in compliance with 37 CFR 1.321(b).

The USPTO internet Web site contains terminal disclaimer forms which may be used. Please visit http://www.uspto.gov/forms/. The filing date of the application will

determine what form should be used. A web-based eTerminal Disclaimer may be filled out completely online using web-screens. An eTerminal Disclaimer that meets all requirements is auto-processed and approved immediately upon submission. For more information about eTerminal Disclaimers, refer to http://www.uspto.gov/patents/process/file/efs/guidance/eTD-info-I.jsp.

12. Claims 19-23, 39-43, 49-53 are rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1-16 of U.S. Patent No. 8,755,876 in view of Greco and Lichter. In regard to claims 19-23, 39-43, 49-53 of present application, claims 1-16 of '876 recite all the limitations except a system and a method comprises providing a physiological indicator signal to a handheld mobile communication device; analyzing, using the device, the physiological indicator signal to obtain measurements of one or more physiological parameters; and detecting, using the a handheld mobile communication device and using only the measurements of the one or more physiological parameters, effects of motion artifacts in the measurements of the one or more physiological parameters and deciding whether to retain the measurements based on effects of motion artifacts in the measurements based on detected effects of motion artifacts. Greco discloses a method and an apparatus for physiological parameter monitoring (abstract and associated descriptions), the method comprising: providing a physiological indicator signal (electric signals, Fig. 1 and associated descriptions in page 203) obtained from a physiological indicator signal sensing component (EEG sensors and a recording machine, Fig. 1 and associated descriptions in page 203) to a device (EEGLAB, pages 206 and 207; it is inherently that the downloaded program is

executed by a computer); analyzing, using the device, the physiological indicator signal (amplifier, page 203 and Sec. IV, page 206) to obtain measurements of one or more physiological parameters (EEG signals and associated independent components/ ICs in page 206); and detecting, using the device and using only the measurements of the one or more physiological parameters (ICs in the detected EEG signals pages 205-206), effects of motion artifacts in the measurements of the one or more physiological parameters (first paragraph in the right column of page 203; Sec. IV on page 206) and deciding whether to retain the measurements based on detected effects of motion artifacts (reject an IC, Sec. IV on page 206). Claims 1-16 of '876 recite a processor to process data related to R-R intervals (claims 1, 2, 6, 7, 12 and 13) but do not recite the processor is in part of a computing device. Greco discloses an artifact rejection method for biomedical signal processing (abstract and Sec. II, IV and V). Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention was made to modify the method and the apparatus (claims 1-16 of '876) to incorporate the artifact rejection method (Greco) in order to better reject artifacts contained in the signal. Claims 1-16 of '876 as modified by Greco does not specifically recite the device is a handheld mobile communication device. Lichter teaches a handheld mobile communication device (personal computer 27, Figs. 2-3) which can be connected to various sensors to measure and analyze the collected data (Figs. 16) including ECG signals obtained from ECG sensor (Fig. 15). Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention was made to substitute the

computer (Claims 1-16 of '876 as modified by Greco) with the handheld mobile communications device (Lichter) to yield predictable results.

Response to Arguments

13. Applicant's arguments, see page 17 of Remarks, filed on 06/11/2015, with respect to claims 1, 3-9, 18-24, 27-34, 39-44 and 49-53 have been fully considered and are persuasive. The 35 USC 112 rejection of claims 1, 3-9, 18-24, 27-34, 39-44 and 49-53 has been withdrawn.

Applicant's arguments filed on 06/11/2015 have been fully considered but they are not persuasive. In regard to the 35 USC 101 rejection, applicant alleged that the claimed invention amounts significantly more than the judicial exception. In response, the claims are NOT considered as significantly more than the judicial exception (see the detail analyses above). Therefore, the rejections are maintained for the reason of record. For additional guidance, applicant is directed generally to MPEP 2106 and to the USPTO's December 2014 Interim Guidance on Subject Matter Eligibility (Federal Register notice titled 2014 Interim Guidance on Patent Subject Matter Eligibility, 79 FR 74618) and Identifying Abstract Ideas in July 2015 Update: Interim Eligibility Guidance, as above, and http://www.uspto.gov/patent/laws-and-regulations/examination-policy/2014-interim-guidance-subject-matter-eligibility-0.

In regard to 35 USC 103(a) rejections, Applicant first alleged that Greco discloses obtaining a value of at least one indicator of volatility for the independent components, which is not preprocessed data segment. In response, Greco discloses

the ICs are extracted from the EEG signals (see section III, page 205). Therefore, the ICs are considered as part of the preprocessed EEG data segment. Secondly, Applicant alleged that the at least one indicator of volatility being at least Shannon entropy for the preprocessed segment. In response, Greco discloses the at least one indicator of volatility being at least Shannon entropy (kurtosis, Shannon's entropy and Renyi's entropy were computed for each trial for each IC, as described in Section III...Kurtosis detected IC10, Shannon's entropy detected IC2, IC10, IC17, IC21, IC24, Renyi's entropy detected IC1, IC2, IC9, IC10, IC17, IC21, IC24. Global kurtosis detected IC14 which accounts for an amount of the eye movement artifact, see section IV. Results in page 206). It is noted that the claims recite transitional phrase "comprising" which is inclusive or open-ended and does not exclude additional, unrecited elements or method steps (see MPEP 2111.03). Therefore, the rejections are maintained for the reason of record.

In regard to the double patenting rejections, applicant alleged Greco does not teach or suggest using **only** the measurements of one or more physiological parameters to detect the effect of motion artifacts. In response, Greco discloses using **only** the measurements (ICs extracted from the EEG data, see section III, page 205) to detect the effect of motion artifacts (first paragraph in the right column of page 203; Sec. IV on page 206 and ICs in section IV. Results of page 206). Therefore, the rejections are maintained for the reason of record.

Conclusion

14. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to CHU CHUAN (JJ) LIU whose telephone number is (571)270-5507. The examiner can normally be reached on M-TH 8:00am~4:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tse Chen can be reached on (571)272-3672. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/CHU CHUAN (JJ) LIU/
Examiner, Art Unit 3777

/TSE CHEN/
Supervisory Patent Examiner, Art Unit 3777

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13354941	CHON ET AL.
	Examiner	Art Unit
	CHU CHUAN (JJ) LIU	3777

CPC- SEARCHED		
Symbol	Date	Examiner
A61B5/1455	02/24/2015	CCL
A61B5/0002,0004,145,1455,14551	08/11/2015	CCL

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner
600	300, 301, 309, 310, 322, 323, 324, 326, 330, 336, 473, 476, 500, 501, 502, 508, 509,518	10/24/2013	CCL
600	300, 301, 309, 310, 322, 323, 324, 326, 330, 336, 473, 476, 500, 501, 502, 508, 509,518	03/12/2014	CCL
600	300, 301, 309, 310, 322, 323, 324, 326, 330, 336, 473, 476, 500, 501, 502, 508, 509,518	09/16/2014	CCL
600	300, 301, 309, 310, 322, 323, 324, 326, 330, 336, 473, 476, 500, 501, 502, 508, 509,518	02/24/2015	CCL
600	300, 301, 309, 310, 322, 323, 324, 326, 330, 336, 473, 476, 500, 501, 502, 508, 509,518	8/11/2015	CCL

SEARCH NOTES		
Search Notes	Date	Examiner
Inventor Name Search (PALM and EAST)	10/23/2013	CCL
EAST Search (TEXT, USPGPUB, USPAT) See Search History	10/24/2013	CCL
Google NPL Search	10/24/2013	CCL
Updated EAST Search (TEXT, USPGPUB, USPAT) See Search History	03/12/2014	CCL
Google NPL Search	03/12/2014	CCL
Updated EAST Search (TEXT, USPGPUB, USPAT) See Search History	09/16/2014	CCL
Updated EAST Search (TEXT, USPGPUB, USPAT, CPC) See Search History	02/24/2015	CCL
Google NPL Search	02/24/2015	CCL

/CHU CHUAN (JJ) LIU/ Examiner.Art Unit 3777	

SEARCH NOTES		
Search Notes	**Date**	**Examiner**
Updated EAST Search (TEXT, USPGPUB, USPAT, CPC) See Search History	8/11/2015	CCL
NPL Search	8/11/2015	CCL

INTERFERENCE SEARCH			
US Class/ CPC Symbol	**US Subclass / CPC Group**	**Date**	**Examiner**

/CHU CHUAN (JJ) LIU/ Examiner.Art Unit 3777	

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L3	12	1 and Shannon with entropy with threshold	US-PGPUB; USPAT	OR	ON	2015/08/11 14:07
L2	118	1 and Shannon with entropy	US-PGPUB; USPAT	OR	ON	2015/08/11 14:06
L1	552	(kurtosis Shannon with entropy) and (noise artifact artefact) and ("600".clas. A61B5/0002,0004,145,1455,14551.cpc.)	US-PGPUB; USPAT	OR	ON	2015/08/11 14:05

EAST Search History (Interference)

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8/ 11/ 2015 2:10:41 PM
C:\ Users\ cliu\ Documents\ EAST\ Workspaces\ 13354941.wsp

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13354941	CHON ET AL.
	Examiner	Art Unit
	CHU CHUAN (JJ) LIU	3777

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	10/24/2013	03/12/2014	09/16/2014	02/24/2015	08/11/2015				
	1	✓	✓	✓	✓	✓				
	2	✓	✓	-	-	-				
	3	✓	✓	✓	✓	✓				
	4	✓	✓	✓	✓	✓				
	5	✓	✓	✓	✓	✓				
	6	✓	✓	✓	✓	✓				
	7	✓	✓	✓	✓	✓				
	8	✓	✓	✓	✓	✓				
	9	✓	✓	✓	✓	✓				
	10	N	N	N	N	N				
	11	N	N	N	N	N				
	12	N	N	N	N	N				
	13	N	N	N	N	N				
	14	N	N	N	N	N				
	15	N	N	N	N	N				
	16	N	N	N	N	N				
	17	N	N	N	N	N				
	18	✓	✓	✓	✓	✓				
	19	✓	✓	✓	✓	✓				
	20	✓	✓	✓	✓	✓				
	21	✓	✓	✓	✓	✓				
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	24	✓	✓	✓	✓	✓				
	25	✓	✓	-	-	-				
	26	✓	✓	-	-	-				
	27	✓	✓	✓	✓	✓				
	28	✓	✓	✓	✓	✓				
	29	✓	✓	✓	✓	✓				
	30	✓	✓	✓	✓	✓				
	31	✓	✓	✓	✓	✓				
	32	✓	✓	✓	✓	✓				
	33	✓	✓	✓	✓	✓				
	34	✓	✓	✓	✓	✓				
	35	N	N	N	N	N				
	36	N	N	N	N	N				

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
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	CHU CHUAN (JJ) LIU	3777

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	10/24/2013	03/12/2014	09/16/2014	02/24/2015	08/11/2015				
	37	N	N	N	N	N				
	38	N	N	N	N	N				
	39	✓	✓	✓	✓	✓				
	40	✓	✓	✓	✓	✓				
	41	✓	✓	✓	✓	✓				
	42	✓	✓	✓	✓	✓				
	43	✓	✓	✓	✓	✓				
	44	✓	✓	✓	✓	✓				
	45	N	N	N	N	N				
	46	N	N	N	N	N				
	47	N	N	N	N	N				
	48	N	N	N	N	N				
	49	✓	✓	✓	✓	✓				
	50	✓	✓	✓	✓	✓				
	51	✓	✓	✓	✓	✓				
	52	✓	✓	✓	✓	✓				
	53	✓	✓	✓	✓	✓				

PATENT APPLICATION
Attorney Docket No. 30210-201

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants: Ki H. Chon et al.
Application Number: 13/354,941
Filed: January 20, 2012
Title: PHYSIOLOGICAL PARAMETER MONITORING WITH A MOBILE COMMUNICATION DEVICE

Examiner: LIU, CHU CHUAN
Group Art Unit: 3777
Confirmation No. 9133

BURNS & LEVINSON, LLP
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Boston, MA 02110
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TO: Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450,
Alexandria, VA 22313-1450

AMENDMENT AND RESPONSE TO FINAL OFFICE ACTION

Sir:

In reply to the final Office Action dated August 20, 2015, Applicants submit the following amendments and remarks that place this application in condition for allowance or in better form for appeal. An After Final Consideration Request form is attached hereto.

Amendments to the claims begin on page 2 of this paper.

Remarks begin on page 15 of this paper.

Attachments to this paper also include a copy of Form PTO/SB/434 (1 sheet).

Amendments to the Claims:

This listing of claims replaces all prior versions and listings of the claims.

1. (Currently amended) A method for physiological parameter monitoring, the method comprising:

providing a physiological indicator signal to a handheld mobile communication device;

analyzing, using the handheld mobile communication device, the physiological indicator signal;

obtaining, from said analyzing, measurements of one or more physiological parameters; and

detecting, using the handheld mobile communication device and using only the measurements of one or more physiological parameters, effects of motion artifacts in the measurements of the one or more physiological parameters and deciding whether to retain the measurements based on detected effects of motion artifacts;

wherein detecting effects of motion artifacts in the measurements comprises:

a. preprocessing a segment from the measurement of one physiological parameter;

b. obtaining a value of at least one indicator of volatility, used in determining whether motion artifacts are present, for the preprocessed segment; the at least one indicator of volatility being at least Shannon entropy for the preprocessed segment;

c. including the segment in analyses of physiological measurements, ~~if~~ when comparison of the value of the at least one indicator of volatility with a predetermined threshold indicates noise/motion artifacts are not present; and

d. selecting another segment of the signal from the physiological measurement and proceeding to step (a) when the value of the at least one indicator of volatility is less than a predetermined threshold and when another segment is available.

2. (Canceled)

Petitioner Ex-1004, 0447

3. (Currently amended) The method of claim 1 wherein said at least one indicator of volatility also comprises kurtosis.

4-5. (Canceled)

6. (Previously presented) The method of claim 1 wherein the predetermined threshold is determined using receiver operator characteristic (ROC) analysis.

7. (Previously presented) The method of claim 1 wherein providing a physiological indicator signal comprises:

placing a portion of a subject's body over an objective lens of a camera in a handheld mobile communication device; and

obtaining video images of the portion of the subject's body.

8. (Previously presented) The method of claim 1 wherein providing a physiological indicator signal comprises obtaining a signal from a physiological monitoring sensor.

9. (Previously presented) The method of claim 8 wherein the physiological monitoring sensor is a photoplethysmographic (PPG) sensor or an electrocardiogram sensor.

10. (Withdrawn) The method of claim 1 wherein the one or more physiological measurements comprise heart rate and heart rate variability.

11. (Withdrawn) The method of claim 10 wherein obtaining measurements of heart rate and heart rate variability comprise:

determining beats for the physiological indicator signal;

determining beat to beat intervals; and

applying a cubic spline algorithm to obtain a substantially continuous beat to beat interval signal indicative of heart rate.

Petitioner Ex-1004, 0448

12. (Withdrawn) The method of claim 1 wherein the one or more physiological measurements comprise respiratory rate.

13. (Withdrawn) The method of claim 12 wherein measurement of respiratory rate comprises:

obtaining time–frequency spectrum of the physiological indicator signal utilizing variable frequency complex demodulation (VFCDM); and

obtaining respiratory rates by extracting a frequency component that has a largest amplitude for each time point at a heart rate frequency band.

14. (Withdrawn) The method of claim 1 wherein the one or more physiological measurements comprise a measure of oxygen saturation.

15. (Withdrawn) The method of claim 14 wherein providing a physiological indicator signal comprises:

placing a portion of a subject's body over an objective lens of a camera in a mobile communication device; and

obtaining video images of the portion of the subject's body, and

wherein obtaining the measure of oxygen saturation comprises:

obtaining an average intensity of a red component and a blue component of the video images of the portion of the subject's body; the average intensity of the red component and the average intensity of the blue component constituting DC_{RED} and DC_{BLUE} respectively;

obtaining a standard deviation of the red component and the blue component; the standard deviation of the red component and the blue component constituting AC_{RED} and AC_{BLUE} respectively; and

obtaining the measure of oxygen saturation (SpO2) by

$$SpO2 = A - B\frac{AC_{RED}/DC_{RED}}{AC_{BLUE}/DC_{BLUE}},$$

Petitioner Ex-1004, 0449

16. (Withdrawn) The method of claim 1 wherein the one or more physiological measurements comprise a measure of blood loss.

17. (Withdrawn) The method of claim 16 wherein obtaining the measure of blood loss comprises:

obtaining time–frequency spectrum of the physiological indicator signal utilizing variable frequency complex demodulation (VFCDM);

obtaining the amplitude modulation (AM) series from a set of the largest instantaneous amplitude at each time sample within the heart rate frequency band of the time–frequency spectrum; and

determining whether the amplitude modulation decreases; a decrease in the amplitude modulation indicating blood volume loss in subject.

18. (Previously presented) The method of claim 1 wherein the one or more physiological measurements comprise a measure of atrial fibrillation.

19. (Previously presented) A method for physiological parameter monitoring, the method comprising:

providing a physiological indicator signal to a handheld mobile communication device;

analyzing, using the handheld mobile communication device, the physiological indicator signal;

obtaining, from said analyzing, measurements of one or more physiological parameters; and

detecting, using the handheld mobile communication device and using only the measurements of one or more physiological parameters, effects of motion artifacts in the measurements of the one or more physiological parameters and deciding whether to retain the measurements based on effects of motion artifacts in the measurements;

wherein the one or more physiological measurements comprise a measure of atrial fibrillation;

wherein obtaining the measure of atrial fibrillation comprises:

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obtaining a time-varying coherence function by multiplying two time-varying transfer functions (TVFTs), the two time-varying transfer functions obtained using two adjacent data segments, from the physiological indicator signal, one of the two adjacent data segment as an input signal and another of the two adjacent data segment as an output signal to produce a first TVTF; a second TVTF is produced by reversing the input and the output signals, using said another of the two adjacent data segment as the input signal and said one of the two adjacent data segment as the output signal; and

determining whether the time-varying coherence function is less than a predetermined quantity.

20. (Previously presented) The method of claim 19 wherein determining whether the time-varying coherence function is less than the predetermined quantity comprises:

obtaining one or more indicators of atrial fibrillation; and

determining whether the one or more indicators of atrial fibrillation exceed predetermined thresholds.

21. (Previously presented) The method of claim 20 wherein the one or more indicators of atrial fibrillation comprise a variance of the time-varying coherence function.

22. (Previously presented) The method of claim 21 wherein the one or more indicators of atrial fibrillation also comprise Shannon entropy.

23. (Previously presented) The method of claim 20 wherein the predetermined thresholds are determined using receiver operator characteristic (ROC) analysis.

24. (Previously presented) A system for physiological parameter monitoring, the system comprising:

a physiological indicator signal sensing component; and a handheld mobile communication device comprising:

at least one processor; and

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at least one computer usable medium, the computer usable medium having computer readable code embodied therein, the computer readable code causing the at least one processor to:

analyze the physiological indicator signal;

obtain, from results of analyzing, measurements of one or more physiological parameters; and

detect effects of motion artifacts in the measurements of the one or more physiological parameters;

wherein the computer readable code, in causing the at least one processor to detect effects of motion artifacts, causes the at least one processor to:

a. preprocess a segment from the measurement of one physiological parameter;

b. obtain a value of at least one indicator of volatility for the preprocessed segment; the at least one indicator of volatility being at least Shannon entropy for the preprocessed segment;

c. include the segment in analyses of physiological measurements when comparison of the value of the at least one indicator of volatility with a predetermined threshold indicates noise/motion artifacts are not present;

d. select another segment of the signal from the physiological measurement and proceeding to step (a) when the value of the at least one indicator of volatility is less than a predetermined threshold and another segment is available.

25-26. (Canceled)

27. (Currently amended) The system of claim 24 wherein said at least one indicator of volatility also comprises kurtosis.

28-29. (Canceled)

30. (Previously presented) The system of claim 24 wherein the predetermined threshold is determined using receiver operator characteristic (ROC) analysis.

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31. (Previously presented) The system of claim 24 wherein the physiological indicator signal sensing component comprises an image acquisition component, said acquisition component capable of acquiring a number of frames, each frame acquired at a predetermined time.

32. (Previously presented) The system of claim 31 wherein the handheld mobile communications device comprises said image acquisition component.

33. (Previously presented) The system of claim 24 wherein the physiological indicator signal sensing component comprises a physiological monitoring sensor.

34. (Previously presented) The system of claim 33 wherein the physiological monitoring sensor is a photoplethysmographic (PPG) sensor or an electrocardiogram sensor.

35. (Withdrawn) The system of claim 25 wherein the physiological indicator signal sensing component comprises an image acquisition component, said acquisition component capable of acquiring a number of frames, each frame acquired at a predetermined time; wherein said image acquisition component acquires a color image having red, green and blue components; wherein one or more physiological measurements comprise a measure of oxygen saturation; and wherein the computer readable code, in causing the at least one processor to analyze the physiological indicator signal, causes the at least one processor to:

obtain an average intensity of a red component and a blue component of the images of a portion of a subject's body; the average intensity of the red component and the average intensity of the blue component constituting DC_{RED} and DC_{BLUE} respectively;

obtain a standard deviation of the red component and the blue component; the standard deviation of the red component and the blue component constituting AC_{RED} and AC_{BLUE} respectively; and

obtain the measure of oxygen saturation by

$$SpO2 = A - B\frac{AC_{RED}/DC_{RED}}{AC_{BLUE}/DC_{BLUE}}.$$

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36. (Withdrawn) The system of claim 25 wherein the one or more physiological measurements comprise heart rate and heart rate variability; and wherein the computer readable code, in causing the at least one processor to analyze the physiological indicator signal, causes the at least one processor to:

determine beats for the physiological indicator signal;

determine beat to beat intervals; and

apply a cubic spline algorithm to obtain a substantially continuous beat to beat interval signal indicative of heart rate.

37. (Withdrawn) The system of claim 25 wherein the one or more physiological measurements comprise respiratory rate; and wherein the computer readable code, in causing the at least one processor to analyze the physiological indicator signal, causes the at least one processor to:

obtain time--frequency spectrum of the physiological indicator signal utilizing variable frequency complex demodulation (VFCDM); and

obtain respiratory rates by extracting a frequency component that has a largest amplitude for each time point at a heart rate frequency band.

38. (Withdrawn) The system of claim 25 wherein the one or more physiological measurements comprise a measure of blood loss; and wherein the computer readable code, in causing the at least one processor to analyze the physiological indicator signal, causes the at least one processor to:

obtain time--frequency spectrum of the physiological indicator signal utilizing variable frequency complex demodulation (VFCDM);

obtain the amplitude modulation (AM) series from set of the largest instantaneous amplitude at each time sample within the heart rate frequency band of the time--frequency spectrum; and

determine whether the amplitude modulation decreases; a decrease in the amplitude modulation indicating blood volume loss in subject.

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39. (Previously presented) A system for physiological parameter monitoring, the system comprising:

a physiological indicator signal sensing component; and a handheld mobile communication device comprising:

at least one processor; and

at least one computer usable medium, the computer usable medium having computer readable code embodied therein, the computer readable code causing the at least one processor to:

analyze the physiological indicator signal;

obtain, from results of analyzing, measurements of one or more physiological parameters; and

detect effects of motion artifacts, using only the measurements of one or more physiological parameters, in the measurements of the one or more physiological parameters; wherein the one or more physiological measurements comprise a measure of atrial fibrillation; and wherein the computer readable code, in causing the at least one processor to analyze the physiological indicator signal, causes the at least one processor to:

obtain a time-varying coherence function by multiplying two time-varying transfer functions (TVFTs), the two time-varying transfer functions obtained using two adjacent data segments , from the physiological indicator signal, one of the two adjacent data segment as an input signal and another of the two adjacent data segment as an output signal to produce a first TVTF; a second TVTF is produced by reversing the input and the output signals, using said another of the two adjacent data segment as the input signal and said one of the two adjacent data segment as the output signal; and

determine whether the time-varying coherence function is less than a predetermined quantity.

40. (Previously presented) The system of claim 39 wherein the computer readable code, in causing the at least one processor to determine whether the time-varying coherence function is less than the predetermined quantity, causes the at least one processor to:

obtain one or more indicators of atrial fibrillation; and

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determine whether the one or more indicators of atrial fibrillation exceed predetermined thresholds.

41. (Previously presented) The system of claim 40 wherein the one or more indicators of atrial fibrillation comprise a variance of the time-varying coherence function.

42. (Previously presented) The system of claim 41 wherein the one or more indicators of atrial fibrillation also comprise Shannon entropy.

43. (Previously presented) The system of claim 41 wherein the predetermined thresholds are determined using receiver operator characteristic (ROC) analysis.

44. (Previously presented) A non-transitory computer usable medium having computer readable code embodied therein, the computer readable code causing at least one processor to:

analyze the physiological indicator signal;

obtain, from said analyzing, measurements of one or more physiological parameters; and

detect, using only the measurements of one or more physiological parameters, effects of motion artifacts in the measurements of the one or more physiological parameters;

wherein the computer readable code, in causing the at least one processor to detect effects of motion artifacts, causes the at least one processor to:

e. preprocess a segment from the measurement of one physiological parameter;

f. obtain a value of at least one indicator of volatility for the preprocessed segment; the at least one indicator of volatility being at least Shannon entropy for the preprocessed segment;

g. include the segment in analyses of physiological measurements when comparison of the value of the at least one indicator of volatility with a predetermined threshold indicates noise/motion artifacts are not present;

h. select another segment of the signal from the physiological measurement and proceeding to step (a) when the value of the at least one indicator of volatility is less than a predetermined threshold and another segment is available.

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45. (Withdrawn) The computer usable medium of claim 44 wherein the physiological indicator signal comprises a video color image having red, green and blue components, the video color image being an image obtained from of a portion of a subject's body; wherein the measurements of one or more physiological parameters comprise a measure of oxygen saturation; and wherein the computer readable code, in causing the at least one processor to analyze the physiological indicator signal, causes the at least one processor to:

obtain an average intensity of the red component and a blue component of the video color image of a portion of a subject's body; the average intensity of the red component and the average intensity of the blue component constituting DC_{RED} and DC_{BLUE} respectively;

obtain a standard deviation of the red component and the blue component; the standard deviation of the red component and the blue component constituting AC_{RED} and AC_{BLUE} respectively; and

obtain the measure of oxygen saturation by

$$SpO2 = A - B\frac{AC_{RED}/DC_{RED}}{AC_{BLUE}/DC_{BLUE}}.$$

46. (Withdrawn) The computer usable medium of claim 44 wherein the one or more physiological measurements comprise heart rate and heart rate variability; and wherein the computer readable code, in causing the at least one processor to analyze the physiological indicator signal, causes the at least one processor to:

determine beats for the physiological indicator signal;

determine beat to beat intervals; and

apply a cubic spline algorithm to obtain a substantially continuous beat to beat interval signal indicative of heart rate.

47. (Withdrawn) The computer usable medium of claim 44 wherein the one or more physiological measurements comprise respiratory rate; and wherein the computer readable code, in causing the at least one processor to analyze the physiological indicator signal, causes the at least one processor to:

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obtain time–frequency spectrum of the physiological indicator signal utilizing variable frequency complex demodulation (VFCDM); and

obtain respiratory rates by extracting a frequency component that has a largest amplitude for each time point at a heart rate frequency band.

48. (Withdrawn) The computer usable medium of claim 44 wherein the one or more physiological measurements comprise a measure of blood loss; and wherein the computer readable code, in causing the at least one processor to analyze the physiological indicator signal, causes the at least one processor to:

obtain time–frequency spectrum of the physiological indicator signal utilizing variable frequency complex demodulation (VFCDM);

obtain the amplitude modulation (AM) series from set of the largest instantaneous amplitude at each time sample within the heart rate frequency band of the time–frequency spectrum; and

determine whether the amplitude modulation decreases; a decrease in the amplitude modulation indicating blood volume loss in subject.

49. (Previously presented) A non-transitory computer usable medium having computer readable code embodied therein, the computer readable code causing at least one processor to:

analyze the physiological indicator signal;

obtain, from said analyzing, measurements of one or more physiological parameters; and

detect, using only the measurements of one or more physiological parameters, effects of motion artifacts in the measurements of the one or more physiological parameters;

wherein the one or more physiological measurements comprise a measure of atrial fibrillation; and wherein the computer readable code, in causing the at least one processor to analyze the physiological indicator signal, causes the at least one processor to:

obtain a time-varying coherence function by multiplying two time-varying transfer functions (TVFTs), the two time-varying transfer functions obtained using two adjacent data segments, from the physiological indicator signal, one of the two adjacent data segment as an input signal and another of the two adjacent data segment as an output signal to produce a first

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TVTF; a second TVTF is produced by reversing the input and the output signals, using said another of the two adjacent data segment as the input signal and said one of the two adjacent data segment as the output signal; and

determine whether the time-varying coherence function is less than a predetermined quantity.

50. (Previously presented) The non-transitory computer usable medium of claim 44 wherein the computer readable code, in causing the at least one processor to determine whether the time-varying coherence function is less than the predetermined quantity, causes the at least one processor to:

obtain one or more indicators of atrial fibrillation; and

determine whether the one or more indicators of atrial fibrillation exceed predetermined thresholds.

51. (Previously presented) The non-transitory computer usable medium of claim 50 wherein the one or more indicators of atrial fibrillation comprise a variance of the time-varying coherence function.

52. (Previously presented) The non-transitory computer usable medium of claim 51 wherein the one or more indicators of atrial fibrillation also comprise Shannon entropy.

53. (Previously presented) The computer usable medium of claim 50 wherein the predetermined thresholds are determined using receiver operator characteristic (ROC) analysis.

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REMARKS

Applicants have carefully reviewed the Final Office Action dated August 19, 2015, and this response addresses the Examiner's concerns. Applicants respectfully request reconsideration of the application.

I. STATUS OF THE CLAIMS

Claims 1, 3-24 and 27-53 are pending in the application.

Claims 10-17, 35-38 and 45-48 are withdrawn from consideration.

Claim 1, 3-9, 18-24, 27-34, 39-44, and 49-53 are rejected.

Claim 1 is amended.

Claims 2 and 25-26 are canceled.

Support for the amendments to claim 1 can be found in paragraph 37 of the specification.

II. THE 35 U.S.C. 101 REJECTIONS

Claims 1, 3-24, and 27-53 are rejected under 35 U.S.C. 101 because the claimed inventions are directed to a judicial exception (i.e., a law of nature, a natural phenomenon, or an abstract idea) without significantly more.

The Examiner states, in the Final Office Action, that "the claims are directed to the judicial exception of **mathematical relationship and/ or ideas.**" Applicants respectfully state that the claims are directed to methods and systems for physiological parameter monitoring, where the claims further states that the physiological parameter is a parameters such as blood loss, oxygen saturation heart rate variability, atrial fibrillation and others.

Applicants, in providing a rebuttal to the examiner's arguments, follow the argument presented by the Patent Trial and Appeals Board (PTAB) in ex parte Wegman (appeal 2013-008168, Application 12/765954, September 22, 2015).

Claim 1 is directed to a methods for physiological parameter monitoring, where the physiological parameter is a parameters such as blood loss, oxygen saturation heart rate variability, atrial fibrillation and others. The method starts by providing a physiological indicator signal to a handheld communication device. Measurements of one or more physiological parameters are obtained from the physiological indicator signal. In order to make a handheld

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mobile communication device useful in monitoring physiological parameters, the method proceeds to determine whether motion artifacts are present in the measurements in order to retain only those measurements where motion artifacts are not present. In determining the presence of motion artifacts, the method uses Shannon entropy as an indicator of motion artifacts. Following the PTAB analysis in Ex Parte Wegman, claim 1 is directed to a method, one of the four statutory categories. We then move to determine whether the claim is directed to an abstract idea. *Alice* provides several broad examples of what might constitute an "abstract idea," including: (1) fundamental economic practices; (2) certain methods of organizing human activities; (3) "an idea of itself"; and (4) mathematical relationships or formulae. *Id.* (citing *Alice,* 134 S.Ct. at 2350; 2356; 2350; 2350). Although by no means exhaustive, these examples provide a broad outline within which to frame our analysis.

Applicants respectfully state that claim 1 is more specific than the abstract idea of the mathematical relationship known as the Shannon entropy. One application of the method of claim 1 and the system using the method is the use of a handheld mobile communication device, such as a smart phone, for physiological parameter monitoring, enabling monitoring physiological parameters at a remote location, such as the home of the patient. Claim 1 is more specific than the abstract idea of the Shannon entropy. Nothing in the steps of claim 1 can be considered routine are conventional in terms of the fundamental abstract idea of the Shannon entropy. Applicants respectfully state that the steps are sufficiently concrete to set them outside the broad definition of abstract idea as set forth in *Alice*. Applicants respectfully state that claim 1 is not directed to an abstract idea.

Assuming, for argument sake, that claim 1 is directed to an abstract idea, applicants present further arguments herein below.

For the second part of the *Alice* analysis, we follow the PTAB decision in Ex Parte Weber (appeal 2012-003904, Application 10/554334, October 10, 2014) and the PTAB decision in Ex Parte Schmid (appeal 2012-002155, Application 11/820634, December 26, 2014). As in Ex Parte Weber, the Applicants' claims are comparable to those in *Diamond v Diehr* (U.S. Patent No. 4,344,142), example 3 in section III of USPTO's 2014 Interim Eligibility Guidance", issued on December 16, 2014, 79 FR 74618. In Diamond v Diehr, the claim included the use of the Arrhenius equation, a known mathematical relationship, in a process for molding rubber into

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precision products. In the Applicants' claimed invention, a method and systems for physiological parameter monitoring are recited, including acquiring a physiological indicator signal, analyzing the signal and obtaining, from the analysis, measurements of a physiological parameter, such as heart rate, heart rate variability, respiratory rate, oxygen saturation, blood loss, and atrial fibrillation, and detecting motion artifacts in the measurements using the Shannon entropy of the preprocessed segment of the measurement of the one physiological parameter, where the segment is included in the analysis if motion artifacts are not present.

As in Diehr, analyzing the claim as a whole, the specifically disclosed and claimed analysis of the physiological indicator signal and obtaining, from the analysis, measurements of one or more physiological parameters are additional elements that provide "something more" than mere computer implementation of calculation of the Shannon entropy. Further, the claimed steps act in concert to transform the physiological indicator signal into measurement of one or more physiological parameters. The combination of steps recited in addition are used in determining the health status of a subject. The combination of steps recited in addition to the mathematical formula show that the claim is not to the formula in isolation, but rather that the steps impose meaningful limits that apply the formula to improve an existing technological process, the measurement of heart rate, heart rate variability, respiratory rate, oxygen saturation, blood loss, and atrial fibrillation.

As in Ex Parte Weber, claim 1 recites method steps related to obtaining, from the analysis, measurements of one or more physiological parameters. Although the claim incorporates abstract ideas such as use of the Shannon entropy, much like the invention in *Diehr,* the claim is directed toward improving the underlying technical process of obtaining measurements of one or more physiological parameters. Therefore, the claim amounts to significantly more than the abstract idea itself. The claim is eligible subject matter.

As in Ex Parte Schmid, Applicants also respectfully state that the claimed invention does not preempt others from applying the concept of Shannon entropy. The concept of Shannon entropy has been applied in communications, where it originated (see, for example, Without Shannon's information theory there would have been no internet, The Guardian, June 22, 2014, http://www.theguardian.com/science/2014/jun/22/shannon-information-theory , provided in the Appendix) , in the identification of putative drug targets (see The application of Shannon entropy

in the identification of putative drug targets, BioSystems 55 (2000) 5–14), in quantifying the quality of mixing in various systems, including polymeric ones (see Quantifying Fluid Mixing with the Shannon Entropy, Macromolecular Theory and Simulations, Volume 15, Issue 8, pages 595–607, October 11, 200, both of which are provided in the Appendix) and in a number of other applications. In the method of clam 1, the use of Shannon entropy is tied to the determination of whether the effects of motion artifacts are present in the measurement of the physiological parameter. Because the rejected claims are limited to the use of Shannon entropy in the determination of whether the effects of motion artifacts are present in the measurement of the physiological parameters, the claims do not preclude a number of other methods of using the Shannon entropy. Accordingly, the claims include "additional features" that ensure the claims are "more than a drafting effort designed to monopolize the [abstract idea]." *Alice*, 134 S. Ct. at 2357. The claim recites eligible subject matter.

Applicants respectfully state that, as in Wegman, Weber and Schmid, 1, 3-24, and 27-53 recite patentable subject matter

III. THE 35 U.S.C. 103 REJECTIONS

Claims 1, 3-5, 8-9, 24, 27-29, 33-34, and 44 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Greco et al., "Kurtosis, Renyi's Entropy and Independent Component Scalp Maps for the Automatic Artifact Rejection from EEG data". International Journal of Computer, Information, Systems and Control Engineering 2(9), January 2008: 180-184 — cited by applicant) in view of Lichter et al. (USPN 6,159,147 — cited in previous action).

The Examiner, in the Final office Action, states that "In regard to claims 1, 3-5, 24, 27-29 and 44, Greco discloses a method and an apparatus for physiological parameter monitoring (abstract and associated descriptions), the method comprising: providing a physiological indicator signal (electric signals, Fig. 1 and associated descriptions in page 203) obtained from a physiological indicator signal sensing component (EEG sensors and a recording machine, Fig. 1 and associated descriptions in page 203) to a device (EEGLAB, pages 206 and 207; it is inherently that the downloaded program is executed by a computer); analyzing, using the device, the physiological indicator signal (amplifier, page 203 and Sec. IV, page 206); obtaining, from said analyzing, measurements of one or more physiological parameters (EEG signals and

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associated independent components/ ICs in page 206); and detecting, using the device and using only the measurements of the one or more physiological parameters (ICs in the detected EEG signals pages 205-206), effects of motion artifacts in the measurements of the one or more physiological parameters (first paragraph in the right column of page 203; Sec. IV on page 206) and deciding whether to retain the measurements based on detected effects of motion artifacts (reject an IC, Sec. IV on page 206), wherein the step of detecting effects of motion artifacts in the measurements comprises: a. preprocessing a segment from the measurement of one physiological parameter (remove noise, Sec. IV on page 206); b. obtaining a value of at least one indicator of volatility for the preprocessed segment; the at least one indicator of volatility being at least one of kurtosis and Shannon entropy for the preprocessed segment (kurtosis and Shannon entropy, Sec. III, A and B, pages 205-206).

Applicants respectfully state that examining Greco, Greco sets out to determine whether Shannon entropy is a good measure of volatility and finds that using Shannon entropy a number of motion artifacts are missed and suggests instead using Renji entropy as the measure of volatility ("The test showed some failures of the procedure in detecting some artifactual signals, thus we wondered whether another entropy definition could improve the performance of the method and we decided to introduce the Renyi's entropy." Greco, p. 181, left column. "Kurtosis detected IC10, **Shannon's entropy detected IC2, IC10, IC17, IC21, IC24, Renyi's entropy detected IC1, IC2, IC9, IC10, IC17, IC21, IC24**. ..." Greco, p. 183, right column. "Thus, the joint use of kurtosis and Shannon's entropy detected IC2, IC10, IC14, IC17, IC21, IC24, whereas the joint use of kurtosis and Renyi's entropy detected IC1, IC2, IC9, IC10, IC14, IC17, IC21, IC24. **IC9 was detected only by our method**... In Fig. 6, the cleaned dataset is depicted, it was reconstructed cancelling the ICs detected by the joint use of kurtosis and Renyi's entropy, the artifacts appear suppressed.", p. 184, left column.)

One skilled in the art, upon reading Greco, would be led in a direction divergent from the path that was taken by the applicant since one skilled in the art would not select an indicator of motion artifacts that misses the detection of some motion artifacts. Selecting an indicator of motion artifacts that does not detect some of the motion artifacts would result in a reconstructed data set that includes those motion artifacts. Greco criticize, discredit, or otherwise discourage one skilled in the art from using the Shannon entropy to detect motion artifacts. Therefore Greco

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teaches away from the use of Shannon entropy to detect motion artifacts. There is no teaching in Lichter that counters the teaching away in Greco.

"A reference may be said to teach away when a person of ordinary skill, upon reading the reference, ...would be led in a direction divergent from the path that was taken by the applicant." *In re Gurley*, 27 F.3d 551, 553 (Fed. Cir. 1994).

In *KSR International Co. v. Teleflex Inc.*, 127 S. Ct. 1727, 1740 (2007), the Court identified "teaching away" as a strong indicator of nonobviousness.

Since Greco teaches away from the use of Shannon entropy as an indicator of motion artifacts and Lichter does not counter this teaching away, applicants respectfully state that a prima facie case of obviousness has not been stylish for claims 1, 3-5, 8-9, 24, 27-29, 33-34, and 44.

Claims 6 and 30 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over the combination of Greco and Lichter as applied to claims 1 and 24 above, and further in view of Maier et al. (USPGPUB 2006/0253261 -cited in previous action).

Claim 6 is dependent on claim 1 and claim 30 is dependent on claim 24.

As stated above, Greco teaches away from the use of Shannon entropy as an indicator of motion artifacts and Lichter does not counter this teaching away. Applicant respectfully state that Maier also does not correct Greco's teaching away from the use of Shannon entropy.

Applicants respectfully state that a *prima facie* case of obviousness has not been established for claim 6 and claim 30.

Claims 7 and 31-32 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over the combination of Greco and Lichter as applied to claims 1 and 24 above, and further in view of Jacobsen et al. (USPN 6,198,394 — cited in previous action).

Claim 7 depends on claim 1 and claims 31-32 depend on claim 24.

As stated above, Greco teaches away from the use of Shannon entropy as an indicator of motion artifacts and Lichter does not counter this teaching away. Applicant respectfully state that Jacobsen also does not does not correct Greco's teaching away from the use of Shannon entropy.

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Applicants respectfully state that a *prima facie* case of obviousness has not been established for claims 7 and 31-32.

Claim 18 is rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over the combination of Greco and Lichter as applied to claim 1 above, and further in view of Zhang (USPGPUB 2009/0112110 — cited in previous action).

Claim 18 is dependent on claim 1.

As stated above, Greco teaches away from the use of Shannon entropy as an indicator of motion artifacts and Lichter does not counter this teaching away. Applicant respectfully state that Zhang also does not does not correct Greco's teaching away from the use of Shannon entropy.

Applicants respectfully state that a *prima facie* case of obviousness has not been established for claim 18.

IV. DOUBLE PATENTING

Claims 19-23, 39-43, 49-53 are rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1-16 of U.S. Patent No. 8,755,876 in view of Greco and Lichter.

While Applicants are not opposed to filing a terminal disclaimer, Applicants respectfully state that nonstatutory obviousness double patenting requires a prima facie case of obviousness. U.S. Patent No. 8,755,876 only claims the detection of atrial fibrillation while claim 19 recites "detecting, using the handheld mobile communication device and using **only** the measurements of one or more physiological parameters, effects of motion artifacts in the measurements of the one or more physiological parameters and deciding whether to retain the measurements based on effects of motion artifacts in the measurements." Claims 39 and 49 also recite detecting, using the handheld mobile communication device and using **only** the measurements of one or more physiological parameters, effects of motion artifacts. Greco teaches performing Independent Component Analysis on the preprocessed data in order to obtain independent components and obtaining a value of at least one indicator of volatility for the **independent component in** order to detect motion artifacts. Applicants respectfully state that Greco does not teach or suggest

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using **only** the measurements of one or more physiological parameters to detect the effect of motion artifacts and neither does Lichter. Applicants respectfully state that a *prima facie* case of obviousness has not been established for 19-23, 39-43, 49-53 and nonstatutory obviousness double patenting is not proper.

V. CONCLUSION

Any amendments to the claims as set forth herein, including the modification, addition, cancellation, or withdrawal of any claims, have been offered to advance this application to issue. None of the amendments made herein should be construed as an admission that the subject matter of the claims, as originally filed, is anticipated by or made obvious in light of any art of record whether considered singularly or in combinations. Applicants expressly reserve the right to pursue the originally filed claims in another co-pending application without being prejudiced by any amendments, including cancellation of claims, made herein.

The Director of Patents and Trademarks is hereby authorized to charge any underpayment of fees, or credit any overpayments, to Deposit Account 03-2410 (Order No. 30210-201).

The following information is presented in the event that a call may be deemed desirable by the Examiner:

ORLANDO LOPEZ (617) 345-3000.

Respectfully submitted,

Dated: October 19, 2015

By: /Orlando Lopez/
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APPENDIX

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theguardian

Without Shannon's information theory there would have been no internet

It showed how to make communications faster and take up less space on a hard disk, making the internet possible

Alok Jha

Sunday 22 June 2014 03.00 EDT

This equation was published in the 1949 book *The Mathematical Theory of Communication*, co-written by Claude Shannon and Warren Weaver. An elegant way to work out how efficient a code could be, it turned "information" from a vague word related to how much someone knew about something into a precise mathematical unit that could be measured, manipulated and transmitted. It was the start of the science of "information theory", a set of ideas that has allowed us to build the internet, digital computers and telecommunications systems. When anyone talks about the information revolution of the last few decades, it is Shannon's idea of information that they are talking about.

Claude Shannon was a mathematician and electronic engineer working at Bell Labs in the US in the middle of the 20th century. His workplace was the celebrated research and development arm of the Bell Telephone Company, the US's main provider of telephone services until the 1980s when it was broken up because of its monopolistic position. During the second world war, Shannon worked on codes and methods of sending messages efficiently and securely over long distances, ideas that became the seeds for his information theory.

Before information theory, remote communication was done using analogue signals. Sending a message involved turning it into varying pulses of voltage along a wire, which could be measured at the other end and interpreted back into words. This is generally fine for short distances but, if you want to send something across an ocean, it becomes unusable. Every metre that an analogue electrical signal travels along a wire, it gets weaker and suffers more from random fluctuations, known as noise, in the materials around it. You could boost the signal at the outset, of course, but this will have the unwanted effect of also boosting the noise.

Information theory helped to get over this problem. In it, Shannon defined the units of information, the smallest possible chunks that cannot be divided any further, into what he called "bits" (short for binary digit), strings of which can be used to encode any message. The most widely used digital code in modern electronics is based around bits that can each have only one of two values: 0 or 1.

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This simple idea immediately improves the quality of communications. Convert your message, letter by letter, into a code made from 0s and 1s, then send this long string of digits down a wire – every 0 represented by a brief low-voltage signal and every 1 represented by a brief burst of high voltage. These signals will, of course, suffer from the same problems as an analogue signal, namely weakening and noise. But the digital signal has an advantage: the 0s and 1s are such obviously different states that, even after deterioration, their original state can be reconstructed far down the wire. An additional way to keep the digital message clean is to read it, using electronic devices, at intervals along its route and resend a clean repeat.

Shannon showed the true power of these bits, however, by putting them into a mathematical framework. His equation defines a quantity, H, which is known as Shannon entropy and can be thought of as a measure of the information in a message, measured in bits.

In a message, the probability of a particular symbol (represented by "x") turning up is denoted by p(x). The right hand side of the equation above sums up the probabilities of the full range of symbols that might turn up in a message, weighted by the number of bits needed to represent that value of x, a term given by $\log p(x)$. (A logarithm is the reverse process of raising something to a power – we say that the logarithm of 1000 to base 10 – written $\log_{10}(1000)$ – is 3, because $10^3=1000$.)

A coin toss, for example, has two possible outcomes (or symbols) – x could be heads or tails. Each outcome has a 50% probability of occurring and, in this instance, p(heads) and p(tails) are each ½. Shannon's theory uses base 2 for its logarithms and $\log_2(½)$ is -1. That gives us a total information content in flipping a coin, a value for H, of 1 bit. Once a coin toss has been completed, we have gained one bit of information or, rather, reduced our uncertainty by one bit.

A single character taken from an alphabet of 27 has around 4.76 bits of information – in other words $\log_2(1/27)$ – because each character either is or is not a particular letter of that alphabet. Because there are 27 of these binary possibilities, the probability of each is 1/27. This is a basic description of a basic English alphabet (26 characters and a space), if each character was equally likely to turn up in a message. By this calculation, messages in English need bandwidth for storage or transmission equal to the number of characters multiplied by 4.76.

But we know that, in English, each character does not appear equally. A "u" usually follows a "q" and "e" is more common than "z". Take these statistical details into account and it is possible to reduce the H value for English characters to less than one bit. Which is useful if you want to speed up comms or take up less space on a hard disk.

Information theory was created to find practical ways to make better, more efficient codes and find the limits on how fast computers could process digital signals. Every piece of digital information is the result of codes that have been examined and improved using Shannon's equation. It has provided the mathematical underpinning for increased data storage and compression – Zip files, MP3s and

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JPGs could not exist without it. And none of those high-definition videos online would have been possible without Shannon's mathematics.

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Feature Article

Quantifying Fluid Mixing with the Shannon Entropy

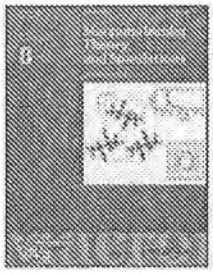
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Macromolecular Theory and Simulations

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Additional Information

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- Abstract
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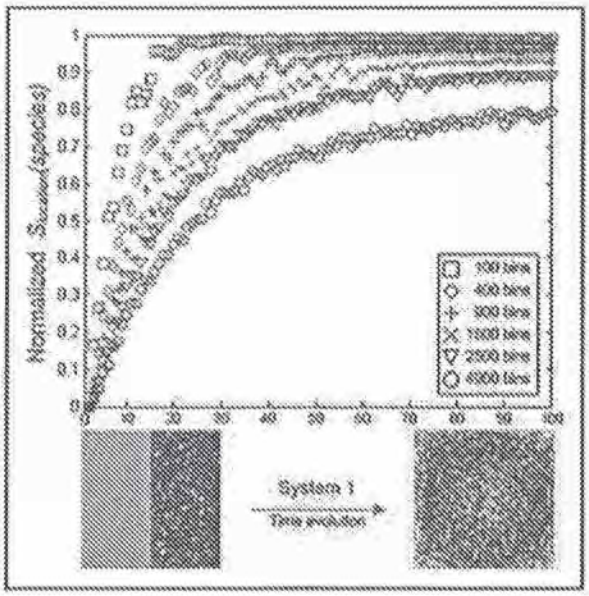
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Keywords:

entropy; mixing; numerical simulations; polymer processing

Abstract

Summary: We introduce a methodology to quantify the quality of mixing in various systems, including polymeric ones, by adapting the Shannon information entropy. For illustrative purposes we use particle advection of two species in a two-dimensional cavity flow.



We compute the entropy by using the probability of finding a suitable chosen group/complex of particles of a given species, at a given location. By choosing the size of the group to be in direct proportion to the overall concentration of the components in the mixture we ensure that the entropic measure is maximized for the case of perfect mixing, that is, when at each location the component concentration is equal to the corresponding overall component concentrations. The scale of observation role in evaluating mixing is analyzed using the entropic methodology. We also illustrate the effect of initial conditions on mixing in a laminar system, typical in operations involving polymers.

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The application of Shannon entropy in the identification of putative drug targets

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Abstract

A major challenge in the field of functional genomics is the development of computational techniques for organizing and interpreting large amounts of gene expression data. These methods will be critical for the discovery of new therapeutic drug targets. Here, we present a simple method for determining the most likely drug target candidates from temporal gene expression patterns assayed with reverse-transcription polymerase chain reaction (RT-PCR) and DNA microarrays. © 2000 Elsevier Science Ireland Ltd. All rights reserved.

Keywords: Information theory; Microarrays; PCR; Drug development; Gene expression; Genomics

1. Introduction

The collection of large-scale gene expression data using DNA microarrays (Shalon et al., 1996), serial analysis of gene expression (SAGE; Velculescu et al., 1995), robotic reverse-transcription polymerase chain reaction (RT-PCR), and EST databases such as LifeSeq® database (Incyte Pharmaceuticals), offers a wealth of opportunities for the discovery of new therapeutic drug targets. Traditionally, biologists have focused their efforts on individual genes that demonstrate a single change in expression from the normal to the diseased state. We are now faced with the challenge of determining the biological significance of thousands of genes, all of which vary in expression over time to some extent. The interpretation of large-scale gene expression data will require sophisticated analytical techniques for selecting good drug target candidates from among tens of thousands of expression patterns. It could be argued that all genes — an estimated 100 000–150 000 in humans — are potential drug targets, since even genes that are expected to maintain constant expression levels show variations in these levels over time (Wen et al., 1998). Narrowing the field of candidate drug targets will therefore be critical for increasing the efficiency of the drug development process. Here, the use of Shannon entropy (Shannon and Weaver, 1963) is proposed as a method for selecting the most likely drug target candidates from among thousands of genes assayed in parallel.

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Shannon entropy (H) is a measure of the information content or complexity of a measurement series. It was originally developed by Claude Shannon for use in communications technology (series of signaling events in telegraphy; Shannon and Weaver, 1963). In the present case, H may be applied to temporal or anatomical gene expression patterns (Fig. 1). H provides a measure of the information contained in a gene's expression pattern over time, or across anatomical regions, and therefore indicates the amount of information carried by that gene during a disease process or during normal phenotypic change. By definition, entropy measures variation or change in a series of events; unchanging patterns — such as genes with no diversity of expression levels — have zero entropy, or zero information. Genes that are expressed at more than one level, on the other hand, have greater than zero entropy, and therefore contain information about phenotypic change (Fig. 1). It follows that the genes with highest entropy are the biggest participants in a disease process, and therefore, the best drug target candidates.

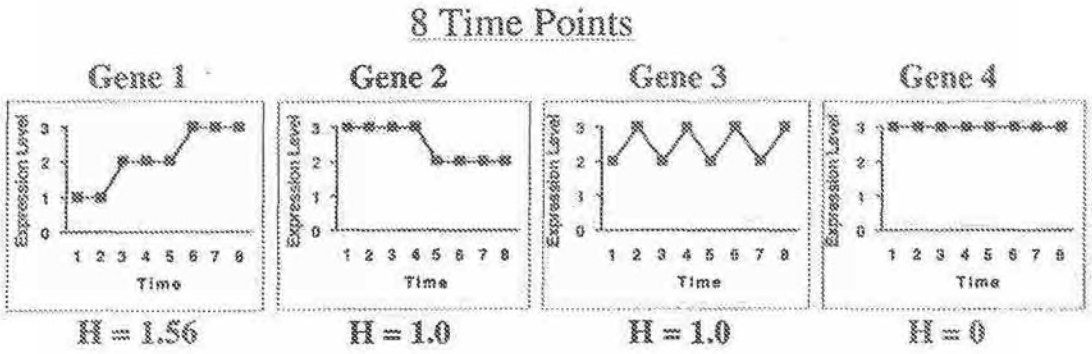


Fig. 1. Hypothetical gene expression patterns are shown. Upper panel: for temporal gene expression patterns, three expression level bins may be used for eight time points. Gene 1 has the maximum possible entropy (H), with its efficient distribution of expression levels over the time course. Gene 4 is unchanging in expression and has zero entropy. (Not shown: a spike pattern, such as seven points at level one and one point at level 3, has a low entropy since most of the pattern is invariant.) Genes 2 and 3 are expressed at only two of the three levels, so their entropy values are sub-maximal; they have the same entropy because the position of an expression level is not relevant to the complexity of the pattern. Lower panel: each grid represents an anatomical map, as in the case of the brain with its many anatomical regions. Gene expression levels can be binned (four bins for 16 regions), and the complexity of the anatomical pattern for each gene can be calculated. Gene A has the highest diversity of expression possible over the 16 regions, and therefore has the maximum possible entropy. Gene C has no diversity of expression, occurring at the same level in all 16 regions, and therefore has an entropy of zero; this may be interpreted to mean that gene C does not contribute to the complexity of brain anatomy. However, anatomical patterns should be combined with time series to account for changes induced by normal development, aging, disease, or injury.

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Although molecular biologists are accustomed to using change in gene expression as an indicator of physiological relevance, they have traditionally done so one gene at a time and without a formal definition of change. Measures used have included the quantification of a single increase or decrease in expression from normal to diseased, and non-quantitative descriptions of time series or anatomical patterns, among others. Shannon entropy, unlike these traditional measures, quantifies the information content of gene expression patterns over entire time courses or anatomical areas. This provides a more complete measure of each gene's participation in a disease process, and permits a rank ordering by physiological relevance.

This paper demonstrates the application of Shannon entropy to actual large-scale temporal gene expression data, and explains how results such as these may be used in the discovery of new therapeutic drugs.

2. Methods

RT-PCR was used to assay mRNA levels of 112 genes at nine stages of rat spinal cord development (Wen et al., 1998). Triplicate animals were used for embryonic day 11 (E11), E13, E15, E18, E21, postnatal day 0 (P0), P7, P14, and P90 (adult). Gene expression levels were determined relative to a control at each time point. The control, a plasmid-derived RNA, was reverse transcribed and amplified with each PCR sample. After resolving the PCR products with polyacrylamide gel electrophoresis (PAGE), the ratio of each sample to control band was used as a measure of relative gene expression. Data from triplicate animals were then averaged, and the average used as the gene expression level at each time point. For each gene, expression levels were normalized to maximal expression in the time series for that gene. Entropy was calculated for each of the 112 normalized temporal expression patterns, using the definition, $H = -\Sigma\, p_i \log_2 p_i$, where p is the probability (frequency) of occurrence of a level of gene expression, i. Gene expression was binned into three levels for this calculation (see Section 4 and the caption for Table 1 for explanation).

Gene expression microarrays (GEM™ microarrays) at Incyte Pharmaceuticals were used to assay relative gene expression levels of 7400 rat genes over a time series. For each experiment, one of three compounds was administered to male rats (triplicate animals), i.p., in doses known to cause toxicity: benzo(a)pyrene, clofibrate, and acetaminophen. Rats were sacrificed at six intervals (12 h, 24 h, 3 days, 7 days, 14 days, and 28 days; there are only five time points for clofibrate, since the 14-day rat did not survive the treatment) and their livers snap frozen in liquid nitrogen. Total RNA was isolated by the Trizol procedure (Life Technologies, Gaithersburg, MD), and polyA mRNA was selected and purified from total RNA by the OligoTex method (Qiagen, Valencia, CA). The mRNA was then assayed using microarrays, with one microarray per time point. The same control animal (treated with dimethyl sulfoxide (DMSO) vehicle, sacrificed after 12 h) was used on all microarrays for comparison with hepatotoxin-treated animals. cDNAs made from sample mRNAs were labeled with fluorescent tags: Cy5 for toxin-treated, and Cy3 for control. Competitive hybridization of the two sets of cDNA for DNA probes spotted on microarrays resulted in color differences based on the ratio of Cy5 to Cy3 at each spot. For each gene represented by a probe on the microarray, the relative expression level of toxin-treated to control was then determined. Entropy analysis included only one rat per hepatotoxin treatment, and only those genes that have a known function and were expressed in all three hepatotoxin treatments (approx. 1000 genes). For each gene, expression levels were normalized to the maximal expression in the time series for that gene. Entropy was then calculated for each of the 1000 temporal expression patterns, as described above for the PCR data, except that only two bins were used.

3. Results

Entropy values calculated for genes expressed in spinal cord (Table 1) reveal that certain recognized functional categories are over-represented at the highest entropy levels. As shown in Fig. 2(A),

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Table 1
Entropy for genes expressed in the developing rat spinal cord[a]

Gene	Category	H	Gene	Category	H
Gamma aminobutyric acid receptor alpha4	iNT	1.585	Midkine 2	Peptide signaling	1.352
Nicotinic acetylcholine receptor alpha4	iNT	1.585	Nicotinic acetylcholine receptor alpha5	NT	1.352
N-methyl-D-aspartate receptor 2D	iNT	1.585	Nestin	Neuroglial markers	1.352
SC7 (novel/EST)	Diverse	1.585	Platelet-derived growth factor beta	Peptide signaling	1.352
5HT1B (serotonin receptor)	mNT	1.53	Platelet-derived growth factor receptor	Peptide signaling	1.352
5HT2 (serotonin receptor)	mNT	1.53	SC1 (novel/EST)	Diverse	1.352
Ciliary neurotrophic factor	Peptide signaling	1.53	G67186 (GAD67 splice variant)	Neuroglial markers	1.224
CyclinB	Diverse	1.53	Gamma aminobutyric acid receptor alpha2	iNT	1.224
Epidermal growth factor	Peptide signaling	1.53	Gamma aminobutyric acid receptor alpha3	iNT	1.224
Epidermal growth factor receptor	Peptide signaling	1.53	Gamma aminobutyric acid receptor alpha5	iNT	1.224
Glutamate decarboxylase 65 (GAD65)	NME	1.53	Gamma aminobutyric acid receptor beta3	iNT	1.224
Glutamate decarboxylase 67 (GAD67)	NME	1.53	Insulin Receptor	Peptide signaling	1.224
Gamma aminobutyric acid receptor gamma2	iNTR	1.53	Nicotinic acetylcholine receptor alpha3	iNT	1.224
Insulin-like growth factor receptor 2	Peptide signaling	1.53	Nerve growth factor	Peptide signaling	1.224
Inositol trisphosphate receptor 3	Diverse	1.53	Nitric oxide synthase	NME	1.224
Neural cell adhesion molecule	Neuroglial markers	1.53	Statin	Diverse	1.224
Metabotropic glutamate receptor 2	mNT	1.53	trkB (a neurotrophin receptor)	Peptide signaling	1.224
Metabotropic glutamate receptor 4	mNT	1.53	Brain-derived neurotrophic factor	Peptide signaling	0.991
Metabotropic glutamate receptor 5	mNT	1.53	Cytochrome C oxidase subunit 2	Diverse	0.991
Metabotropic glutamate receptor 6	mNT	1.53	Inositol trisphosphate receptor 1	Diverse	0.991
Metabotropic glutamate receptor 8	mNT	1.53	Inositol trisphosphate receptor 2	Diverse	0.991
Nicotinic acetylcholine receptor alpha2	iNT	1.53	SC2 (novel/EST)	Diverse	0.991
N-methyl-D-aspartate receptor 1	iNT	1.53	Superoxide dismutase	Diverse	0.991
Acidic fibroblast growth factor	Peptide signaling	1.53	cjun	Diverse	0.986
Choline acetyltransferase	NME	1.53	Keratin	Neuroglial markers	0.986
G6718086 (GAD67 splice variant)	NME	1.53	Metabotropic glutamate receptor 1	mNT	0.986
Glial-derived neurotrophic factor	Peptide signaling	1.53	Nicotinic acetylcholine receptor delta	iNT	0.986
Gamma aminobutyric acid receptor gamma1	iNT	1.53	Neuron-specific enolase	Neuroglial markers	0.986
Muscarinic acetylcholine receptor 3	mNT	1.53	Neurofilament medium	Neuroglial markers	0.986
Neurofilament heavy	Neuroglial markers	1.53	*N*-methyl-D-aspartate receptor 2A	iNT	0.986
N-methyl-D-aspartate receptor 2C	iNT	1.53	trkC (a neurotrophin receptor)	Peptide signaling	0.986

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Table 1 (*Continued*)

Gene	Category	*H*	Gene	Category	*H*
NT3 (a neurotrophin)	Peptide signaling	1.53	Insulin 2	Peptide signaling	0.918
S100beta	Neuroglial markers	1.53	Myelin oligodendrocyte glycoprotein	Neuroglial markers	0.918
Tyrosine hydroxylase	NME	1.53	Transforming growth factor receptor	Peptide signaling	0.918
Acetylcholinesterase	NME	1.436	CRAF	Diverse	0.764
Brahma (transcription factor)	Diverse	1.436	CyclinA	Diverse	0.764
Gamma aminobutyric acid receptor gamma3	iNT	1.436	DD63.2 (novel/EST)	Diverse	0.764
Metabotropic glutamate receptor 3	mNT	1.436	Growth-associated protein 43	Neuroglial markers	0.764
Nicotinic acetylcholine receptor alpha7	iNT	1.436	GABA transporter 1	NME	0.764
Neurofilament light	Neuroglial markers	1.436	Insulin-like growth factor receptor 1	Peptide signaling	0.764
N-methyl-D-aspartate receptor 2B	iNT	1.436	Microtubule-associated protein	Neuroglial markers	0.764
Synaptophysin	Neuroglial markers	1.436	Ornithine decarboxylase	NME	0.764
5HT3 (serotonin receptor)	iNT	1.392	PreGAD67	NME	0.764
Basic fibroblast growth factor	Peptide signaling	1.392	SC6 (novel/EST)	Diverse	0.764
Cellubrevin	Neuroglial markers	1.392	Cytochrome C oxidase subunit 1	Diverse	0.503
cfos	Diverse	1.392	Fibroblast growth factor receptor	Peptide signaling	0.503
Insulin-like growth factor 2	Peptide signaling	1.392	Insulin 1	Peptide signaling	0.503
Muscarinic acetylcholine receptor 4	mNT	1.392	Nicotinic acetylcholine receptor epsilon	iNT	0.503
Nicotinic acetylcholine receptor alpha6	iNT	1.392	Piciotrophin	Peptide signaling	0.503
5HT1C (serotonin receptor)	mNT	1.352	trk (a neurotrophin receptor)	Peptide signaling	0.503
Glial fibrillary acidic protein	Neuroglial markers	1.352	Actin	Diverse	0
Gamma aminobutyric acid receptor alpha1	iNT	1.352	Ciliary neurotrophic factor receptor	Peptide signaling	0
Gamma aminobutyric acid receptor beta1	iNT	1.352	H2AZ (a histone)	Diverse	0
Gamma aminobutyric acid receptor beta2	iNT	1.352	Insulin-like growth factor 1	Peptide signaling	0
Muscarinic acetylcholine receptor 2	mNT	1.352	Platelet-derived growth factor alpha	Peptide signaling	0
Metabotropic glutamate receptor 7	mNT	1.352	T-complex protein (transcription factor)	Diverse	0

[a] Shannon entropy for 112 genes expressed in rat spinal cord for developmental stages ranging from embryonic day 11 to adult (postnatal day 90). Normalized time series data were grouped into three mRNA expression levels or bins: bin 1 < 0.34; bin 2 ranges from 0.34 to 0.66; bin 3 ranges from 0.67 to 1.00. (See Wen et al., 1998 for normalized data and http://rsb.info.nih.gov/mol-physiol/PNAS/GEMtable.html for raw data.) Entropy (H) was then calculated for each gene using the definition $H = -\Sigma\, p_i \log_2 p_i$, where p is the frequency of a gene expression level, i, for the time series. H is expressed in bits. Abbreviations: iNT, ionotropic neurotransmitter receptors; mNT, metabotropic neurotransmitter receptors; NME, neurotransmitter metabolizing enzymes.

the ionotropic neurotransmitter receptors are concentrated at the highest entropy level (1.585 bits), with almost 3.5-fold as many as were expected. (This particular class of genes represents 22% of the total assay, but 75% of genes with an entropy of 1.585 bits.) At the next highest entropy value,

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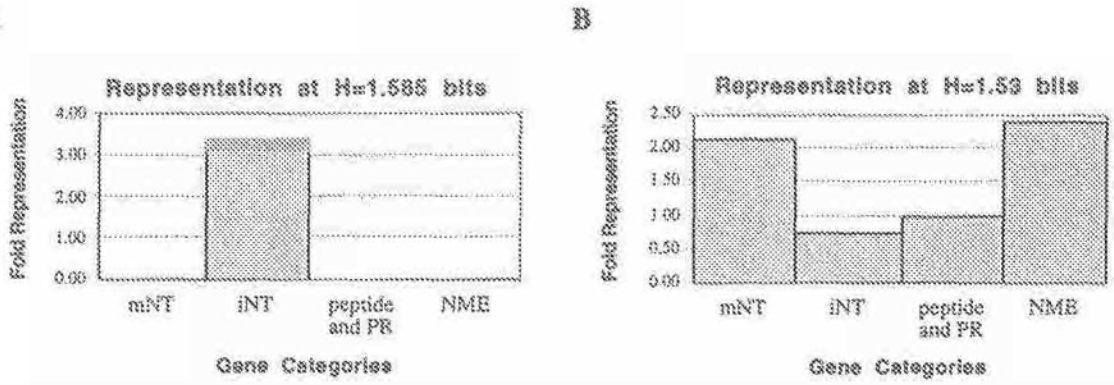


Fig. 2. Representation of functional categories at high entropy in rat spinal cord development. (A) At 1.585 bits of entropy, ionotropic neurotransmitter receptors (iNT) are represented at more than three times the expected frequency, while metabotropic neurotransmitter receptors (mNT), peptides and peptide receptors (peptide and PR), and neurotransmitter metabolizing enzymes (NME) are not represented at all. (B) At 1.53 bits, the next highest entropy value, mNT and NME occur at more than two-fold their expected frequencies, while peptide and PR are found in the same relative abundance as in the total assay, and iNT are somewhat under-represented.

Table 2
Functional category representation at different levels of entropy in developing rat spinal cord[a]

	Entropy (bits)										
	1.585	1.53	1.436	1.392	1.352	1.224	0.991	0.986	0.918	0.764	0.503	0
mNT	–	0.27	0.13	0.14	0.23	–	–	0.13	–	–	–	–
iNT	0.75	0.17	0.38	0.29	0.31	0.45	–	0.25	–	–	0.17	–
Peptide or PR	–	0.23	–	0.29	0.23	0.27	0.17	0.13	0.67	0.10	0.67	0.50
NME	–	0.17	0.13	–	–	0.18	–	–	–	0.30	–	–

[a] Proportion of every entropy level occupied by different functional categories of genes in spinal cord development. Totals do not equal 1 because only the four largest functional categories are included in the table: mNT, metabotropic neurotransmitter receptors (G protein-coupled receptors); iNT, ionotropic neurotransmitter receptors; peptide or PR, peptides or peptide receptors (receptor tyrosine kinases); and NME, neurotransmitter metabolizing enzymes.

1.53 bits, the metabotropic neurotransmitter receptors and neurotransmitter metabolizing enzyme genes are over-represented (Fig. 2(B)). The proportion of every entropy level occupied by different functional categories of genes is shown in Table 2. Both ionotropic and metabotropic neurotransmitter receptor genes are clearly biased toward high entropy. Conversely, peptide and peptide receptor genes are represented at expected levels at high entropy values, and over-represented at low entropy.

Similarly, entropy calculations for the toxicology data show concentrations of functional categories at the highest entropy value for all three experiments. For example, in the acetaminophen and clofibrate experiments, the flavoproteins are in 3.1- and 5.3-fold the expected proportion, respectively, at the highest entropy value. See Table 3 for more details. Most of the genes have low entropy with only 5–8% of them at the highest entropy value. In addition, the distribution of genes among the four entropy levels appears to be exponential, as shown in Fig. 3.

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4. Discussion

The application of Shannon entropy reduces the range of potential drug targets to a more manageable size. By focusing on the genes with the highest entropy in a particular disease model, limited resources may be concentrated on those shown to be the most important participants in a disease process. Results from our toxicology study suggest that very high entropy genes may represent less than 10% of the genome, and that most genes have low entropy, at least in response to toxins. Further, the observation that certain functional classes of genes are concentrated at high entropy levels may be useful in further studies, permitting a focus on the assay of more genes in those categories.

Table 3
Representation of gene functional categories at highest level of entropy in a toxicology study of rat liver[a]

Functional category	No. genes in functional category for total assay	Fold occurrence in highest entropy category in relation to expected
Benzo(a)pyrene		
Fermentation	15	4.1
Hexosyltransferases	16	5.1
Peroxisome	24	3.4
Serine endopeptidases	25	3.3
Ribosome, small subunit	28	5.1
Sterol, steroid and isoprenoid metabolism	15	5.4
With a quinone or related compound as acceptor	14	5.8
Acetaminophen		
Carboxy-lyases	15	3.4
Carboxylic ester hydrolases	15	5.0
Flavoproteins	24	3.1
Glutamate family	10	3.8
Transaminases (aminotransferases)	10	3.8
Clofibrate		
Carboxylic ester hydrolases	15	4.3
Flavoproteins	24	5.3
Glutamate family	10	6.4
Urea metabolism	13	4.9
With oxygen as acceptor	25	3.4

[a] Functional categories over-represented at high entropy in a toxicology study of rat liver. Listed are those categories found to be at least three times as prevalent at the highest entropy level as they were for the entire assay (Functional classifications are from the functional hierarchy developed at Incyte Pharmaceuticals Inc.).

Given that the high entropy list may contain as many as 500–1000 genes for an assay of 10 000, decisions must be made as to which of these would make the best targets for laboratory testing. The most practical approach to this problem is the selection of receptors for which ligands are already known. For instance, suppose that genes for a group of metabotropic receptors have high entropy in an animal model of a degenerative disease. Although these particular receptors may never have been associated with that disease before, given their high entropy it would be worth treating a set of animals with agonists or antagonists for these receptors, to determine whether there are any effects on the pathology.

The application of Shannon entropy in the analysis of mRNA patterns may be limited by the possibility of poor correlations between transcript abundance and protein activity. For example, some high entropy gene expression patterns may correspond to low entropy protein expression or protein activity patterns. In this case, the high entropy short list would be contaminated by genes that actually have low entropy in a functional sense. Instances of poor correlations between mRNA expression and protein expression have been found in yeast (Gygi et al., 1999). However, many studies have shown that transcript and protein abundance or activity are well-correlated over time series and anatomical regions, as in the cases of opiate receptor distribution (George et al., 1994), lipoprotein lipase activity (Uchida et al., 1995) and adenosine receptor expression (Matherne et al., 1996).

Another possible source of false high entropy values is the problem of binning artifacts caused by data points that lie close to, and on either side of, bin boundaries. This problem, which dimin-

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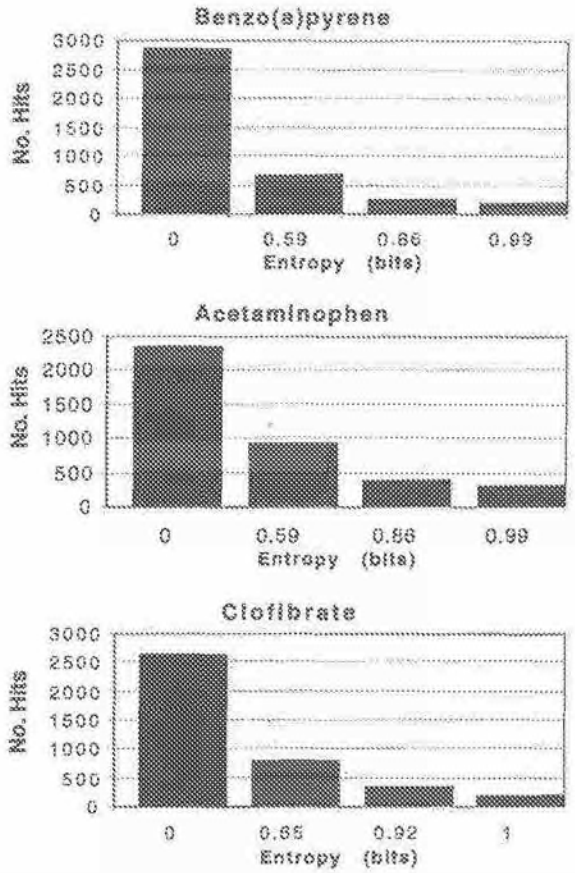


Fig. 3. Histograms of functional categories occurring at different entropy values in rat liver toxicology study. Most of the gene expression patterns exhibit low entropy, regardless of toxin administered (benzo(a)pyrene, acetaminophen, or clofibrate). Since each gene falls under a number of functional categories, the total number of 'hits' is about 4000 (four times the number of genes). Entropy was calculated based on seven time points for benzo(a)pyrene and acetaminophen, and six time points for clofibrate; this includes the 'zero' time point (DMSO control).

ishes with higher bin numbers, can be rectified by graphing the expression patterns of the final short list of drug target candidates and eliminating low entropy genes by visual inspection.

Other limitations are less important, since they introduce error on the side of low entropy. This includes proteins that are regulated by post-transcriptional or post-translational events, such as phosphorylation, regardless of changes in transcript abundance. Another example is the case of genes that show little variation in expression, but could, by some unknown pathway, have an effect on the disease if perturbed. False low entropy values may be obtained for genes that fluctuate over unexpectedly short time intervals, and for those that have a single, large measurement error such as a very high or very low expression value in a time series or anatomical survey. In addition, some targets will be missed if they initiate the disease process with a single spike. These examples would not interfere with the use of the high entropy list, however. Given an estimated 100 000 or more human genes, it makes sense to concentrate limited resources on those that are 'likely' participants in disease development — the high entropy genes.

To further illustrate the appropriateness of entropy as a measure of biological complexity, it may be worthwhile to consider another possible measure of gene expression patterns, such as the variance. At the Santa Fe Institute, it was demonstrated that, for statistical reasons, the number of bins used in entropy calculations should be less than or equal to the log of the number of events (Bruce Sawhill, personal communication). Therefore, in the case of patterns with fewer than eight time points or anatomical regions, expression levels can be binned into no more than two levels. In this situation, the variance will produce the same rank ordering of genes as will entropy. However, in cases that allow for more than two bins, the merits of entropy become apparent. The variance places an emphasis on the actual distance between expression levels, thereby inflating the rank of certain patterns with low entropy, while reducing the rank of the most complex patterns (Fig. 4). The variance would therefore function more as a distance measure for changes between expression levels, rather than as a measure of complexity.

It could be argued, on the other hand, that expression level differences are important, and that entropy fails to account for this. However, if sampling intervals are of the appropriate size, a jump in expression from, e.g. level 1 to level 3 suggests that level 2 may not be physiologically relevant. Biological systems need time to respond to a change in gene expression, and sampling intervals should be selected based on knowledge

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of the rates of response for each system. Further, entropy recognizes the most efficient distribution of expression levels. If a gene has an entropy value near the theoretical maximum, then all expression levels will occur for approximately equal time periods. For example, for three bins, a near-maximal entropy time series will be at each of the three expression levels for a significant portion of the time course. This decreases the chance that an expression level is irrelevant physiologically.

The application of entropy improves with large amounts of gene expression data. In some situations, however, it may not be economical to collect data from large numbers of time points or anatomical regions. This may be a problem in that a limited number of data points will restrict the number of entropy values. For example, in the case of seven time points and two bins, as in our toxicology study (seven includes the DMSO control or 'zero' time point), the result will be four different entropy values. It would then be possible to focus drug discovery efforts on the set of genes that have the highest of four entropy values. It is likely that given a larger number of time points, many of the genes in that highest entropy category would be spread out among a number of entropy values. Ideally, each gene assayed would have its own unique entropy, permitting a selection of the best, second best, third best, etc., from the rank-ordered list. Although this would require impossibly large amounts of data, it is appropriate to collect as many data points as possible, thereby allowing for a large number of entropy values. This will provide greater precision in selecting the best drug target candidates.

Ideally, experiments should be run in parallel with non-diseased controls that follow the same time course. This will prevent, for example, the effects of normal aging from being confused with those of a degenerative disease. Some genes may have high entropy over the course of normal aging; we can subtract the normal from the abnormal fluctuations to correct for this, before calculating entropy. In that context, we are currently conducting studies of degenerative diseases in animals. Through the use of microarrays and RT-PCR, with subsequent pharmacological studies, we will attempt to demonstrate the effectiveness of Shannon entropy as a guide to discovering new therapeutic drug targets.

7 time points, 2 bins.

							Var.	H
1	1	1	1	1	1	1	0	0
1	1	2	1	1	1	1	0.14	0.59
2	2	2	2	2	2	1	0.14	0.59
1	1	2	2	1	1	1	0.24	0.86
2	2	2	2	1	1	1	0.29	0.99

8 time points, 3 bins.

								Var.	H
3	3	3	3	3	3	2	2	0.21	0.81
3	3	1	1	1	1	1	1	0.86	0.81
3	3	2	2	2	2	3	2	0.21	0.81
1	1	1	1	3	3	3	3	1.14	1.00
2	2	2	2	3	3	3	3	0.39	1.00
1	2	3	2	1	1	1	1	0.57	1.30
3	3	3	2	2	2	1	1	0.70	1.56

Fig. 4. Entropy (H) vs variance (Var.). Upper panel: variance and entropy produce the same rank ordering of time series if only two bins are used. Lower panel: with three or more bins, entropy ranks the most complex pattern as highest (1.56), while variance places this pattern in the middle of the ranking (0.70). The two highlighted time series have the same entropy, but widely differing variances that emphasize expression level distances rather than pattern complexity.

References

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Petitioner Ex-1004, 0483

Doc Code: A.NE.AFCP
Document Description: After Final Consideration Pilot Program Request

PTO/SB/434 (05-13)

CERTIFICATION AND REQUEST FOR CONSIDERATION UNDER THE AFTER FINAL CONSIDERATION PILOT PROGRAM 2.0

Practitioner Docket No.:	Application No.:	Filing Date:
30210-201	13/354,941	January 20, 2012
First Named Inventor:	**Title:**	
Ki H. Chon	PHYSIOLOGICAL PARAMETER MONITORING WITH A MOBILE COMMUNICATION DEVICE	

APPLICANT HEREBY CERTIFIES THE FOLLOWING AND REQUESTS CONSIDERATION UNDER THE AFTER FINAL CONSIDERATION PILOT PROGRAM 2.0 (AFCP 2.0) OF THE ACCOMPANYING RESPONSE UNDER 37 CFR 1.116.

1. The above-identified application is (i) an original utility, plant, or design nonprovisional application filed under 35 U.S.C. 111(a) [a continuing application (*e.g.*, a continuation or divisional application) is filed under 35 U.S.C. 111(a) and is eligible under (i)], or (ii) an international application that has entered the national stage in compliance with 35 U.S.C. 371(c).
2. The above-identified application contains an outstanding final rejection.
3. Submitted herewith is a response under 37 CFR 1.116 to the outstanding final rejection. The response includes an amendment to at least one independent claim, and the amendment does not broaden the scope of the independent claim in any aspect.
4. This certification and request for consideration under AFCP 2.0 is the only AFCP 2.0 certification and request filed in response to the outstanding final rejection.
5. Applicant is willing and available to participate in any interview requested by the examiner concerning the present response.
6. This certification and request is being filed electronically using the Office's electronic filing system (EFS-Web).
7. Any fees that would be necessary consistent with current practice concerning responses after final rejection under 37 CFR 1.116, *e.g.*, extension of time fees, are being concurrently filed herewith. [There is no additional fee required to request consideration under AFCP 2.0.]
8. By filing this certification and request, applicant acknowledges the following:
   - Reissue applications and reexamination proceedings are not eligible to participate in AFCP 2.0.
   - The examiner will verify that the AFCP 2.0 submission is compliant, *i.e.*, that the requirements of the program have been met (see items 1 to 7 above). For compliant submissions:
     - The examiner will review the response under 37 CFR 1.116 to determine if additional search and/or consideration (i) is necessitated by the amendment and (ii) could be completed within the time allotted under AFCP 2.0. If additional search and/or consideration is required but cannot be completed within the allotted time, the examiner will process the submission consistent with current practice concerning responses after final rejection under 37 CFR 1.116, *e.g.*, by mailing an advisory action.
     - If the examiner determines that the amendment does not necessitate additional search and/or consideration, or if the examiner determines that additional search and/or consideration is required and could be completed within the allotted time, then the examiner will consider whether the amendment places the application in condition for allowance (after completing the additional search and/or consideration, if required). If the examiner determines that the amendment does not place the application in condition for allowance, then the examiner will contact the applicant and request an interview.
       - The interview will be conducted by the examiner, and if the examiner does not have negotiation authority, a primary examiner and/or supervisory patent examiner will also participate.
       - If the applicant declines the interview, or if the interview cannot be scheduled within ten (10) calendar days from the date that the examiner first contacts the applicant, then the examiner will proceed consistent with current practice concerning responses after final rejection under 37 CFR 1.116.

Signature	Date
/Orlando Lopez/	October 19, 2015
Name (Print/Typed) Orlando Lopez	**Practitioner Registration No.** 46,880

Note: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. Submit multiple forms if more than one signature is required, see below.*

☐ * Total of _____ forms are submitted.

Electronic Acknowledgement Receipt

EFS ID:	23823790
Application Number:	13354941
International Application Number:	
Confirmation Number:	9133
Title of Invention:	PHYSIOLOGICAL PARAMETER MONITORING WITH A MOBILE COMMUNICATION DEVICE
First Named Inventor/Applicant Name:	Ki H. Chon
Customer Number:	26486
Filer:	Marlo Schepper Grolnic
Filer Authorized By:	
Attorney Docket Number:	
Receipt Date:	19-OCT-2015
Filing Date:	20-JAN-2012
Time Stamp:	15:49:36
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		201RFOA.pdf	2363399 637e15edbe5a2d697ddd12059f2273bb7b175040	yes	39

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Response After Final Action	1	1
	Claims	2	14
	Applicant Arguments/Remarks Made in an Amendment	15	38
	After Final Consideration Program Request	39	39
Warnings:			
Information:			
	Total Files Size (in bytes):	2363399	

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 13/354,941	Filing Date 01/20/2012	☐ To be Mailed

ENTITY: ☐ LARGE ☒ SMALL ☐ MICRO

APPLICATION AS FILED – PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).			
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL	

APPLICATION AS AMENDED – PART II

AMENDMENT **10/19/2015**

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE ($)	(Column 3) ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	* 46	Minus	** 46	= 0	X $40 =	0
Independent (37 CFR 1.16(h))	* 6	Minus	***6	= 0	X $210 =	0
☐ Application Size Fee (37 CFR 1.16(s))						
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
					TOTAL ADD'L FEE	0

AMENDMENT

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE ($)	(Column 3) ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =	
☐ Application Size Fee (37 CFR 1.16(s))						
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
					TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

LIE
/MARCUS MONROE/

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**
If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

UNITED STATES PATENT AND TRADEMARK OFFICE

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/354,941	01/20/2012	Ki H. Chon	30210-201	9133

26486 7590 10/28/2015

BURNS & LEVINSON, LLP
125 SUMMER STREET
BOSTON, MA 02110

EXAMINER
LIU, CHU CHUAN

ART UNIT	PAPER NUMBER
3777	

NOTIFICATION DATE	DELIVERY MODE
10/28/2015	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

docketing@burnslev.com

Advisory Action Before the Filing of an Appeal Brief	**Application No.** 13/354,941	**Applicant(s)** CHON ET AL.	
	Examiner CHU CHUAN (JJ) LIU	**Art Unit** 3777	**AIA (First Inventor to File) Status** No

--The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

THE REPLY FILED 19 October 2015 FAILS TO PLACE THIS APPLICATION IN CONDITION FOR ALLOWANCE.

NO NOTICE OF APPEAL FILED

1. ☒ The reply was filed after a final rejection. No Notice of Appeal has been filed. To avoid abandonment of this application, applicant must timely file one of the following replies: (1) an amendment, affidavit, or other evidence, which places the application in condition for allowance; (2) a Notice of Appeal (with appeal fee) in compliance with 37 CFR 41.31; or (3) a Request for Continued Examination (RCE) in compliance with 37 CFR 1.114 if this is a utility or plant application. Note that RCEs are not permitted in design applications. The reply must be filed within one of the following time periods:
   a) ☐ The period for reply expires _____months from the mailing date of the final rejection.
   b) ☒ The period for reply expires on: (1) the mailing date of this Advisory Action; or (2) the date set forth in the final rejection, whichever is later. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of the final rejection.
   c) ☐ A prior Advisory Action was mailed more than 3 months after the mailing date of the final rejection in response to a first after-final reply filed within 2 months of the mailing date of the final rejection. The current period for reply expires months from the mailing date of *the prior Advisory Action* or SIX MONTHS from the mailing date of the final rejection, whichever is earlier.
   Examiner Note: If box 1 is checked, check either box (a), (b) or (c). ONLY CHECK BOX (b) WHEN THIS ADVISORY ACTION IS THE FIRST RESPONSE TO APPLICANT'S FIRST AFTER-FINAL REPLY WHICH WAS FILED WITHIN TWO MONTHS OF THE FINAL REJECTION. ONLY CHECK BOX (c) IN THE LIMITED SITUATION SET FORTH UNDER BOX (c). See MPEP 706.07(f).

Extensions of time may be obtained under 37 CFR 1.136(a). The date on which the petition under 37 CFR 1.136(a) and the appropriate extension fee have been filed is the date for purposes of determining the period of extension and the corresponding amount of the fee. The appropriate extension fee under 37 CFR 1.17(a) is calculated from: (1) the expiration date of the shortened statutory period for reply originally set in the final Office action; or (2) as set forth in (b) or (c) above, if checked. Any reply received by the Office later than three months after the mailing date of the final rejection, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

NOTICE OF APPEAL

2. ☐ The Notice of Appeal was filed on _____. A brief in compliance with 37 CFR 41.37 must be filed within two months of the date of filing the Notice of Appeal (37 CFR 41.37(a)), or any extension thereof (37 CFR 41.37(e)), to avoid dismissal of the appeal. Since a Notice of Appeal has been filed, any reply must be filed within the time period set forth in 37 CFR 41.37(a).

AMENDMENTS

3. ☐ The proposed amendments filed after a final rejection, but prior to the date of filing a brief, will not be entered because
   a) ☐ They raise new issues that would require further consideration and/or search (see NOTE below);
   b) ☐ They raise the issue of new matter (see NOTE below);
   c) ☐ They are not deemed to place the application in better form for appeal by materially reducing or simplifying the issues for appeal; and/or
   d) ☐ They present additional claims without canceling a corresponding number of finally rejected claims.
   NOTE: _____. (See 37 CFR 1.116 and 41.33(a)).
4. ☐ The amendments are not in compliance with 37 CFR 1.121. See attached Notice of Non-Compliant Amendment (PTOL-324).
5. ☐ Applicant's reply has overcome the following rejection(s): _____.
6. ☐ Newly proposed or amended claim(s) _____ would be allowable if submitted in a separate, timely filed amendment canceling the non-allowable claim(s).
7. ☒ For purposes of appeal, the proposed amendment(s): (a) ☐ will not be entered, or (b) ☒ will be entered, and an explanation of how the new or amended claims would be rejected is provided below or appended.

AFFIDAVIT OR OTHER EVIDENCE

8. ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.
9. ☐ The affidavit or other evidence filed after final action, but before or on the date of filing a Notice of Appeal will not be entered because applicant failed to provide a showing of good and sufficient reasons why the affidavit or other evidence is necessary and was not earlier presented. See 37 CFR 1.116(e).
10. ☐ The affidavit or other evidence filed after the date of filing the Notice of Appeal, but prior to the date of filing a brief, will not be entered because the affidavit or other evidence failed to overcome all rejections under appeal and/or appellant fails to provide a showing of good and sufficient reasons why it is necessary and was not earlier presented. See 37 CFR 41.33(d)(1).
11. ☐ The affidavit or other evidence is entered. An explanation of the status of the claims after entry is below or attached.

REQUEST FOR RECONSIDERATION/OTHER

12. ☒ The request for reconsideration has been considered but does NOT place the application in condition for allowance because: See Continuation Sheet.
13. ☐ Note the attached Information *Disclosure Statement*(s). (PTO/SB/08) Paper No(s). _____
14. ☒ Other: PTOL 2323 is attached.

STATUS OF CLAIMS

15. The status of the claim(s) is (or will be) as follows:
    Claim(s) allowed: .
    Claim(s) objected to: .
    Claim(s) rejected: 1,3-9,18-24,27-34,39-44 and 49-53.
    Claim(s) withdrawn from consideration: 10-17, 35-38, and 45-48.

/TSE CHEN/ Supervisory Patent Examiner, Art Unit 3777	/CHU CHUAN (JJ) LIU/ Examiner, Art Unit 3777

Continuation of 12. does NOT place the application in condition for allowance because:

In regard to the 35 USC 101 rejection, applicant alleged that the claimed invention amounts significantly more than the judicial exception. In response, the claims are NOT considered as significantly more than the judicial exception (see the detail analyses in previous action). The claim(s) does/do not include additional steps/elements that are sufficient to amount to significantly more than the judicial exception for the following reasons (prong 2B of the two-part test). In particular, the claimed steps amount to nothing more than: routine data collection and/or insignificant extrasolution activity (e.g. "providing a physiological indicator signal; analyzing the signal by using a handheld mobile communication device; and obtaining one or more physiological parameters"); generic computer functions performing well-understood, routine, and conventional activities previously known to the industry (e.g. "using a handheld mobile communication device for detecting effects of motion artifacts and associated functions/steps and deciding whether to retain the measurements based on detected effects of motion artifacts"; see Greco and Lichter); generic processing steps recited at a high level of generality such that substantially all practical applications of the judicial exception(s) are covered (e.g. ""using a handheld mobile communication device for detecting effects of motion artifacts and associated functions/steps and deciding whether to retain the measurements based on detected effects of motion artifacts"; see Grecoand Lichter"); and/or general instructions to apply or use the judicial exception(s) (e.g. ""using a handheld mobile communication device for detecting effects of motion artifacts and associated functions/steps and deciding whether to retain the measurements based on detected effects of motion artifacts"; see Greco and Lichter"). These features when considered separately and in combination, do not add significantly more to the judicial exception. Additionally, the claims fail to recite any limitations that purport to improve the functioning of the computer itself or effect an improvement in any other technology or technical field, or provide meaningful limitations beyond generally linking the use of an abstract idea to a particular technological environment. Therefore, the rejections are maintained for the reason of record.

In regard to 35 USC 103(a) rejections, Applicant first alleged that Greco discloses that a number of motion artifacts are missed using Shannon entropy and suggest the use of Renji entropy. In response, Greco discloses the at least one indicator of volatility being at least Shannon entropy (kurtosis, Shannon's entropy and Renyi's entropy were computed for each trial for each IC, as described in Section III). Therefore, Greco discloses the use of Shannon entropy for analyzing the ICs in the EEG signals to identify artifacts (i.e. the Shannon entropy and associated motion artifacts analysis is/are performed for comparison). Therefore, the rejections are maintained for the reason of record.

In regard to the double patenting rejections, applicant alleged Greco does not teach or suggest using only the measurements of one or more physiological parameters to detect the effect of motion artifacts. In response, Greco discloses using only the measurements (ICs extracted from the EEG data, see section III, page 205) to detect the effect of motion artifacts (first paragraph in the right column of page 203; Sec. IV on page 206 and ICs in section IV. Results of page 206). The measurements taught by Greco comprises the EEG data and associated ICs contained in the EEG data. Therefore, the rejections are maintained for the reason of record..

OK TO ENTER: /CCL/

PATENT APPLICATION
Attorney Docket No. 30210-201

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants: Ki H. Chon et al.
Application Number: 13/354,941
Filed: January 20, 2012
Title: PHYSIOLOGICAL PARAMETER MONITORING WITH A MOBILE COMMUNICATION DEVICE

Examiner: LIU, CHU CHUAN
Group Art Unit: 3777
Confirmation No. 9133

BURNS & LEVINSON, LLP
125 Summer Street
Boston, MA 02110
(617) 345-3243

TO: Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450,
Alexandria, VA 22313-1450

AMENDMENT AND RESPONSE TO FINAL OFFICE ACTION

Sir:

In reply to the final Office Action dated August 20, 2015, Applicants submit the following amendments and remarks that place this application in condition for allowance or in better form for appeal. An After Final Consideration Request form is attached hereto.

Amendments to the claims begin on page 2 of this paper.

Remarks begin on page 15 of this paper.

Attachments to this paper also include a copy of Form PTO/SB/434 (1 sheet).

AFCP 2.0 Decision	Application No.	Applicant(s)
	13/354,941	CHON ET AL.
	Examiner	Art Unit
	CHU CHUAN (JJ) LIU	3777

This is in response to the After Final Consideration Pilot request filed 19 October 2015.

1. **Improper Request** – The AFCP 2.0 request is improper for the following reason(s) and the after final amendment submitted with the request will be treated under pre-pilot procedure.

   ☐ An AFCP 2.0 request form PTO/SB/434 (or equivalent document) was not submitted.

   ☐ A non-broadening amendment to at least one independent claim was not submitted.

   ☐ A proper AFCP 2.0 request was submitted in response to the most recent final rejection.

   ☒ Other: the amendments does not change/ amend the scope of the claim.

2. **Proper Request**

   A. After final amendment submitted with the request will not be treated under AFCP 2.0.
   The after final amendment cannot be reviewed and a search conducted within the guidelines of the pilot program.

   ☐ The after final amendment will be treated under pre-pilot procedure.

   B. Updated search and/or completed additional consideration.
   The examiner performed an updated search and/or completed additional consideration of the after final amendment within the time authorized for the pilot program. The result(s) of the updated search and/or completed additional consideration are:

   ☐ 1. All of the rejections in the most recent final Office action are overcome and a Notice of Allowance is issued herewith.

   ☐ 2. The after final amendment would not overcome all of the rejections in the most recent final Office action. See attached interview summary for further details.

   ☐ 3. The after final amendment was reviewed, and it raises a new issue(s). See attached interview summary for further details.

   ☐ 4. The after final amendment raises new issues, but would overcome all of the rejections in the most recent final Office action. A decision on determining allowability could not be made within the guidelines of the pilot. See attached interview summary for further details, including any newly discovered prior art.

   ☐ 5. Other:

   Examiner Note: Please attach an interview summary when necessary as described above.

Doc code: RCEX
Doc description: Request for Continued Examination (RCE)

PTO/SB/30EFS (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

REQUEST FOR CONTINUED EXAMINATION(RCE)TRANSMITTAL
(Submitted Only via EFS-Web)

Application Number	13354941	Filing Date	2012-01-20	Docket Number (if applicable)	30210-201	Art Unit	3777
First Named Inventor	Ki H. Chon			Examiner Name	Chu Chuan Liu		

This is a Request for Continued Examination (RCE) under 37 CFR 1.114 of the above-identified application.
Request for Continued Examination (RCE) practice under 37 CFR 1.114 does not apply to any utility or plant application filed prior to June 8, 1995, or to any design application. The Instruction Sheet for this form is located at WWW.USPTO.GOV

SUBMISSION REQUIRED UNDER 37 CFR 1.114

Note: If the RCE is proper, any previously filed unentered amendments and amendments enclosed with the RCE will be entered in the order in which they were filed unless applicant instructs otherwise. If applicant does not wish to have any previously filed unentered amendment(s) entered, applicant must request non-entry of such amendment(s).

☒ Previously submitted. If a final Office action is outstanding, any amendments filed after the final Office action may be considered as a submission even if this box is not checked.

- ☐ Consider the arguments in the Appeal Brief or Reply Brief previously filed on _____
- ☐ Other _____

☐ Enclosed

- ☐ Amendment/Reply
- ☐ Information Disclosure Statement (IDS)
- ☐ Affidavit(s)/ Declaration(s)
- ☐ Other _____

MISCELLANEOUS

☐ Suspension of action on the above-identified application is requested under 37 CFR 1.103(c) for a period of months _____ (Period of suspension shall not exceed 3 months; Fee under 37 CFR 1.17(i) required)

☐ Other _____

FEES

The RCE fee under 37 CFR 1.17(e) is required by 37 CFR 1.114 when the RCE is filed.

☒ The Director is hereby authorized to charge any underpayment of fees, or credit any overpayments, to Deposit Account No 032410

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED

☒ Patent Practitioner Signature

☐ Applicant Signature

PTO/SB/30EFS (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Signature of Registered U.S. Patent Practitioner			
Signature	/Orlando Lopez/	Date (YYYY-MM-DD)	2015-10-30
Name	Orlando Lopez, Ph.D.	Registration Number	46880

This collection of information is required by 37 CFR 1.114. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Acknowledgement Receipt

EFS ID:	23940215
Application Number:	13354941
International Application Number:	
Confirmation Number:	9133
Title of Invention:	PHYSIOLOGICAL PARAMETER MONITORING WITH A MOBILE COMMUNICATION DEVICE
First Named Inventor/Applicant Name:	Ki H. Chon
Customer Number:	26486
Filer:	Marlo Schepper Grolnic
Filer Authorized By:	
Attorney Docket Number:	30210-201
Receipt Date:	30-OCT-2015
Filing Date:	20-JAN-2012
Time Stamp:	11:05:00
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Request for Continued Examination (RCE)	201RCETrans2.pdf	833119 57c17acb289e1907b0cd25264afe8cae4695f20f	no	3

Warnings:	
Information:	

Total Files Size (in bytes):	833119

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Electronic Patent Application Fee Transmittal

Application Number:	13354941
Filing Date:	20-Jan-2012
Title of Invention:	PHYSIOLOGICAL PARAMETER MONITORING WITH A MOBILE COMMUNICATION DEVICE
First Named Inventor/Applicant Name:	Ki H. Chon
Filer:	Marlo Schepper Grolnic
Attorney Docket Number:	30210-201

Filed as Small Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
RCE- 2nd and Subsequent Request	2820	1	850	850
		Total in USD ($)		**850**

Electronic Acknowledgement Receipt

EFS ID:	23940239
Application Number:	13354941
International Application Number:	
Confirmation Number:	9133
Title of Invention:	PHYSIOLOGICAL PARAMETER MONITORING WITH A MOBILE COMMUNICATION DEVICE
First Named Inventor/Applicant Name:	Ki H. Chon
Customer Number:	26486
Filer:	Marlo Schepper Grolnic
Filer Authorized By:	
Attorney Docket Number:	30210-201
Receipt Date:	30-OCT-2015
Filing Date:	20-JAN-2012
Time Stamp:	11:06:08
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$850
RAM confirmation Number	8934
Deposit Account	032410
Authorized User	LOPEZ, ORLANDO

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.19 (Document supply fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.20 (Post Issuance fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Fee Worksheet (SB06)	fee-info.pdf	30793 9a92cf2fceffa428a97d48f51abb603485447e5b	no	2

Warnings:

Information:

Total Files Size (in bytes):	30793

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

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UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/354,941	01/20/2012	Ki H. Chon	30210-201	9133

26486 7590 11/13/2015

BURNS & LEVINSON, LLP
125 SUMMER STREET
BOSTON, MA 02110

EXAMINER
LIU, CHU CHUAN

ART UNIT	PAPER NUMBER
3777	

NOTIFICATION DATE	DELIVERY MODE
11/13/2015	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

docketing@burnslev.com

Applicant-Initiated Interview Summary	Application No.	Applicant(s)	
	13/354,941	CHON ET AL.	
	Examiner	Art Unit	
	CHU CHUAN (JJ) LIU	3777	

All participants (applicant, applicant's representative, PTO personnel):

(1) *Chu Chuan Liu*.

(2) *Tse Chen*.

(3) *Orlando Lopez*.

(4) _____.

Date of Interview: *05 November 2015*.

Type: ☒ Telephonic ☐ Video Conference
☐ Personal [copy given to: ☐ applicant ☐ applicant's representative]

Exhibit shown or demonstration conducted: ☐ Yes ☐ No.
If Yes, brief description: _____.

Issues Discussed ☒101 ☐112 ☐102 ☒103 ☐Others
(For each of the checked box(es) above, please describe below the issue and detailed description of the discussion)

Claim(s) discussed: *1*.

Identification of prior art discussed: *Greco*.

Substance of Interview
(For each issue discussed, provide a detailed description and indicate if agreement was reached. Some topics may include: identification or clarification of a reference or a portion thereof, claim interpretation, proposed amendments, arguments of any applied references etc...)

During the interview, attorney explained his position with respect to the Greco reference for the 103 rejection. Attorney alleged that Greco teaches away from using Shannon's entropy in the physiological data. Examiner indicated how Greco met the claimed limitations because Shannon's entropy was utilized in the analyses of the EEG signals. No agreement was reached. In regard to the 101 rejection, Attorney indicated the claimed invention utilizes a handheld mobile communication device to perform the Shannon's entropy analysis. Examiner indicated the formal response will be considered with respect to the most recent eligibility guidance, In regard to the double patenting rejection, Attorney consulted with the examiner and potential options were discussed.

Applicant recordation instructions: The formal written reply to the last Office action must include the substance of the interview. (See MPEP section 713.04). If a reply to the last Office action has already been filed, applicant is given a non-extendable period of the longer of one month or thirty days from this interview date, or the mailing date of this interview summary form, whichever is later, to file a statement of the substance of the interview

Examiner recordation instructions: Examiners must summarize the substance of any interview of record. A complete and proper recordation of the substance of an interview should include the items listed in MPEP 713.04 for complete and proper recordation including the identification of the general thrust of each argument or issue discussed, a general indication of any other pertinent matters discussed regarding patentability and the general results or outcome of the interview, to include an indication as to whether or not agreement was reached on the issues raised.

☐ Attachment

/CHU CHUAN (JJ) LIU/ Examiner, Art Unit 3777	/TSE CHEN/ Supervisory Patent Examiner, Art Unit 3777

Summary of Record of Interview Requirements

Manual of Patent Examining Procedure (MPEP), Section 713.04, Substance of Interview Must be Made of Record
A complete written statement as to the substance of any face-to-face, video conference, or telephone interview with regard to an application must be made of record in the application whether or not an agreement with the examiner was reached at the interview.

Title 37 Code of Federal Regulations (CFR) § 1.133 Interviews
Paragraph (b)

In every instance where reconsideration is requested in view of an interview with an examiner, a complete written statement of the reasons presented at the interview as warranting favorable action must be filed by the applicant. An interview does not remove the necessity for reply to Office action as specified in §§ 1.111, 1.135. (35 U.S.C. 132)

37 CFR §1.2 Business to be transacted in writing.
All business with the Patent or Trademark Office should be transacted in writing. The personal attendance of applicants or their attorneys or agents at the Patent and Trademark Office is unnecessary. The action of the Patent and Trademark Office will be based exclusively on the written record in the Office. No attention will be paid to any alleged oral promise, stipulation, or understanding in relation to which there is disagreement or doubt.

The action of the Patent and Trademark Office cannot be based exclusively on the written record in the Office if that record is itself incomplete through the failure to record the substance of interviews.

It is the responsibility of the applicant or the attorney or agent to make the substance of an interview of record in the application file, unless the examiner indicates he or she will do so. It is the examiner's responsibility to see that such a record is made and to correct material inaccuracies which bear directly on the question of patentability.

Examiners must complete an Interview Summary Form for each interview held where a matter of substance has been discussed during the interview by checking the appropriate boxes and filling in the blanks. Discussions regarding only procedural matters, directed solely to restriction requirements for which interview recordation is otherwise provided for in Section 812.01 of the Manual of Patent Examining Procedure, or pointing out typographical errors or unreadable script in Office actions or the like, are excluded from the interview recordation procedures below. Where the substance of an interview is completely recorded in an Examiners Amendment, no separate Interview Summary Record is required.

The Interview Summary Form shall be given an appropriate Paper No., placed in the right hand portion of the file, and listed on the "Contents" section of the file wrapper. In a personal interview, a duplicate of the Form is given to the applicant (or attorney or agent) at the conclusion of the interview. In the case of a telephone or video-conference interview, the copy is mailed to the applicant's correspondence address either with or prior to the next official communication. If additional correspondence from the examiner is not likely before an allowance or if other circumstances dictate, the Form should be mailed promptly after the interview rather than with the next official communication.

The Form provides for recordation of the following information:
- Application Number (Series Code and Serial Number)
- Name of applicant
- Name of examiner
- Date of interview
- Type of interview (telephonic, video-conference, or personal)
- Name of participant(s) (applicant, attorney or agent, examiner, other PTO personnel, etc.)
- An indication whether or not an exhibit was shown or a demonstration conducted
- An identification of the specific prior art discussed
- An indication whether an agreement was reached and if so, a description of the general nature of the agreement (may be by attachment of a copy of amendments or claims agreed as being allowable). Note: Agreement as to allowability is tentative and does not restrict further action by the examiner to the contrary.
- The signature of the examiner who conducted the interview (if Form is not an attachment to a signed Office action)

It is desirable that the examiner orally remind the applicant of his or her obligation to record the substance of the interview of each case. It should be noted, however, that the Interview Summary Form will not normally be considered a complete and proper recordation of the interview unless it includes, or is supplemented by the applicant or the examiner to include, all of the applicable items required below concerning the substance of the interview.

A complete and proper recordation of the substance of any interview should include at least the following applicable items:
1) A brief description of the nature of any exhibit shown or any demonstration conducted,
2) an identification of the claims discussed,
3) an identification of the specific prior art discussed,
4) an identification of the principal proposed amendments of a substantive nature discussed, unless these are already described on the Interview Summary Form completed by the Examiner,
5) a brief identification of the general thrust of the principal arguments presented to the examiner,
   (The identification of arguments need not be lengthy or elaborate. A verbatim or highly detailed description of the arguments is not required. The identification of the arguments is sufficient if the general nature or thrust of the principal arguments made to the examiner can be understood in the context of the application file. Of course, the applicant may desire to emphasize and fully describe those arguments which he or she feels were or might be persuasive to the examiner.)
6) a general indication of any other pertinent matters discussed, and
7) if appropriate, the general results or outcome of the interview unless already described in the Interview Summary Form completed by the examiner.

Examiners are expected to carefully review the applicant's record of the substance of an interview. If the record is not complete and accurate, the examiner will give the applicant an extendable one month time period to correct the record.

Examiner to Check for Accuracy

If the claims are allowable for other reasons of record, the examiner should send a letter setting forth the examiner's version of the statement attributed to him or her. If the record is complete and accurate, the examiner should place the indication, "Interview Record OK" on the paper recording the substance of the interview along with the date and the examiner's initials.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/354,941	01/20/2012	Ki H. Chon	30210-201	9133

26486 7590 12/01/2015

BURNS & LEVINSON, LLP
125 SUMMER STREET
BOSTON, MA 02110

EXAMINER
LIU, CHU CHUAN

ART UNIT	PAPER NUMBER
3777	

NOTIFICATION DATE	DELIVERY MODE
12/01/2015	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

docketing@burnslev.com

Office Action Summary	Application No. 13/354,941	Applicant(s) CHON ET AL.	
	Examiner CHU CHUAN (JJ) LIU	Art Unit 3777	AIA (First Inventor to File) Status No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *10/30/2015*.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

5)☒ Claim(s) *1,3-24 and 27-53* is/are pending in the application.

5a) Of the above claim(s) *10-17,35-38 and 45-48* is/are withdrawn from consideration.

6)☐ Claim(s) _____ is/are allowed.

7)☒ Claim(s) *1, 3-9, 18-24, 27-34, 39-44, and 49-53* is/are rejected.

8)☐ Claim(s) _____ is/are objected to.

9)☐ Claim(s) _____ are subject to restriction and/or election requirement.

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a)☐ All b)☐ Some** c)☐ None of the:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)

2) ☐ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date _____.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

4) ☐ Other: _____.

DETAILED ACTION

1. The present application is being examined under the pre-AIA first to invent provisions.

2. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 10/19/2015 has been entered.

3. The amendments and remarks filed on 10/19/2015 have been fully considered.

Status of Claims

4. Claims 1, 3-24, and 27-53 are pending for examination. Claims 10-17, 35-38, and 45-48 are withdrawn from consideration. Claims 2 and 25-26 are cancelled.

Claim Rejections - 35 USC § 101- abstract idea

5. 35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

6. Claims 1, 3-24, and 27-53 are rejected under 35 U.S.C. 101 because the claimed inventions are directed to a judicial exception (i.e., a law of nature, a natural phenomenon, or an abstract idea) without significantly more. Claims 1, 19, 24, 39, 44,

and 49 are directed to an abstract idea. Instant claims 1, 19, 24, 39, 44, and 49 are drawn to “method(s) or system(s)” (prong 1 of the two-part test). In this case, the claims are directed to the judicial exception of **mathematical relationship and/ or ideas**, which is considered an abstract idea, or concepts similar to those found by the courts to be abstract, as they require mathematically relating data and/or comparing data (prong 2A of the two-part test). See also Federal Register, Vol. 79, No. 241, December 16, 2014 at 74622, column 2 and see “An algorithm for calculating parameters indicating an abnormal condition” or other associated examples, of Identifying Abstract Ideas in July 2015 Update: Interim Eligibility Guidance.

The claim(s) does/do not include additional steps/elements that are sufficient to amount to significantly more than the judicial exception for the following reasons (prong 2B of the two-part test). In particular, the claimed steps amount to nothing more than: routine data collection and/or insignificant extrasolution activity (e.g. "providing a physiological indicator signal; analyzing the signal by using a handheld mobile communication device; and obtaining one or more physiological parameters"); generic computer functions performing well-understood, routine, and conventional activities previously known to the industry (e.g. "using a handheld mobile communication device for detecting effects of motion artifacts and associated functions/steps and deciding whether to retain the measurements based on detected effects of motion artifacts"; see Greco and Lichter below); generic processing steps recited at a high level of generality such that substantially all practical applications of the judicial exception(s) are covered (e.g. "using a handheld mobile communication device for detecting effects of motion

artifacts and associated functions/steps and deciding whether to retain the measurements based on detected effects of motion artifacts"; see Greco and Lichter below); and/or general instructions to apply or use the judicial exception(s) (e.g. "using a handheld mobile communication device for detecting effects of motion artifacts and associated functions/steps and deciding whether to retain the measurements based on detected effects of motion artifacts"; see Greco and Lichter below).

Therefore, these features when considered separately and in combination, do not add significantly more to the judicial exception. Additionally, the claims fail to recite any limitations that purport to improve the functioning of the computer itself or effect an improvement in any other technology or technical field, or provide meaningful limitations beyond generally linking the use of an abstract idea to a particular technological environment.

For additional guidance, applicant is directed generally to MPEP 2106 and to the USPTO's December 2014 Interim Guidance on Subject Matter Eligibility (Federal Register notice titled 2014 Interim Guidance on Patent Subject Matter Eligibility, 79 FR 74618) and Identifying Abstract Ideas in July 2015 Update: Interim Eligibility Guidance, as above, and http://www.uspto.gov/patent/laws-and-regulations/examination-policy/2014-interim-guidance-subject-matter-eligibility-0.

Claim Rejections - 35 USC § 103

7. The following is a quotation of pre-AIA 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

8. Claims 1, 3-5, 8-9, 24, 27-29, 33-34, and 44 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Greco et al., "Kurtosis, Renyi's Entropy and Independent Component Scalp Maps for the Automatic Artifact Rejection from EEG data". International Journal of Computer, Information, Systems and Control Engineering 2(9), January 2008: 180-184 – cited by applicant) in view of Lichter et al. (USPN 6,159,147 – cited in previous action). In regard to claims 1, 3-5, 24, 27-29 and 44, Greco discloses a method and an apparatus for physiological parameter monitoring (abstract and associated descriptions), the method comprising: providing a physiological indicator signal (electric signals, Fig. 1 and associated descriptions in page 203) obtained from a physiological indicator signal sensing component (EEG sensors and a recording machine, Fig. 1 and associated descriptions in page 203) to a device (EEGLAB, pages 206 and 207; it is inherently that the downloaded program is executed by a computer); analyzing, using the device, the physiological indicator signal (amplifier, page 203 and Sec. IV, page 206); obtaining, from said analyzing, measurements of one or more physiological parameters (EEG signals and associated independent components/ ICs in page 206); and detecting, using the device and using only the measurements of the one or more physiological parameters (ICs in the detected EEG signals pages 205-206), effects of motion artifacts in the measurements of the one or more physiological parameters (first paragraph in the right column of page 203; Sec. IV

on page 206) and deciding whether to retain the measurements based on detected effects of motion artifacts (reject an IC, Sec. IV on page 206), wherein the step of detecting effects of motion artifacts in the measurements comprises: a. preprocessing a segment from the measurement of one physiological parameter (remove noise, Sec. IV on page 206); b. obtaining a value of at least one indicator of volatility, used in determining whether motion artifacts are present, for the preprocessed segment; the at least one indicator of volatility being at least one of kurtosis and Shannon entropy for the preprocessed segment (kurtosis and Shannon entropy, Sec. III, A and B, pages 205-206). c. including the segment in analyses of physiological measurements, when comparison of the value of the at least one indicator of volatility with a predetermined threshold (threshold of ± 1.64, Sec. III, A and B, pages 205-206) indicates noise/motion artifacts are not present (reject the ICs only when the volatility exceeds the threshold, Sec. III, A and B, pages 205-206; i.e. the ICs not exceeded the threshold is included); and d. selecting another segment of the signal from the physiological measurement and proceeding to step (a) when the value of the at least one indicator of volatility is less than a predetermined threshold and another segment is available (comparing all ICs extracted from the data segments/ trials with the threshold and rejecting the IC(s) exceed the threshold, Sec. III and IV on pages 205-207). Greco does not specifically disclose the device a handheld mobile communication device. Lichter teaches a handheld mobile communication device (personal computer 27, Figs. 2-3) which can be connected to various sensors to measure and analyze the collected data (Figs. 16) including EEG (Fig. 16). One ordinary would have recognized that a personal computer

is an alternative equivalent computing device. Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention was made to substitute the device/ computer (Greco) with the handheld mobile communications device (Lichter) to yield predictable results.

In regard to claims 8-9 and 33-34, Greco as modified by Lichter discloses providing a physiological indicator signal comprises obtaining a signal from a physiological monitoring sensor (EEG sensors, Greco and EEG sensor, Fig. 16 of Lichter) which comprises a PPG sensor and an ECG sensor (Fig. 16 and associated descriptions of Lichter).

9. Claims 6 and 30 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over the combination of Greco and Lichter as applied to claims 1 and 24 above, and further in view of Maier et al. (USPGPUB 2006/0253261 -cited in previous action). In regard to claims 6 and 30, Greco as modified by Lichter discloses all the claimed limitation except the predetermined threshold is determined using receiver operator characteristic (ROC) analysis. Maier teaches a threshold value can be determined using receiver operator characteristic (ROC) analysis ([0235]) in order to have a constant false alarm rate ([0235]). Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention was made to modify the method and the apparatus (Greco as modified by Lichter) to incorporate the ROC determined threshold (Maier) in order to find the optimal threshold values for the comparison(s).

10. Claims 7 and 31-32 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over the combination of Greco and Lichter as applied to claims 1 and 24 above, and further in view of Jacobsen et al. (USPN 6,198,394 – cited in previous action). In regard to claims 7 and 31-32, Greco as modified by Lichter discloses all the claim limitation except placing a portion of a subject's body over an objective lens of a camera in a mobile communication device; and obtaining video images of the portion of the subject's body. Jacobsen teaches placing a portion of a subject's body over an objective lens of a camera in a mobile communication device (element 376, Fig. 5A; Fig. 8; Col 13 lines 55-67); and obtaining video images of the portion of the subject's body (element 376, Fig. 5A; Fig. 8; Col 13 lines 55-67). The portable communication device taught by Jacobsen can be connected to various sensors applied to a user (Figs. 1-3, 5-7, and 8 and associated description) and provide video images associated with specific location of the user to the command center (Col 13 lines 55-67). Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention was made to modify the method and the apparatus (Greco as modified by Lichter) to incorporate the camera of the portable communication device (Jacobsen) in order to obtain video images associated with specific location of the user and transferring to a central monitoring system/ unit.

11. Claim 18 is rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over the combination of Greco and Lichter as applied to claim 1 above, and further in view of Zhang (USPGPUB 2009/0112110 – cited in previous action). In regard to claim 18,

Greco as modified by Lichter discloses the measurement of ECG signals (Fig. 16 and associated descriptions of Lichter) but does not specifically discloses a measure of atrial fibrillation. Zhang teaches a measure of atrial fibrillation based on ECG signal analysis (abstract and Figs. 1-9). Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention was made to modify the method (Greco as modified by Lichter) to incorporate the ECG-based atrial fibrillation analysis (Zhang) in order to obtain more health information of the user.

Double Patenting

12. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory double patenting rejection is appropriate where the claims at issue are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the reference application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement. A terminal disclaimer must be signed in compliance with 37 CFR 1.321(b).

The USPTO internet Web site contains terminal disclaimer forms which may be used. Please visit http://www.uspto.gov/forms/. The filing date of the application will determine what form should be used. A web-based eTerminal Disclaimer may be filled out completely online using web-screens. An eTerminal Disclaimer that meets all requirements is auto-processed and approved immediately upon submission. For more information about eTerminal Disclaimers, refer to http://www.uspto.gov/patents/process/file/efs/guidance/eTD-info-I.jsp.

13. Claims 19-23, 39-43, 49-53 are rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1-16 of U.S. Patent No. 8,755,876 in view of Greco and Lichter. In regard to claims 19-23, 39-43, 49-53 of present application, claims 1-16 of '876 recite all the limitations except a system and a method comprises providing a physiological indicator signal to a handheld mobile communication device; analyzing, using the device, the physiological indicator signal to obtain measurements of one or more physiological parameters; and detecting, using the a handheld mobile communication device and using only the measurements of the one or more physiological parameters, effects of motion artifacts in the measurements of the one or

more physiological parameters and deciding whether to retain the measurements based on effects of motion artifacts in the measurements based on detected effects of motion artifacts. Greco discloses a method and an apparatus for physiological parameter monitoring (abstract and associated descriptions), the method comprising: providing a physiological indicator signal (electric signals, Fig. 1 and associated descriptions in page 203) obtained from a physiological indicator signal sensing component (EEG sensors and a recording machine, Fig. 1 and associated descriptions in page 203) to a device (EEGLAB, pages 206 and 207; it is inherently that the downloaded program is executed by a computer); analyzing, using the device, the physiological indicator signal (amplifier, page 203 and Sec. IV, page 206) to obtain measurements of one or more physiological parameters (EEG signals and associated independent components/ ICs in page 206); and detecting, using the device and using only the measurements of the one or more physiological parameters (ICs in the detected EEG signals pages 205-206), effects of motion artifacts in the measurements of the one or more physiological parameters (first paragraph in the right column of page 203; Sec. IV on page 206) and deciding whether to retain the measurements based on detected effects of motion artifacts (reject an IC, Sec. IV on page 206). Claims 1-16 of ‘876 recite a processor to process data related to R-R intervals (claims 1, 2, 6, 7, 12 and 13) but do not recite the processor is in part of a computing device. Greco discloses an artifact rejection method for biomedical signal processing (abstract and Sec. II, IV and V). Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention was made to modify the method and the apparatus (claims 1-16 of ‘876) to incorporate the

artifact rejection method (Greco) in order to better reject artifacts contained in the signal. Claims 1-16 of '876 as modified by Greco does not specifically recite the device is a handheld mobile communication device. Lichter teaches a handheld mobile communication device (personal computer 27, Figs. 2-3) which can be connected to various sensors to measure and analyze the collected data (Figs. 16) including ECG signals obtained from ECG sensor (Fig. 15). Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention was made to substitute the computer (Claims 1-16 of '876 as modified by Greco) with the handheld mobile communications device (Lichter) to yield predictable results.

Response to Arguments

14. Applicant's arguments filed on 10/19/2015 have been fully considered but they are not persuasive.

In regard to the 35 USC 101 rejection, applicant alleged that the claimed invention amounts significantly more than the judicial exception. In response, the claims are NOT considered as significantly more than the judicial exception (see the detail analyses). It is noted that the phrase of "physiological indicator signal" generally covers all signals and/or all indicators derived from the signals, e.g. acoustic signals, electrical signals, optical signals, magnetic signals…etc. obtained from any physiological fields/areas, which is not considered as a particular/specific technological field. Therefore, the claims are considered as implementing the abstract idea(s)/ mathematical relationship(s) on a generic computer and/or generic computer structures

for any signal(s) associated with any physiological fields/areas. The rejections are maintained for the reason of record.

In regard to 35 USC 103(a) rejections, Applicant first alleged that Greco discloses that a number of motion artifacts are missed using Shannon entropy and suggest the use of Renji entropy. In response, Greco discloses the at least one indicator of volatility being at least Shannon entropy (**kurtosis, Shannon's entropy and Renyi's entropy were computed for each trial for each IC**, as described in Section III…Kurtosis detected IC10, Shannon's entropy detected IC2, IC10, IC17, IC21, IC24, Renyi's entropy detected IC1, IC2, IC9, IC10, IC17, IC21, IC24. Global kurtosis detected IC14, see section IV. Results in page 206). It is noted that the claims recite transitional phrase "comprising" which is inclusive or open-ended and does not exclude additional, unrecited elements or method steps (see MPEP 2111.03). The teachings taught by Greco comprise the use of Shannon entropy for analyzing the ICs in the EEG signals to identify motion artifacts, i.e. the Shannon entropy and associated motion artifacts analyses are performed. Therefore, the rejections are maintained for the reason of record.

In regard to the double patenting rejections, applicant alleged Greco does not teach or suggest using **only** the measurements of one or more physiological parameters to detect the effect of motion artifacts. In response, Greco discloses using only the measurements (ICs extracted from the EEG data, see section III, page 205) to detect the effect of motion artifacts (first paragraph in the right column of page 203; Sec. IV on page 206 and ICs in section IV. Results of page 206). The measurements taught

by Greco comprise the EEG data and associated ICs contained in the EEG data.

Therefore, the rejections are maintained for the reason of record.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to CHU CHUAN (JJ) LIU whose telephone number is (571)270-5507. The examiner can normally be reached on M-TH 8:00am~4:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tse Chen can be reached on (571)272-3672. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/TSE CHEN/
Supervisory Patent Examiner, Art Unit 3777

/CHU CHUAN (JJ) LIU/
Examiner, Art Unit 3777

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L12	1	10 and skewness with kurtosis with Shannon with entropy with Renyi's	US-PGPUB; USPAT	OR	ON	2015/11/18 10:17
L10	1	("20130191035").PN.	US-PGPUB; USPAT	OR	OFF	2015/11/18 10:16
L9	41	Shannon with entropy and (ECG EKG EEG PPG) and (motion movement) with (noise artifact artefact)	US-PGPUB; USPAT	OR	ON	2015/11/18 10:06
L8	17	Shannon with entropy and (ECG EKG EEG PPG) and motion with (noise movement) with (artifact artefact)	US-PGPUB; USPAT	OR	ON	2015/11/18 10:06
L7	30	Shannon with entropy and (ECG EKG EEG PPG) and motion with (noise artifact artefact)	US-PGPUB; USPAT	OR	ON	2015/11/18 10:04
L6	1	4 and Shannon with entropy	US-PGPUB; USPAT	OR	ON	2015/11/18 09:48
L4	19	("20020173729" | "20030055355" | "20030167019" | "20040082876" | "20050010116" | "4907597" | "5010891" | "5320109" | "5458117" | "6631291" | "6658287" | "6678548" | "6731975" | "6801803" | "7228169" | "7299088" | "7367949").PN. OR ("7509161").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2015/11/18 09:47
L3	144	Shannon with entropy and (ECG EKG EEG PPG)	US-PGPUB; USPAT	OR	ON	2015/11/18 09:41
L2	129	Shannon with entropy and (ECG EEG PPG)	US-PGPUB; USPAT	OR	ON	2015/11/18 09:38
L1	9	Shannon with entropy and A61B5/0059,1455.cpc.	US-PGPUB; USPAT	OR	ON	2015/11/18 09:36

EAST Search History (Interference)

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Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13354941	CHON ET AL.
	Examiner	Art Unit
	CHU CHUAN (JJ) LIU	3777

CPC- SEARCHED		
Symbol	Date	Examiner
A61B5/1455	02/24/2015	CCL
A61B5/0002,0004,145,1455,14551	08/11/2015	CCL
A61B5/0059,1455	11/18/2015	CCL

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner
600	300, 301, 309, 310, 322, 323, 324, 326, 330, 336, 473, 476, 500, 501, 502, 508, 509,518	10/24/2013	CCL
600	300, 301, 309, 310, 322, 323, 324, 326, 330, 336, 473, 476, 500, 501, 502, 508, 509,518	03/12/2014	CCL
600	300, 301, 309, 310, 322, 323, 324, 326, 330, 336, 473, 476, 500, 501, 502, 508, 509,518	09/16/2014	CCL
600	300, 301, 309, 310, 322, 323, 324, 326, 330, 336, 473, 476, 500, 501, 502, 508, 509,518	02/24/2015	CCL
600	300, 301, 309, 310, 322, 323, 324, 326, 330, 336, 473, 476, 500, 501, 502, 508, 509,518	8/11/2015	CCL
600	300, 301, 309, 310, 322, 323, 324, 326, 330, 336, 473, 476, 500, 501, 502, 508, 509,518	11/18/2015	CCL

SEARCH NOTES		
Search Notes	Date	Examiner
Inventor Name Search (PALM and EAST)	10/23/2013	CCL
EAST Search (TEXT, USPGPUB, USPAT) See Search History	10/24/2013	CCL
Google NPL Search	10/24/2013	CCL
Updated EAST Search (TEXT, USPGPUB, USPAT) See Search History	03/12/2014	CCL
Google NPL Search	03/12/2014	CCL
Updated EAST Search (TEXT, USPGPUB, USPAT) See Search History	09/16/2014	CCL

/CHU CHUAN (JJ) LIU/ Examiner.Art Unit 3777	

SEARCH NOTES		
Search Notes	**Date**	**Examiner**
Updated EAST Search (TEXT, USPGPUB, USPAT, CPC) See Search History	02/24/2015	CCL
Google NPL Search	02/24/2015	CCL
Updated EAST Search (TEXT, USPGPUB, USPAT, CPC) See Search History	8/11/2015	CCL
NPL Search	8/11/2015	CCL
Updated EAST Search (TEXT, USPGPUB, USPAT, CPC) See Search History	11/18/2015	CCL
Google NPL Search	11/18/2015	

INTERFERENCE SEARCH			
US Class/ CPC Symbol	**US Subclass / CPC Group**	**Date**	**Examiner**

/CHU CHUAN (JJ) LIU/ Examiner.Art Unit 3777	

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13354941	CHON ET AL.
	Examiner	**Art Unit**
	CHU CHUAN (JJ) LIU	3777

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
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	2	✓	✓	-	-	-	-			
	3	✓	✓	✓	✓	✓	✓			
	4	✓	✓	✓	✓	✓	✓			
	5	✓	✓	✓	✓	✓	✓			
	6	✓	✓	✓	✓	✓	✓			
	7	✓	✓	✓	✓	✓	✓			
	8	✓	✓	✓	✓	✓	✓			
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	34	✓	✓	✓	✓	✓	✓			
	35	N	N	N	N	N	N			
	36	N	N	N	N	N	N			

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13354941	CHON ET AL.
	Examiner	**Art Unit**
	CHU CHUAN (JJ) LIU	3777

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	10/24/2013	03/12/2014	09/16/2014	02/24/2015	08/11/2015	11/18/2015			
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	38	N	N	N	N	N	N			
	39	✓	✓	✓	✓	✓	✓			
	40	✓	✓	✓	✓	✓	✓			
	41	✓	✓	✓	✓	✓	✓			
	42	✓	✓	✓	✓	✓	✓			
	43	✓	✓	✓	✓	✓	✓			
	44	✓	✓	✓	✓	✓	✓			
	45	N	N	N	N	N	N			
	46	N	N	N	N	N	N			
	47	N	N	N	N	N	N			
	48	N	N	N	N	N	N			
	49	✓	✓	✓	✓	✓	✓			
	50	✓	✓	✓	✓	✓	✓			
	51	✓	✓	✓	✓	✓	✓			
	52	✓	✓	✓	✓	✓	✓			
	53	✓	✓	✓	✓	✓	✓			

PTO/SB/08a (01-10)
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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	13354941
Filing Date	2012-01-20
First Named Inventor	Ki H. Chon
Art Unit	3777
Examiner Name	Chu Chuan Liu
Attorney Docket Number	30210-201US

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	1							

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	13354941
	Filing Date	2012-01-20
	First Named Inventor	Ki H. Chon
	Art Unit	3777
	Examiner Name	Chu Chuan Liu
	Attorney Docket Number	30210-201US

	1	Barbati et al. "Optimization of an Indepedent Component Analysis Apporach for Artifact Identification and Removal in Magnetoencephalographic Signals." Clin. Neurophys. 115(2004):1220-1232.

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Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	13354941
	Filing Date	2012-01-20
	First Named Inventor	Ki H. Chon
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	Attorney Docket Number	30210-201US

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

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OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

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A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Orlando Lopez/	Date (YYYY-MM-DD)	2016-01-19
Name/Print	Orlando Lopez, Ph.D.	Registration Number	46,880

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Electronic Acknowledgement Receipt

EFS ID:	24651741
Application Number:	13354941
International Application Number:	
Confirmation Number:	9133
Title of Invention:	PHYSIOLOGICAL PARAMETER MONITORING WITH A MOBILE COMMUNICATION DEVICE
First Named Inventor/Applicant Name:	Ki H. Chon
Customer Number:	26486
Filer:	Orlando Lopez/Judith Soule
Filer Authorized By:	Orlando Lopez
Attorney Docket Number:	30210-201
Receipt Date:	19-JAN-2016
Filing Date:	20-JAN-2012
Time Stamp:	10:11:32
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Non Patent Literature	Barbati.pdf	2818636 fd9961bc4eeb59c0e33fcc2b8169b07bf74b4512	no	13

Warnings:	
Information:	

2	Information Disclosure Statement (IDS) Form (SB08)	IDS.pdf	612089 36985e948be722b2a2db451c2c00505ed5d7c7d7	no	4

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants: Ki H. Chon et al.
Application Number: 13/354,941
Filed: January 20, 2012
Title: PHYSIOLOGICAL PARAMETER MONITORING WITH A MOBILE COMMUNICATION DEVICE

Examiner: LIU, CHU CHUAN
Group Art Unit: 3777
Confirmation No. 9133

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Commissioner for Patents
P.O. Box 1450,
Alexandria, VA 22313-1450

AMENDMENT AND RESPONSE TO OFFICE ACTION

Sir:

In reply to the non-final Office Action dated December 1, 2015, Applicants submit the following amendments and remarks.

Amendments to the claims begin on page 2 of this paper.

Remarks begin on page 16 of this paper.

Amendments to the Claims:

This listing of claims replaces all prior versions and listings of the claims.

1. (Currently amended) A method for physiological parameter monitoring, the method comprising:

providing a physiological indicator signal to a handheld mobile communication device;

analyzing, using the handheld mobile communication device, the physiological indicator signal;

obtaining, from said analyzing, measurements of one or more physiological parameters; and

detecting, using the handheld mobile communication device and using only the measurements of one or more physiological parameters, effects of motion artifacts in the measurements of the one or more physiological parameters and deciding whether to retain the measurements based on detected effects of motion artifacts;

wherein detecting effects of motion artifacts in the measurements comprises:

a. ~~preprocessing~~ filtering and detrending a segment from the measurement of one physiological parameter; wherein a filtered and detrended segment is hereinafter referred to as a preprocessed segment;

b. obtaining a value of at least one indicator of volatility, used in determining whether motion artifacts are present, for the preprocessed segment; the at least one indicator of volatility being at least Shannon entropy for the preprocessed segment;

c. including the segment in analyses of physiological measurements, ~~if~~ when comparison of the value of the at least one indicator of volatility with a predetermined threshold indicates noise/motion artifacts are not present; and

d. selecting another segment of the signal from the physiological measurement and proceeding to step (a) when the value of the at least one indicator of volatility is less than a predetermined threshold and when another segment is available.

2. (Canceled)

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3. (Currently amended) The method of claim 1 wherein said at least one indicator of volatility also comprises kurtosis.

4-5. (Canceled)

6. (Previously presented) The method of claim 1 wherein the predetermined threshold is determined using receiver operator characteristic (ROC) analysis.

7. (Previously presented) The method of claim 1 wherein providing a physiological indicator signal comprises:

placing a portion of a subject's body over an objective lens of a camera in a handheld mobile communication device; and

obtaining video images of the portion of the subject's body.

8. (Previously presented) The method of claim 1 wherein providing a physiological indicator signal comprises obtaining a signal from a physiological monitoring sensor.

9. (Previously presented) The method of claim 8 wherein the physiological monitoring sensor is a photoplethysmographic (PPG) sensor or an electrocardiogram sensor.

10. (Withdrawn) The method of claim 1 wherein the one or more physiological measurements comprise heart rate and heart rate variability.

11. (Withdrawn) The method of claim 10 wherein obtaining measurements of heart rate and heart rate variability comprise:

determining beats for the physiological indicator signal;

determining beat to beat intervals; and

applying a cubic spline algorithm to obtain a substantially continuous beat to beat interval signal indicative of heart rate.

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12. (Withdrawn) The method of claim 1 wherein the one or more physiological measurements comprise respiratory rate.

13. (Withdrawn) The method of claim 12 wherein measurement of respiratory rate comprises:

obtaining time--frequency spectrum of the physiological indicator signal utilizing variable frequency complex demodulation (VFCDM); and

obtaining respiratory rates by extracting a frequency component that has a largest amplitude for each time point at a heart rate frequency band.

14. (Withdrawn) The method of claim 1 wherein the one or more physiological measurements comprise a measure of oxygen saturation.

15. (Withdrawn) The method of claim 14 wherein providing a physiological indicator signal comprises:

placing a portion of a subject's body over an objective lens of a camera in a mobile communication device; and

obtaining video images of the portion of the subject's body, and

wherein obtaining the measure of oxygen saturation comprises:

obtaining an average intensity of a red component and a blue component of the video images of the portion of the subject's body; the average intensity of the red component and the average intensity of the blue component constituting DC_{RED} and DC_{BLUE} respectively;

obtaining a standard deviation of the red component and the blue component; the standard deviation of the red component and the blue component constituting AC_{RED} and AC_{BLUE} respectively; and

obtaining the measure of oxygen saturation (SpO2) by

$$SpO2 = A - B\frac{AC_{RED}/DC_{RED}}{AC_{BLUE}/DC_{BLUE}},$$

16. (Withdrawn) The method of claim 1 wherein the one or more physiological measurements comprise a measure of blood loss.

17. (Withdrawn) The method of claim 16 wherein obtaining the measure of blood loss comprises:

obtaining time–frequency spectrum of the physiological indicator signal utilizing variable frequency complex demodulation (VFCDM);

obtaining the amplitude modulation (AM) series from a set of the largest instantaneous amplitude at each time sample within the heart rate frequency band of the time–frequency spectrum; and

determining whether the amplitude modulation decreases; a decrease in the amplitude modulation indicating blood volume loss in subject.

18. (Previously presented) The method of claim 1 wherein the one or more physiological measurements comprise a measure of atrial fibrillation.

19. (Previously presented) A method for physiological parameter monitoring, the method comprising:

providing a physiological indicator signal to a handheld mobile communication device;

analyzing, using the handheld mobile communication device, the physiological indicator signal;

obtaining, from said analyzing, measurements of one or more physiological parameters; and

detecting, using the handheld mobile communication device and using only the measurements of one or more physiological parameters, effects of motion artifacts in the measurements of the one or more physiological parameters and deciding whether to retain the measurements based on effects of motion artifacts in the measurements;

wherein the one or more physiological measurements comprise a measure of atrial fibrillation;

wherein obtaining the measure of atrial fibrillation comprises:

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obtaining a time-varying coherence function by multiplying two time-varying transfer functions (TVFTs), the two time-varying transfer functions obtained using two adjacent data segments, from the physiological indicator signal, one of the two adjacent data segment as an input signal and another of the two adjacent data segment as an output signal to produce a first TVTF; a second TVTF is produced by reversing the input and the output signals, using said another of the two adjacent data segment as the input signal and said one of the two adjacent data segment as the output signal; and

determining whether the time-varying coherence function is less than a predetermined quantity.

20. (Previously presented) The method of claim 19 wherein determining whether the time-varying coherence function is less than the predetermined quantity comprises:

obtaining one or more indicators of atrial fibrillation; and

determining whether the one or more indicators of atrial fibrillation exceed predetermined thresholds.

21. (Previously presented) The method of claim 20 wherein the one or more indicators of atrial fibrillation comprise a variance of the time-varying coherence function.

22. (Previously presented) The method of claim 21 wherein the one or more indicators of atrial fibrillation also comprise Shannon entropy.

23. (Previously presented) The method of claim 20 wherein the predetermined thresholds are determined using receiver operator characteristic (ROC) analysis.

24. (Currently amended) A system for physiological parameter monitoring, the system comprising:

a physiological indicator signal sensing component; and a handheld mobile communication device comprising:

at least one processor; and

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at least one computer usable medium, the computer usable medium having computer readable code embodied therein, the computer readable code causing the at least one processor to:

analyze the physiological indicator signal;

obtain, from results of analyzing, measurements of one or more physiological parameters; and

detect effects of motion artifacts in the measurements of the one or more physiological parameters;

wherein the computer readable code, in causing the at least one processor to detect effects of motion artifacts, causes the at least one processor to:

a. ~~preprocess~~ filter and detrend a segment from the measurement of one physiological parameter; wherein a filtered and detrended segment is hereinafter referred to as a preprocessed segment;

b.

c. obtain a value of at least one indicator of volatility, used in determining whether motion artifacts are present, for the preprocessed segment; the at least one indicator of volatility being at least Shannon entropy for the preprocessed segment;

d. include the segment in analyses of physiological measurements when comparison of the value of the at least one indicator of volatility with a predetermined threshold indicates noise/motion artifacts are not present;

e. select another segment of the signal from the physiological measurement and proceeding to step (a) when the value of the at least one indicator of volatility is less than a predetermined threshold and another segment is available.

25-26. (Canceled)

27. (Currently amended) The system of claim 24 wherein said at least one indicator of volatility also comprises kurtosis.

28-29. (Canceled)

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30. (Previously presented) The system of claim 24 wherein the predetermined threshold is determined using receiver operator characteristic (ROC) analysis.

31. (Previously presented) The system of claim 24 wherein the physiological indicator signal sensing component comprises an image acquisition component, said acquisition component capable of acquiring a number of frames, each frame acquired at a predetermined time.

32. (Previously presented) The system of claim 31 wherein the handheld mobile communications device comprises said image acquisition component.

33. (Previously presented) The system of claim 24 wherein the physiological indicator signal sensing component comprises a physiological monitoring sensor.

34. (Previously presented) The system of claim 33 wherein the physiological monitoring sensor is a photoplethysmographic (PPG) sensor or an electrocardiogram sensor.

35. (Withdrawn) The system of claim 25 wherein the physiological indicator signal sensing component comprises an image acquisition component, said acquisition component capable of acquiring a number of frames, each frame acquired at a predetermined time; wherein said image acquisition component acquires a color image having red, green and blue components; wherein one or more physiological measurements comprise a measure of oxygen saturation; and wherein the computer readable code, in causing the at least one processor to analyze the physiological indicator signal, causes the at least one processor to:

obtain an average intensity of a red component and a blue component of the images of a portion of a subject's body; the average intensity of the red component and the average intensity of the blue component constituting DC_{RED} and DC_{BLUE} respectively;

obtain a standard deviation of the red component and the blue component; the standard deviation of the red component and the blue component constituting AC_{RED} and AC_{BLUE} respectively; and

obtain the measure of oxygen saturation by

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$$SpO2 = A - B\frac{AC_{RED}/DC_{RED}}{AC_{BLUE}/DC_{BLUE}},$$

36. (Withdrawn) The system of claim 25 wherein the one or more physiological measurements comprise heart rate and heart rate variability; and wherein the computer readable code, in causing the at least one processor to analyze the physiological indicator signal, causes the at least one processor to:

determine beats for the physiological indicator signal;

determine beat to beat intervals; and

apply a cubic spline algorithm to obtain a substantially continuous beat to beat interval signal indicative of heart rate.

37. (Withdrawn) The system of claim 25 wherein the one or more physiological measurements comprise respiratory rate; and wherein the computer readable code, in causing the at least one processor to analyze the physiological indicator signal, causes the at least one processor to:

obtain time–frequency spectrum of the physiological indicator signal utilizing variable frequency complex demodulation (VFCDM); and

obtain respiratory rates by extracting a frequency component that has a largest amplitude for each time point at a heart rate frequency band.

38. (Withdrawn) The system of claim 25 wherein the one or more physiological measurements comprise a measure of blood loss; and wherein the computer readable code, in causing the at least one processor to analyze the physiological indicator signal, causes the at least one processor to:

obtain time–frequency spectrum of the physiological indicator signal utilizing variable frequency complex demodulation (VFCDM);

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obtain the amplitude modulation (AM) series from set of the largest instantaneous amplitude at each time sample within the heart rate frequency band of the time–frequency spectrum; and

determine whether the amplitude modulation decreases; a decrease in the amplitude modulation indicating blood volume loss in subject.

39. (Previously presented) A system for physiological parameter monitoring, the system comprising:

a physiological indicator signal sensing component; and a handheld mobile communication device comprising:

at least one processor; and

at least one computer usable medium, the computer usable medium having computer readable code embodied therein, the computer readable code causing the at least one processor to:

analyze the physiological indicator signal;

obtain, from results of analyzing, measurements of one or more physiological parameters; and

detect effects of motion artifacts, using only the measurements of one or more physiological parameters, in the measurements of the one or more physiological parameters; wherein the one or more physiological measurements comprise a measure of atrial fibrillation; and wherein the computer readable code, in causing the at least one processor to analyze the physiological indicator signal, causes the at least one processor to:

obtain a time-varying coherence function by multiplying two time-varying transfer functions (TVFTs), the two time-varying transfer functions obtained using two adjacent data segments , from the physiological indicator signal, one of the two adjacent data segment as an input signal and another of the two adjacent data segment as an output signal to produce a first TVTF; a second TVTF is produced by reversing the input and the output signals, using said another of the two adjacent data segment as the input signal and said one of the two adjacent data segment as the output signal; and

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determine whether the time-varying coherence function is less than a predetermined quantity.

40. (Previously presented) The system of claim 39 wherein the computer readable code, in causing the at least one processor to determine whether the time-varying coherence function is less than the predetermined quantity, causes the at least one processor to:

obtain one or more indicators of atrial fibrillation; and

determine whether the one or more indicators of atrial fibrillation exceed predetermined thresholds.

41. (Previously presented) The system of claim 40 wherein the one or more indicators of atrial fibrillation comprise a variance of the time-varying coherence function.

42. (Previously presented) The system of claim 41 wherein the one or more indicators of atrial fibrillation also comprise Shannon entropy.

43. (Previously presented) The system of claim 41 wherein the predetermined thresholds are determined using receiver operator characteristic (ROC) analysis.

44. (Previously presented) A non-transitory computer usable medium having computer readable code embodied therein, the computer readable code causing at least one processor to:

analyze the physiological indicator signal;

obtain, from said analyzing, measurements of one or more physiological parameters; and

detect, using only the measurements of one or more physiological parameters, effects of motion artifacts in the measurements of the one or more physiological parameters;

wherein the computer readable code, in causing the at least one processor to detect effects of motion artifacts, causes the at least one processor to:

a. ~~preprocess~~ filter and detrend a segment from the measurement of one physiological parameter; wherein a filtered and detrended segment is hereinafter referred to as a preprocessed segment;

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b. obtain a value of at least one indicator of volatility, used in determining whether motion artifacts are present, for the preprocessed segment; the at least one indicator of volatility being at least Shannon entropy for the preprocessed segment;

c. include the segment in analyses of physiological measurements when comparison of the value of the at least one indicator of volatility with a predetermined threshold indicates noise/motion artifacts are not present;

d. select another segment of the signal from the physiological measurement and proceeding to step (a) when the value of the at least one indicator of volatility is less than a predetermined threshold and another segment is available.

45. (Withdrawn) The computer usable medium of claim 44 wherein the physiological indicator signal comprises a video color image having red, green and blue components, the video color image being an image obtained from of a portion of a subject's body; wherein the measurements of one or more physiological parameters comprise a measure of oxygen saturation; and wherein the computer readable code, in causing the at least one processor to analyze the physiological indicator signal, causes the at least one processor to:

obtain an average intensity of the red component and a blue component of the video color image of a portion of a subject's body; the average intensity of the red component and the average intensity of the blue component constituting DC_{RED} and DC_{BLUE} respectively;

obtain a standard deviation of the red component and the blue component; the standard deviation of the red component and the blue component constituting AC_{RED} and AC_{BLUE} respectively; and

obtain the measure of oxygen saturation by

$$SpO2 = A - B\frac{AC_{RED}/DC_{RED}}{AC_{BLUE}/DC_{BLUE}},$$

46. (Withdrawn) The computer usable medium of claim 44 wherein the one or more physiological measurements comprise heart rate and heart rate variability; and wherein the

computer readable code, in causing the at least one processor to analyze the physiological indicator signal, causes the at least one processor to:

determine beats for the physiological indicator signal;

determine beat to beat intervals; and

apply a cubic spline algorithm to obtain a substantially continuous beat to beat interval signal indicative of heart rate.

47. (Withdrawn) The computer usable medium of claim 44 wherein the one or more physiological measurements comprise respiratory rate; and wherein the computer readable code, in causing the at least one processor to analyze the physiological indicator signal, causes the at least one processor to:

obtain time–frequency spectrum of the physiological indicator signal utilizing variable frequency complex demodulation (VFCDM); and

obtain respiratory rates by extracting a frequency component that has a largest amplitude for each time point at a heart rate frequency band.

48. (Withdrawn) The computer usable medium of claim 44 wherein the one or more physiological measurements comprise a measure of blood loss; and wherein the computer readable code, in causing the at least one processor to analyze the physiological indicator signal, causes the at least one processor to:

obtain time–frequency spectrum of the physiological indicator signal utilizing variable frequency complex demodulation (VFCDM);

obtain the amplitude modulation (AM) series from set of the largest instantaneous amplitude at each time sample within the heart rate frequency band of the time–frequency spectrum; and

determine whether the amplitude modulation decreases; a decrease in the amplitude modulation indicating blood volume loss in subject.

49. (Previously presented) A non-transitory computer usable medium having computer readable code embodied therein, the computer readable code causing at least one processor to:

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analyze the physiological indicator signal;

obtain, from said analyzing, measurements of one or more physiological parameters; and

detect, using only the measurements of one or more physiological parameters, effects of motion artifacts in the measurements of the one or more physiological parameters;

wherein the one or more physiological measurements comprise a measure of atrial fibrillation; and wherein the computer readable code, in causing the at least one processor to analyze the physiological indicator signal, causes the at least one processor to:

obtain a time-varying coherence function by multiplying two time-varying transfer functions (TVFTs), the two time-varying transfer functions obtained using two adjacent data segments, from the physiological indicator signal, one of the two adjacent data segment as an input signal and another of the two adjacent data segment as an output signal to produce a first TVTF; a second TVTF is produced by reversing the input and the output signals, using said another of the two adjacent data segment as the input signal and said one of the two adjacent data segment as the output signal; and

determine whether the time-varying coherence function is less than a predetermined quantity.

50. (Previously presented) The non-transitory computer usable medium of claim 44 wherein the computer readable code, in causing the at least one processor to determine whether the time-varying coherence function is less than the predetermined quantity, causes the at least one processor to:

obtain one or more indicators of atrial fibrillation; and

determine whether the one or more indicators of atrial fibrillation exceed predetermined thresholds.

51. (Previously presented) The non-transitory computer usable medium of claim 50 wherein the one or more indicators of atrial fibrillation comprise a variance of the time-varying coherence function.

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52. (Previously presented) The non-transitory computer usable medium of claim 51 wherein the one or more indicators of atrial fibrillation also comprise Shannon entropy.

53. (Previously presented) The computer usable medium of claim 50 wherein the predetermined thresholds are determined using receiver operator characteristic (ROC) analysis.

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REMARKS

Applicants have carefully reviewed the Office Action dated December 1, 2015, and this response addresses the Examiner's concerns. Applicants respectfully request reconsideration of the application.

I. STATUS OF THE CLAIMS

Claims 1, 3-24 and 27-53 are pending in the application.

Claims 10-17, 35-38 and 45-48 are withdrawn from consideration.

Claims 1, 3-9, 18-24, 27-34, 39-44, and 49-53 are rejected.

Claims 2 and 25-26 are cancelled.

Claims 1, 24 and 44 are amended. Support for the amendments to claims 1, 24 and 44 can be found in paragraph 44 and 45 of the specification.

II. THE 35 U.S.C. 101 REJECTIONS

Claims 1, 3-24, and 27-53 are rejected under 35 U.S.C. §101 because the claimed inventions are directed to a judicial exception (i.e., a law of nature, a natural phenomenon, or an abstract idea) without significantly more.

Applicants respectfully state that, for the reasons given below, claims 1, 3-24, 27-53 recite patentable subject matter.

Claim 1 is directed to a methods for physiological parameter monitoring, where the physiological parameter is a parameters such as blood loss, oxygen saturation heart rate variability, atrial fibrillation and others. There is a need for low-cost physiological monitoring solutions that are easy to use, accurate, and can be used in the home or in ambulatory situations. The method starts by providing a physiological indicator signal to a handheld communication device. Measurements of one or more physiological parameters are obtained from the physiological indicator signal. Motion artifacts can affect the results of standard PPG. In the case of a mobile device and where there is no physical device ensuring a stable connection as is the case with pulse-oximeter clips or EKG electrodes, motion artifacts can be of more concern. It is well known that the PPG is highly sensitive to artifacts, particularly those generated while the patient is in motion. This imposes a huge limitation on the usability of the PPG for ambulatory

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monitoring applications. Motion artifacts) distorting PPG recordings can cause erroneous estimation of HR and SpO2. In order to make a handheld mobile communication device useful in monitoring physiological parameters, the method proceeds to determine whether motion artifacts are present in the measurements in order to retain only those measurements where motion artifacts are not present. In determining the presence of motion artifacts, the method uses Shannon entropy as an indicator of motion artifacts. The method, system and computer program product of the claimed invention produces measurements of one or more physiological parameters using a system that can be used in the home or in ambulatory situations and eliminates the erroneous measurements due to motion artifacts. The claimed invention is an improvement in the technology of physiological parameter monitoring in home or ambulatory environments. In the present claimed invention, concepts are applied "'to a new and useful end,'"

Since the Courts have recognized that the two steps of the *Alice/Mayo* test "are easier to separate in recitation than in application," (see **Central District CA CASE NO. SACV 11-00189 AG (RNBx) AMERANTH v. GENESIS GAMING SOLUTIONS, ORDER DENYING MOTION FOR SUMMARY JUDGMENT OF INVALIDITY,** January 2, 2015) although Applicants do not acquiesce to the claims being directed to an abstract idea, applicants present the following arguments while not following sequentially the steps in the Alice/Mayo test.

Claims provide an improvement in another technology and a new and useful result

As stated above, the method, system and computer program product of the claimed invention produce measurements of one or more physiological parameters using a system that can be used in the home or in ambulatory situations and eliminate the erroneous measurements due to motion artifacts. The claimed invention is an improvement in the technology of physiological parameter monitoring in home or ambulatory environments. In the present claimed invention, concepts are applied "'to a new and useful end'"

The USPTO Guidelines on Subject Matter Eligibility state that limitations that may be enough to qualify as "significantly more" when recited in a claim with a judicial exception include improvements to another technology or technical field, citing *Alice Corp. Pty. Ltd. v. CLS Bank International, 134 S. Ct. 2347, 2357* (2014). The Supreme Court in the *Alice* decision

stated that, "Thus, an invention is not rendered ineligible for patent simply because it involves an abstract concept. "[A]pplication[s]" of such concepts "'to a new and useful end,'" we have said, remain eligible for patent protection. " *Alice*, 134 S. Ct. at 2354 (citations omitted).
The present claimed invention presents an improvement in in the technology of physiological parameter monitoring in home or ambulatory environments and produces measurements of one or more physiological parameters using a system that can be used in the home or in ambulatory situations and eliminates the erroneous measurements due to motion artifacts. The present claimed invention applies concepts to reach a new and useful end, measurements of one or more physiological parameters using a system that can be used in the home or in ambulatory situations and eliminates the erroneous measurements due to motion artifacts. Since the claimed invention is an improvement in another field of technology and it applies concepts to arrive at a new and useful end, the claimed invention is patent eligible subject matter.

Applicants respectfully state that the claims transform the physiological indicator signal data into measurements of one or more physiological parameters

The present claim invention transforms the physiological indicator signal data into measurements of one or more physiological parameters obtained only from segments where noise/motion artifacts are not present.

In *PNC Bank v. Secure Axcess, LLC* (CBM2012-00100, PTAB, September 9, 2014), the Patent Trial and Appeal Board provided an instructive analytical framework in deciding if a claim is directed towards an abstract idea under part one of the *Alice* test. In PNC, the PTAB first examined the claim as a whole, citing *Alice*, 134 S. CT. at 2355 n. 3. Claim 1 in the PNC case, as a whole, relates to: "a computer-implemented method to transform data in a particular manner - by inserting an authenticity key to create formatted data, enabling a particular type of computer file to be located and from which an authenticity stamp is retrieved." PNC, page 20 (emphasis added). "Rather, the challenged claims specifically recite "transforming . . . received data by inserting an authenticity key to create formatted data," thereby authenticating a web page with an authenticity stamp. Thus, the claims require a fundamental change to the data; a change that cannot be performed in the human mind." PNC, page 22.

The PTAB then concluded that, "For these reasons, we are not persuaded by Petitioner's assertion that claims 1-32 are patent-ineligible abstract ideas." PNC, page 23.

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As in *PNC Bank*, the claimed invention transforms the transforms the physiological indicator signal data into measurements of one or more physiological parameters obtained only from segments where noise/motion artifacts are not present, a change that cannot be performed in the human mind. As in *PNC Bank*, the claimed invention is patent eligible.

It should be noted that the claimed invention satisfies another criteria that the USPTO Guidelines on Subject Matter Eligibility state that Limitations that may be enough to qualify as "significantly more" when recited in a claim with a judicial exception satisfy, Effecting a transformation or reduction of a particular article to a different state or thing.

As the PTAB stated in *PNC Bank*, "We are not persuaded that "transforming . . . received data by inserting an authenticity key to create formatted data" fails to satisfy the transformation prong." PNC (page 24). As in PNC Bank, transforming the physiological indicator signal data into measurements of one or more physiological parameters obtained only from segments where noise/motion artifacts are not present satisfies the transformation requirement.

Since the claimed invention transforms the physiological indicator signal data into measurements of one or more physiological parameters obtained only from segments where noise/motion artifacts are not present, Applicants respectfully state that the claimed invention is patentable subject matter.

Applicants respectfully state that the claims apply the judicial exception, if one is present, with, or by use of, a particular machine

As recited in the claims, the transforms the physiological indicator signal data into measurements of one or more physiological parameters is performed by a processor executing recited algorithms. However, the computer executing recited new algorithms is not a general purpose computer. *See, e.g., Noah Sys., Inv. v. Intuit Inc.*, 675 F.3d 1302, 1312 (Fed. Cir. 2012). A computer executing recited new algorithms is a specific machine. See *In re Alappat,* 33 F.3d 1526, 1545, 31 USPQ 1545, 1558 (Fed. Cir. 1994).

The USPTO Guidelines on Subject Matter Eligibility state that limitations that may be enough to qualify as "significantly more" when recited in a claim with a judicial exception include applying the judicial exception with, or by use of, a particular machine, citing Bilski, 130 S. Ct. at 3227.

Since the method of claim 17 and dependent claims is performed by use of a particular machine, applicants respectfully state that claim 17 in the dependent claims recite patentable subject matter.

The claims do not unduly pre-empt others from applying the concept of Shannon entropy

The Supreme Court, in *Alice*, stated that, "The concern that drives the exclusionary principle - exclude Laws of nature, natural phenomena, and abstract ideas - is one of pre-emption. *Alice*, 134 S. Ct. at 2354. Laws of nature, natural phenomena, and abstract ideas are basic tools. The Supreme Court, in *Alice*, stated that "monopolization of those tools through the grant of a patent might tend to impede innovation more than it would tend to promote it, thereby thwarting the primary object of the patent laws." *Alice*, 134 S. Ct. at 2354.

However, the Court in *Alice* gave little insight as to how to determine if there is undue pre-emption of the field, since all claims pre-empt something. The Federal Circuit, in *Accenture*, provides guidance, stating that "In the case of abstractness, the court must determine whether the claim poses "any risk of preempting an abstract idea." To do so the court must first "identify and define whatever fundamental concept appears wrapped up in the claim." Then, proceeding with the preemption analysis, the balance of the claim is evaluated to determine whether "additional substantive limitations . . . narrow, confine, or otherwise tie down the claim so that, in practical terms, it does not cover the full abstract idea itself."" *ACCENTURE GLOBAL SERVICES, GMBH v. GUIDEWIRE SOFTWARE, INC.*, 728 F.3d 1336, 1341 (Fed. Cir. 2013).

The concept of Shannon entropy has been applied in communications, where it originated (see, for example, Without Shannon's information theory there would have been no internet, The Guardian, June 22, 2014, http://www.theguardian.com/science/2014/jun/22/shannon-information-theory , provided in the Appendix) , in the identification of putative drug targets (see The application of Shannon entropy in the identification of putative drug targets, BioSystems 55 (2000) 5–14), in quantifying the quality of mixing in various systems, including polymeric ones (see Quantifying Fluid Mixing with the Shannon Entropy, Macromolecular Theory and Simulations, Volume 15, Issue 8, pages 595–607, October 11, 200, both of which are provided in the Appendix) and in a number of other applications. In the method of clam 1, the use of

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Shannon entropy is tied to the determination of whether the effects of motion artifacts are present in the measurement of the physiological parameter.

The method, system and computer program product of the claimed invention produces measurements of one or more physiological parameters using a system that can be used in the home or in ambulatory situations and eliminates the erroneous measurements due to motion artifacts. The claimed invention is an improvement in the technology of physiological parameter monitoring in home or ambulatory environments. In the present claimed invention, concepts are applied "'to a new and useful end,'"

Since the method, system and computer program product of the claimed invention produces measurements of one or more physiological parameters using a system that can be used in the home or in ambulatory situations and eliminates the erroneous measurements due to motion artifacts, the claimed invention is an improvement in the technology of physiological parameter monitoring in home or ambulatory environments. In the present claimed invention, concepts are applied "'to a new and useful end,'" and these improvement are obtained through substantive limitations in the claimed invention, the claimed invention does not preempt the applying of the concept of Shannon entropy. Applicants respectfully state that the claimed invention recites patentable subject matter.

Applicants respectfully state that equating generic computer functions performing well-understood, routine, and conventional activities previously known to the industry to the cited prior art (as the examiner states, "e.g. "using a handheld mobile communication device for detecting effects of motion artifacts and associated functions/steps and deciding whether to retain the measurements based on detected effects of motion artifacts"; see Greco and Lichter below") is not supported by substantial evidence. Applicants respectfully state that, to the applicants' knowledge, there is no opinion of the Supreme Court or the Federal Circuit that equates generic computer functions performing well-understood, routine, and conventional activities previously known to the industry to the cited prior art.

As the Supreme Court stated in KSR, "because inventions in most, if not all, instances rely upon building blocks long since uncovered, and claimed discoveries almost of necessity will be combinations of what, in some sense, is already known." KSR Int'l Co. v. Teleflex Inc., 127 S. Ct. 1727 (2007). Equating generic computer functions performing well-understood, routine,

and conventional activities previously known to the industry to the cited prior art would render almost all inventions non-patentable subject matter.

"Whether a claim is directed to statutory subject matter is a question of law. .. determination of this question may require findings of underlying facts specific to the particular subject matter and its mode of claiming" *Accenture Global Servs. GmbH v. Guidewire Software, Inc.*, 728 F.3d 1336, 1344 (Fed. Cir. 2013) as cited in **MORTGAGE GRADER, INC. v. FIRST CHOICE LOAN SERVICES INC.,** Opinion 2015-1415, January 20, 2016 (Fed. Cir.). , Applicants respectfully kindly request the examiner to support his statements by substantial evidence as stated in MPEP 2144.0 3C.

III. THE 35 U.S.C. 103 REJECTIONS

Claims 1, 3-5, 8-9, 24, 27-29, 33-34, and 44 are rejected under pre-AIA 35 U.S.C. §103(a) as being unpatentable over Greco et al., "Kurtosis, Renyi's Entropy and Independent Component Scalp Maps for the Automatic Artifact Rejection from EEG data". International Journal of Computer, Information, Systems and Control Engineering 2(9), January 2008: 180-184) in view of Lichter et al. (US 6,159,147).

Applicants respectfully state that, for the reasons given below, a *prima facie* case of obviousness has not been established for claims 1, 3-5, 8-9, 24, 27-29, 33-34 and 44.

Claims 1, 24 and 44, as amended, teach filtering and detrending a segment from the measurement of one physiological parameter, wherein a filtered and detrended segment is hereinafter referred to as a preprocessed segment; the filtered segment being used to determine the presence of motion artifacts.

Lichter is silent as to preprocessing or detection of motion artifacts. Greco starts by performing an independent component analysis (ICA) of the data and then determines the presence of motion artifacts using the independent components (IC) and the independent component's statistical properties (kurtosis and entropy, Renyi entropy being shown to be a better indicator) (Greco, first page, 2nd column, fourth paragraph, "Since it is accepted that the artifactual signals are independent from the rest, it is also well accepted that the artifactual signals can be extracted by Independent Component Analysis (ICA). ICA has been widely exploited as a tool for artifactual signals extraction, since it was proposed by Cichocki et al.

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[1] and Jung et al. [2]. The artifactual signal is isolated by ICA as a component independent from the rest."; Greco, second page, 2nd column, third paragraph,

An approximation of the (13) was used:

$$H^i(j) = -\sum_{x \in j} f_j^i(x) \log\left(f_j^i(x)\right) \qquad (14)$$

which is the entropy of the *ICi* in the trial *j*, and $f_j^i(x)$ is the pdf of the component *ICi* during trial *j*.)

Applicants respectfully state that neither Greco nor Lichter teach or suggest band pass filtering and detrending a segment from the measurement of one physiological parameter; wherein a band pass filtered and detrended segment is hereinafter referred to as a preprocessed segment.

Claims 1, 24 and 44 , as amended, teach obtaining a value of at least one indicator of volatility, used in determining whether motion artifacts are present, for the preprocessed segment; the at least one indicator of volatility being at least Shannon entropy for the preprocessed segment.

Applicants respectfully state that the broadest interpretation of the claims as will be interpreted by one skilled in the art upon reading the specification would be that the Shannon entropy is defined by equation 2 in paragraph 49 of the specification where $p(i)$ is the probability distribution of the signal amplitude.

Applicants respectfully states that, even though equation 2 of the applicants looks the same as equations 13 and 14 of Greco, the terms in equations 13 and 14 of Greco have different meaning than those of equation 2 of the Applicant's specification. Equations 13 and 14 of Greco do not teach or suggest Shannon entropy for the bandpass filtered and detrended segment and neither does Lichter.

Applicants respectfully state that neither Greco nor Lichter teach or suggest obtaining a value of at least one indicator of volatility, used in determining whether motion artifacts are present, for the preprocessed segment; the at least one indicator of volatility being at least Shannon entropy for the preprocessed segment.

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To establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974).

Applicants respectfully state that a *prima facie* case of obviousness has not been established for claims 1, 24 and 44.

Claims 3-5, 8-9 dependent on claim 1. Claims 27-29, 33-34 dependent on claim 24.

Applicants respectfully state that a *prima facie* case of obviousness has not been established for claims 1, 3-5, 8-9, 24, 27-29, 33-34 and 44.

Claims 6 and 30 are rejected under pre-AIA 35 U.S.C. §103(a) as being unpatentable over the combination of Greco et al. and Lichter et al. as applied to claims 1 and 24 above, and further in view of Maier et al. (US 2006/0253261).

Claim 6 is dependent on claim 1 and claim 30 is dependent on claim 24.

As stated above, neither Greco nor Lichter teach or suggest band pass filtering and detrending a segment from the measurement of one physiological parameter; wherein a band pass filtered and detrended segment is hereinafter referred to as a preprocessed segment, or obtaining a value of at least one indicator of volatility, used in determining whether motion artifacts are present, for the preprocessed segment; the at least one indicator of volatility being at least Shannon entropy for the preprocessed segment. Applicant respectfully state that Maier also does not teach or suggest the limitations of claims 1 and 24 that are not taught or suggested by Greco or Lichter.

Applicants respectfully state that a *prima facie* case of obviousness has not been established for claim 6 and claim 30.

Claims 7 and 31-32 are rejected under pre-AIA 35 U.S.C. §103(a) as being unpatentable over the combination of Greco et al. and Lichter et al. as applied to claims 1 and 24 above, and further in view of Jacobsen et al. (US 6,198,394).

Claim 7 depends on claim 1 and claims 31-32 depend on claim 24.

As stated above, neither Greco nor Lichter teach or suggest band pass filtering and detrending a segment from the measurement of one physiological parameter; wherein a band

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pass filtered and detrended segment is hereinafter referred to as a preprocessed segment, or obtaining a value of at least one indicator of volatility, used in determining whether motion artifacts are present, for the preprocessed segment; the at least one indicator of volatility being at least Shannon entropy for the preprocessed segment. Applicant respectfully state that Jacobsen also does not teach or suggest the limitations of claims 1 and 24 that are not taught or suggested by Greco or Lichter.

Applicants respectfully state that a *prima facie* case of obviousness has not been established for claims 7 and 31-32.

Claim 18 is rejected under pre-AIA 35 U.S.C. §103(a) as being unpatentable over the combination of Greco et al. and Lichter et al. as applied to claim 1 above, and further in view of Zhang (US 2009/0112210).

Claim 18 is dependent on claim 1.

As stated above, neither Greco nor Lichter teach or suggest band pass filtering and detrending a segment from the measurement of one physiological parameter; wherein a band pass filtered and detrended segment is hereinafter referred to as a preprocessed segment, or obtaining a value of at least one indicator of volatility, used in determining whether motion artifacts are present, for the preprocessed segment; the at least one indicator of volatility being at least Shannon entropy for the preprocessed segment. Applicant respectfully state that Zhang also does not teach or suggest the limitations of claims 1 and 24 that are not taught or suggested by Greco or Lichter.

Applicants respectfully state that a *prima facie* case of obviousness has not been established for claim 18.

IV. DOUBLE PATENTING

Claims 19-23, 39-43, 49-53 are rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1-16 of U.S. Patent No. 8,755,876 in view of Greco and Lichter.

While Applicants are not opposed to filing a terminal disclaimer, Applicants respectfully state that nonstatutory obviousness double patenting requires a *prima facie* case of obviousness.

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U.S. Patent No. 8,755,876 only claims the detection of atrial fibrillation while claim 19 recites "detecting, using the handheld mobile communication device and using **only** the measurements of one or more physiological parameters, effects of motion artifacts in the measurements of the one or more physiological parameters and deciding whether to retain the measurements based on effects of motion artifacts in the measurements." Claims 39 and 49 also recite detecting, using the handheld mobile communication device and using **only** the measurements of one or more physiological parameters, effects of motion artifacts. Greco teaches performing Independent Component Analysis on the preprocessed data in order to obtain independent components and obtaining a value of at least one indicator of volatility for the **independent component in** order to detect motion artifacts. Applicants respectfully state that Greco does not teach or suggest using **only** the measurements of one or more physiological parameters to detect the effect of motion artifacts and neither does Lichter. Applicants respectfully state that a *prima facie* case of obviousness has not been established for 19-23, 39-43, 49-53 and nonstatutory obviousness double patenting is not proper.

V. CONCLUSION

Any amendments to the claims as set forth herein, including the modification, addition, cancellation, or withdrawal of any claims, have been offered to advance this application to issue. None of the amendments made herein should be construed as an admission that the subject matter of the claims, as originally filed, is anticipated by or made obvious in light of any art of record whether considered singularly or in combinations. Applicants expressly reserve the right to pursue the originally filed claims in another co-pending application without being prejudiced by any amendments, including cancellation of claims, made herein.

The Director of Patents and Trademarks is hereby authorized to charge any underpayment of fees, or credit any overpayments, to Deposit Account 03-2410 (Order No. 30210-201).

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The following information is presented in the event that a call may be deemed desirable by the Examiner:

ORLANDO LOPEZ (617) 345-3000.

Respectfully submitted,

Dated: March 1, 2016

By: /Orlando Lopez/
Orlando Lopez, Ph.D.
Reg. No. 46,880
Attorney for Patent Application Owners

4848-9402-8846.1

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PATENT APPLICATION
Attorney Docket No. 30210-201

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Ki H. Chon et al.
Serial Number: 13/354,941
Filed: January 20, 2012
Title: PHYSIOLOGICAL PARAMETER MONITORING WITH A MOBILE COMMUNICATION DEVICE

Examiner: LIU, CHU CHUAN
Group Art Unit: 3777
Confirmation No. 9133

Burns & Levinson LLP
125 Summer Street
Boston, MA 02110
(617) 345-3000

To: Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

STATEMENT OF SUBSTANCE OF THE INTERVIEW

Sir:

Pursuant to 37 CFR 1.133, Applicants' attorney submits the following written statement of the substance of the telephone interview conducted on November 5, 2015 between Orlando Lopez, Applicants' representative, and Examiners Chu Chuan Li and Tse Chen.

Claims discussed
Claim 1

Prior Art discussed
Greco et al. (2008 publication)

Outcome
No agreement was reached.

In accordance with Section 714.01 of the MPEP, the following information is presented in the event that a call may be deemed desirable by the Examiner:
ORLANDO LOPEZ (617) 345-3000.

Respectfully submitted,

Dated: March 1, 2016

By: /Orlando Lopez/
Orlando Lopez
Reg. No. 46,880
Attorney for Patent Application Owner

Electronic Acknowledgement Receipt

EFS ID:	25064639
Application Number:	13354941
International Application Number:	
Confirmation Number:	9133
Title of Invention:	PHYSIOLOGICAL PARAMETER MONITORING WITH A MOBILE COMMUNICATION DEVICE
First Named Inventor/Applicant Name:	Ki H. Chon
Customer Number:	26486
Filer:	Marlo Schepper Grolnic
Filer Authorized By:	
Attorney Docket Number:	30210-201
Receipt Date:	01-MAR-2016
Filing Date:	20-JAN-2012
Time Stamp:	14:26:00
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		201ROASOS.pdf	1499814 a1302d34bc6d192321c7f9adc8192d333095586d	yes	28

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Amendment/Req. Reconsideration-After Non-Final Reject	1	1
	Claims	2	15
	Applicant Arguments/Remarks Made in an Amendment	16	27
	Applicant summary of interview with examiner	28	28

Warnings:	
Information:	
Total Files Size (in bytes):	1499814

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 13/354,941	Filing Date 01/20/2012	☐ To be Mailed

ENTITY: ☐ LARGE ☒ SMALL ☐ MICRO

APPLICATION AS FILED – PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	RATE ($)	FEE ($)
☒ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	**190**
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).			
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL	**190**

APPLICATION AS AMENDED – PART II

AMENDMENT **03/01/2016**

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	* 46	Minus	** 46	= 0	X $40 =	0
Independent (37 CFR 1.16(h))	* 6	Minus	***6	= 0	X $210 =	0
☐ Application Size Fee (37 CFR 1.16(s))						
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
					TOTAL ADD'L FEE	**0**

AMENDMENT

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =	
☐ Application Size Fee (37 CFR 1.16(s))						
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
					TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

LIE
/GLORIA J. TRAMMELL/

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/354,941	01/20/2012	Ki H. Chon	30210-201	9133

26486 7590 04/28/2016

BURNS & LEVINSON, LLP
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BOSTON, MA 02110

EXAMINER
LIU, CHU CHUAN

ART UNIT	PAPER NUMBER
3777	

NOTIFICATION DATE	DELIVERY MODE
04/28/2016	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

docketing@burnslev.com

Office Action Summary	Application No. 13/354,941	Applicant(s) CHON ET AL.	
	Examiner CHU CHUAN (JJ) LIU	Art Unit 3777	AIA (First Inventor to File) Status No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *03/01/2016*.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

5)☒ Claim(s) *1,3,6-24,27 and 30-53* is/are pending in the application.

5a) Of the above claim(s) *10-17,35-38 and 45-48* is/are withdrawn from consideration.

6)☐ Claim(s) _____ is/are allowed.

7)☒ Claim(s) *1,3,6-9,18-24,27,30-34,39-44 and 49-53* is/are rejected.

8)☐ Claim(s) _____ is/are objected to.

9)☐ Claim(s) _____ are subject to restriction and/or election requirement.

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a)☐ All b)☐ Some** c)☐ None of the:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☒ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date *01/19/2016*.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

4) ☐ Other: _____.

DETAILED ACTION

1. The present application is being examined under the pre-AIA first to invent provisions.

2. The amendments and remarks filed on 03/01/2016 have been fully considered.

Status of Claims

3. Claims 1, 3, 6-24, 27, and 30-53 are pending for examination. Claims 10-17, 35-38, and 45-48 are withdrawn from consideration. Claims 2, 4-5, 25-26, and 28-29 are cancelled.

Claim Objections

4. Claim 24 is objected to because of the following informalities: In regard to claim 24, step b should be deleted and steps “c”, “d”, and “e” should be set forth “b”, “c”, and d”, respectively. Appropriate correction is required.

Claim Rejections - 35 USC § 101- abstract idea

5. 35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

6. Claims 1, 3, 6-24, 27, and 30-53 are rejected under 35 U.S.C. 101 because the claimed inventions are directed to a judicial exception (i.e., a law of nature, a natural phenomenon, or an abstract idea) without significantly more. Claims 1, 19, 24, 39, 44,

and 49 are directed to an abstract idea. Instant claims 1, 19, 24, 39, 44, and 49 are drawn to “method(s) or system(s)” (prong 1 of the two-part test). In this case, the claims are directed to the judicial exception of **mathematical relationship and/ or ideas**, which is considered an abstract idea, or concepts similar to those found by the courts to be abstract, as they require mathematically relating data and/or comparing data (prong 2A of the two-part test). See also Federal Register, Vol. 79, No. 241, December 16, 2014 at 74622, column 2 and see “An algorithm for calculating parameters indicating an abnormal condition” or other associated examples, of Identifying Abstract Ideas in July 2015 Update: Interim Eligibility Guidance.

The claim(s) does/do not include additional steps/elements that are sufficient to amount to significantly more than the judicial exception for the following reasons (prong 2B of the two-part test). In particular, the claimed steps amount to nothing more than: routine data collection and/or insignificant extrasolution activity (e.g. "providing a physiological indicator signal; analyzing the signal by using a handheld mobile communication device; and obtaining one or more physiological parameters"); generic computer functions performing well-understood, routine, and conventional activities previously known to the industry (e.g. "using a handheld mobile communication device for detecting effects of motion artifacts and associated functions/steps and deciding whether to retain the measurements based on detected effects of motion artifacts; filtering and detrending measurements, obtaining/ comparing Shannon entropy of the processed segment, include or select segment based on the comparison of Shannon entropy"; see art rejections below); generic processing steps recited at a high level of

generality such that substantially all practical applications of the judicial exception(s) are covered (e.g. "using a handheld mobile communication device for detecting effects of motion artifacts and associated functions/steps and deciding whether to retain the measurements based on detected effects of motion artifacts; filtering and detrending measurements, obtaining/ comparing Shannon entropy of the processed segment, include or select segment based on the comparison of Shannon entropy"; see art rejections below); and/or general instructions to apply or use the judicial exception(s) (e.g. "using a handheld mobile communication device for detecting effects of motion artifacts and associated functions/steps and deciding whether to retain the measurements based on detected effects of motion artifacts; filtering and detrending measurements, obtaining/ comparing Shannon entropy of the processed segment, include or select segment based on the comparison of Shannon entropy"; see art rejections below).

Therefore, these features when considered separately and in combination, do not add significantly more to the judicial exception. Additionally, the claims fail to recite any limitations that purport to improve the functioning of the computer itself or effect an improvement in any other technology or technical field, or provide meaningful limitations beyond generally linking the use of an abstract idea to a particular technological environment.

For additional guidance, applicant is directed generally to MPEP 2106 and to the USPTO's December 2014 Interim Guidance on Subject Matter Eligibility (Federal Register notice titled 2014 Interim Guidance on Patent Subject Matter Eligibility, 79 FR

74618) and Identifying Abstract Ideas in July 2015 Update: Interim Eligibility Guidance, as above, and http://www.uspto.gov/patent/laws-and-regulations/examination-policy/2014-interim-guidance-subject-matter-eligibility-0.

Response to Arguments

7. Applicant's arguments filed on 03/01/2016 have been fully considered but they are not persuasive. In regard to 35 USC 101 rejection, Applicant first alleged that the claims provide an improvement in a technology or technical field. In response, no specific technology or technical field is reflected in the claim(s). In pages 16 and 17 of Remarks filed on 03/01/2016, Applicant indicated that the physiological parameter includes blood loss, oxygen saturation heart rate variability, arterial fibrillation and others; PPG, EKG, HR and SpO2. However, the claim(s) recites physiological indicator signal and one or more physiological parameters, which are broad enough to cover all possible physiological signals/parameters in physiological and/ or all medical fields associated with physiological conditions. Therefore, the claimed invention is not considered as provide improvements in any specific technology or technical field.

Secondly, Applicant alleged that the claims transform the physiological indicator signal data into measurements of one or more physiological parameters. In response, the transformation is considered as mathematically relating data and/or routine data collection and/or insignificant extra-solution activity (see above).

Thirdly, Applicant alleged that the claims apply the judicial exception with or by use of a particular machine. In response, the claim(s) recite a handheld mobile

communication device which covers all possible devices for communication and can be held by hand. No a particular machine is recited in the claim(s).

Forth of all, applicant alleged that the claims do not preempt others from applying the concept of Shannon entropy. In response, the claims preempt others from applying the concept of Shannon entropy in all possible physiological signals/parameters in physiological and/ or all medical fields associated with physiological conditions (e.g. the claimed invention is applicable to a certain types of physiological signals/parameters)

Claim Rejections - 35 USC § 103

8. The following is a quotation of pre-AIA 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

9. Claims 1, 3, 8-9, 24, 27, 33-34, and 44 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Greco et al., "Kurtosis, Renyi's Entropy and Independent Component Scalp Maps for the Automatic Artifact Rejection from EEG data". International Journal of Computer, Information, Systems and Control Engineering 2(9), January 2008: 180-184 – cited by applicant) in view of Lichter et al. (USPN 6,159,147 – cited in previous action) and further in view of Reisfeld et al. (USPGPUB 2007/0213624). In regard to claims 1, 3, 24, 27 and 44, Greco discloses a method and an apparatus for physiological parameter monitoring (abstract and associated

descriptions), the method comprising: providing a physiological indicator signal (electric signals, Fig. 1 and associated descriptions in page 203) obtained from a physiological indicator signal sensing component (EEG sensors and a recording machine, Fig. 1 and associated descriptions in page 203) to a device (EEGLAB, pages 206 and 207; it is inherently that the downloaded program is executed by a computer); analyzing, using the device, the physiological indicator signal (amplifier, page 203 and Sec. IV, page 206); obtaining, from said analyzing, measurements of one or more physiological parameters (EEG signals and associated independent components/ ICs in page 206); and detecting, using the device and using only the measurements of the one or more physiological parameters (ICs in the detected EEG signals pages 205-206), effects of motion artifacts in the measurements of the one or more physiological parameters (first paragraph in the right column of page 203; Sec. IV on page 206) and deciding whether to retain the measurements based on detected effects of motion artifacts (reject an IC, Sec. IV on page 206), wherein the step of detecting effects of motion artifacts in the measurements comprises: a. preprocessing/ filtering a segment from the measurement of one physiological parameter (remove noise with notch filter, Sec. IV on page 206); b. obtaining a value of at least one indicator of volatility, used in determining whether motion artifacts are present, for the preprocessed segment; the at least one indicator of volatility being at least one of kurtosis and Shannon entropy for the preprocessed segment (kurtosis and Shannon entropy, Sec. III, A and B, pages 205-206). c. including the segment in analyses of physiological measurements, when comparison of the value of the at least one indicator of volatility with a predetermined threshold (threshold of ±

1.64, Sec. III, A and B, pages 205-206) indicates noise/motion artifacts are not present (reject the ICs only when the volatility exceeds the threshold, Sec. III, A and B, pages 205-206; i.e. the ICs not exceeded the threshold is included); and d. selecting another segment of the signal from the physiological measurement and proceeding to step (a) when the value of the at least one indicator of volatility is less than a predetermined threshold and another segment is available (comparing all ICs extracted from the data segments/ trials with the threshold and rejecting the IC(s) exceed the threshold, Sec. III and IV on pages 205-207).

Greco does not specifically disclose the device is a handheld mobile communication device.

Lichter teaches a handheld mobile communication device (personal computer 27, Figs. 2-3) which can be connected to various sensors to measure and analyze the collected data (Figs. 16) including EEG (Fig. 16). One ordinary would have recognized that a personal computer is an alternative equivalent computing device. Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention was made to substitute the device/ computer (Greco) with the handheld mobile communications device (Lichter) to yield predictable results.

Greco as modified by Lichter does not specifically disclose to detrend/ detrending a segment from the measurements of one physiological parameter.

Reisfeld teaches to detrend/ detrending a segment from the measurements of one physiological parameter (physiological signals, [0003] and detrend, [0080-0081]).

It would have been obvious to one with ordinary skill in the art at the time of the invention was made to modify the method and system (Greco as modified by Lichter) to incorporate the detrending step/ function as taught by Reisfeld, since one ordinary would have recognized that both Greco as modified by Lichter and Reisfeld teach analyzing physiological data, signals, and parameters and it is commonly known in the art that detrending is a data preprocessing step for analyzing EEG signals (e.g. see Muthuswamy et al., "Spectral analysis methods for neurological signals", Journal of Neuroscience Methods 83 (1998) 1–14) for removing the mean and linear trends in the segment of the signal. The rationale would have been to removing the mean and linear trends in the segment of the physiological signal.

In regard to claims 8-9 and 33-34, Greco as modified by Lichter and Reisfeld discloses providing a physiological indicator signal comprises obtaining a signal from a physiological monitoring sensor (EEG sensors, Greco and EEG sensor, Fig. 16 of Lichter) which comprises a PPG sensor and an ECG sensor (Fig. 16 and associated descriptions of Lichter).

10. Claims 6 and 30 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over the combination of Greco, Lichter and Reisfeld as applied to claims 1 and 24 above, and further in view of Maier et al. (USPGPUB 2006/0253261 - cited in previous action). In regard to claims 6 and 30, Greco as modified by Lichter and Reisfeld discloses all the claimed limitation except the predetermined threshold is determined using receiver operator characteristic (ROC) analysis. Maier teaches a

threshold value can be determined using receiver operator characteristic (ROC) analysis ([0235]) in order to have a constant false alarm rate ([0235]). Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention was made to modify the method and the apparatus (Greco as modified by Lichter and Reisfeld) to incorporate the ROC determined threshold (Maier) in order to find the optimal threshold values for the comparison(s).

11. Claims 7 and 31-32 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over the combination of Greco, Lichter and Reisfeld as applied to claims 1 and 24 above, and further in view of Jacobsen et al. (USPN 6,198,394 – cited in previous action). In regard to claims 7 and 31-32, Greco as modified by Lichter and Reisfeld discloses all the claim limitation except placing a portion of a subject's body over an objective lens of a camera in a mobile communication device; and obtaining video images of the portion of the subject's body. Jacobsen teaches placing a portion of a subject's body over an objective lens of a camera in a mobile communication device (element 376, Fig. 5A; Fig. 8; Col 13 lines 55-67); and obtaining video images of the portion of the subject's body (element 376, Fig. 5A; Fig. 8; Col 13 lines 55-67). The portable communication device taught by Jacobsen can be connected to various sensors applied to a user (Figs. 1-3, 5-7, and 8 and associated description) and provide video images associated with specific location of the user to the command center (Col 13 lines 55-67). Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention was made to modify the method and the apparatus

(Greco as modified by Lichter) to incorporate the camera of the portable communication device (Jacobsen) in order to obtain video images associated with specific location of the user and transferring to a central monitoring system/ unit.

12. Claim 18 is rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over the combination of Greco, Lichter and Reisfeld as applied to claim 1 above, and further in view of Zhang (USPGPUB 2009/0112110 – cited in previous action). In regard to claim 18, Greco as modified by Lichter and Reisfeld discloses the measurement of ECG signals (Fig. 16 and associated descriptions of Lichter) but does not specifically discloses a measure of atrial fibrillation. Zhang teaches a measure of atrial fibrillation based on ECG signal analysis (abstract and Figs. 1-9). Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention was made to modify the method (Greco as modified by Lichter) to incorporate the ECG-based atrial fibrillation analysis (Zhang) in order to obtain more health information of the user.

Response to Arguments

13. Applicant's amendment and argument with respect to claims 1, 3-9, 18, 24, 31-32, 27-30, 33-34, and 44 filed on 03/01/2016 have been fully considered but they are deemed to be moot in views of the new grounds of rejection. It is also noted that applicant indicated "band pass filtering" in page 23 of Remarks. The limitation is not recited in the claims. It is improper to import limitations from the specification into the claims (see MPEP 2111.01).

Double Patenting

14. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory double patenting rejection is appropriate where the claims at issue are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the reference application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement. A terminal disclaimer must be signed in compliance with 37 CFR 1.321(b).

The USPTO internet Web site contains terminal disclaimer forms which may be used. Please visit http://www.uspto.gov/forms/. The filing date of the application will determine what form should be used. A web-based eTerminal Disclaimer may be filled out completely online using web-screens. An eTerminal Disclaimer that meets all requirements is auto-processed and approved immediately upon submission. For more information about eTerminal Disclaimers, refer to http://www.uspto.gov/patents/process/file/efs/guidance/eTD-info-I.jsp.

15. Claims 19-23, 39-43, and 49-53 are rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1-16 of U.S. Patent No. 8,755,876 in view of Greco and Lichter. In regard to claims 19-23, 39-43, and 49-53 of present application, claims 1-16 of '876 recite all the limitations except a system and a method comprises providing a physiological indicator signal to a handheld mobile communication device; analyzing, using the device, the physiological indicator signal to obtain measurements of one or more physiological parameters; and detecting, using the a handheld mobile communication device and using only the measurements of the one or more physiological parameters, effects of motion artifacts in the measurements of the one or more physiological parameters and deciding whether to retain the measurements based on effects of motion artifacts in the measurements based on detected effects of motion artifacts. Greco discloses a method and an apparatus for physiological parameter monitoring (abstract and associated descriptions), the method comprising: providing a physiological indicator signal (electric signals, Fig. 1 and associated descriptions in page 203) obtained from a physiological indicator signal sensing

component (EEG sensors and a recording machine, Fig. 1 and associated descriptions in page 203) to a device (EEGLAB, pages 206 and 207; it is inherently that the downloaded program is executed by a computer); analyzing, using the device, the physiological indicator signal (amplifier, page 203 and Sec. IV, page 206) to obtain measurements of one or more physiological parameters (EEG signals and associated independent components/ ICs in page 206); and detecting, using the device and using only the measurements of the one or more physiological parameters (ICs in the detected EEG signals pages 205-206), effects of motion artifacts in the measurements of the one or more physiological parameters (first paragraph in the right column of page 203; Sec. IV on page 206) and deciding whether to retain the measurements based on detected effects of motion artifacts (reject an IC, Sec. IV on page 206). Claims 1-16 of '876 recite a processor to process data related to R-R intervals (claims 1, 2, 6, 7, 12 and 13) but do not recite the processor is in part of a computing device. Greco discloses an artifact rejection method for biomedical signal processing (abstract and Sec. II, IV and V). Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention was made to modify the method and the apparatus (claims 1-16 of '876) to incorporate the artifact rejection method (Greco) in order to better reject artifacts contained in the signal. Claims 1-16 of '876 as modified by Greco does not specifically recite the device is a handheld mobile communication device. Lichter teaches a handheld mobile communication device (personal computer 27, Figs. 2-3) which can be connected to various sensors to measure and analyze the collected data (Figs. 16) including ECG signals obtained from ECG sensor (Fig. 15). Therefore, it would have

been obvious to one with ordinary skill in the art at the time of the invention was made to substitute the computer (Claims 1-16 of '876 as modified by Greco) with the handheld mobile communications device (Lichter) to yield predictable results.

Response to Arguments

16. Applicant's arguments filed on 03/01/2016 have been fully considered but they are not persuasive. In regard to the double patenting rejection, applicant alleged Greco does not teach or suggest using **only** the measurements of one or more physiological parameters to detect the effect of motion artifacts. In response, Greco discloses using only the measurements (ICs extracted from the EEG data, see section III, page 205) to detect the effect of motion artifacts (first paragraph in the right column of page 203; Sec. IV on page 206 and ICs in section IV. Results of page 206). The measurements taught by Greco comprise the EEG data and associated ICs contained in the EEG data. Therefore, the rejections are maintained for the reason of record.

Conclusion

1. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within

TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to CHU CHUAN (JJ) LIU whose telephone number is (571)270-5507. The examiner can normally be reached on M-TH 8:00am~4:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tse Chen can be reached on (571)272-3672. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/CHU CHUAN (JJ) LIU/
Examiner, Art Unit 3777

/TSE CHEN/
Supervisory Patent Examiner, Art Unit 3777

Notice of References Cited	Application/Control No. 13/354,941	Applicant(s)/Patent Under Reexamination CHON ET AL.	
	Examiner CHU CHUAN (JJ) LIU	Art Unit 3777	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-2007/0213624 A1	09-2007	Reisfeld; Daniel	A61B5/14551	600/504
	B	US-				
	C	US-				
	D	US-				
	E	US-				
	F	US-				
	G	US-				
	H	US-				
	I	US-				
	J	US-				
	K	US-				
	L	US-				
	M	US-				

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	Muthuswamy et al., “Spectral analysis methods for neurological signals”, Journal of Neuroscience Methods 83 (1998) 1–14
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	13354941
Filing Date	2012-01-20
First Named Inventor	Ki H. Chon
Art Unit	3777
Examiner Name	Chu Chuan Liu
Attorney Docket Number	30210-201US

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
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	1							

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Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /CCL/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	13354941
	Filing Date	2012-01-20
	First Named Inventor	Ki H. Chon
	Art Unit	3777
	Examiner Name	Chu Chuan Liu
	Attorney Docket Number	30210-201US

	1	Barbati et al. "Optimization of an Indepedent Component Analysis Apporach for Artifact Identification and Removal in Magnetoencephalographic Signals." Clin. Neurophys. 115(2004):1220-1232.

If you wish to add additional non-patent literature document citation information please click the Add button Add

EXAMINER SIGNATURE

Examiner Signature	/Chu Chuan Liu/	Date Considered	04/20/2016

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /CCL/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	13354941
Filing Date	2012-01-20
First Named Inventor	Ki H. Chon
Art Unit	3777
Examiner Name	Chu Chuan Liu
Attorney Docket Number	30210-201US

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☒ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Orlando Lopez/	Date (YYYY-MM-DD)	2016-01-19
Name/Print	Orlando Lopez, Ph.D.	Registration Number	46,880

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /CCL/

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these record s.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /CCL/

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13354941	CHON ET AL.
	Examiner	**Art Unit**
	CHU CHUAN (JJ) LIU	3777

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	10/24/2013	03/12/2014	09/16/2014	02/24/2015	08/11/2015	11/18/2015	04/20/2016		
9999	1	✓	✓	✓	✓	✓	✓	✓		
	2	✓	✓	-	-	-	-	-		
	3	✓	✓	✓	✓	✓	✓	✓		
	4	✓	✓	✓	✓	✓	✓	-		
	5	✓	✓	✓	✓	✓	✓	-		
	6	✓	✓	✓	✓	✓	✓	✓		
	7	✓	✓	✓	✓	✓	✓	✓		
	8	✓	✓	✓	✓	✓	✓	✓		
	9	✓	✓	✓	✓	✓	✓	✓		
	10	N	N	N	N	N	N	N		
	11	N	N	N	N	N	N	N		
	12	N	N	N	N	N	N	N		
	13	N	N	N	N	N	N	N		
	14	N	N	N	N	N	N	N		
	15	N	N	N	N	N	N	N		
	16	N	N	N	N	N	N	N		
	17	N	N	N	N	N	N	N		
	18	✓	✓	✓	✓	✓	✓	✓		
	19	✓	✓	✓	✓	✓	✓	✓		
	20	✓	✓	✓	✓	✓	✓	✓		
	21	✓	✓	✓	✓	✓	✓	✓		
	22	✓	✓	✓	✓	✓	✓	✓		
	23	✓	✓	✓	✓	✓	✓	✓		
	24	✓	✓	✓	✓	✓	✓	✓		
	25	✓	✓	-	-	-	-	-		
	26	✓	✓	-	-	-	-	-		
	27	✓	✓	✓	✓	✓	✓	✓		
	28	✓	✓	✓	✓	✓	✓	-		
	29	✓	✓	✓	✓	✓	✓	-		
	30	✓	✓	✓	✓	✓	✓	✓		
	31	✓	✓	✓	✓	✓	✓	✓		
	32	✓	✓	✓	✓	✓	✓	✓		
	33	✓	✓	✓	✓	✓	✓	✓		
	34	✓	✓	✓	✓	✓	✓	✓		
	35	N	N	N	N	N	N	N		
	36	N	N	N	N	N	N	N		

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13354941	CHON ET AL.
	Examiner	**Art Unit**
	CHU CHUAN (JJ) LIU	3777

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	10/24/2013	03/12/2014	09/16/2014	02/24/2015	08/11/2015	11/18/2015	04/20/2016		
	37	N	N	N	N	N	N	N		
	38	N	N	N	N	N	N	N		
	39	✓	✓	✓	✓	✓	✓	✓		
	40	✓	✓	✓	✓	✓	✓	✓		
	41	✓	✓	✓	✓	✓	✓	✓		
	42	✓	✓	✓	✓	✓	✓	✓		
	43	✓	✓	✓	✓	✓	✓	✓		
	44	✓	✓	✓	✓	✓	✓	✓		
	45	N	N	N	N	N	N	N		
	46	N	N	N	N	N	N	N		
	47	N	N	N	N	N	N	N		
	48	N	N	N	N	N	N	N		
	49	✓	✓	✓	✓	✓	✓	✓		
	50	✓	✓	✓	✓	✓	✓	✓		
	51	✓	✓	✓	✓	✓	✓	✓		
	52	✓	✓	✓	✓	✓	✓	✓		
	53	✓	✓	✓	✓	✓	✓	✓		

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S129	4	Detrend$3 with (EEG Electroencephalographic)	US-PGPUB; USPAT	OR	ON	2016/04/20 15:07
S128	4	Detrend$3 with EEG	US-PGPUB; USPAT	OR	ON	2016/04/20 15:06
S127	2	Detrending with EEG	US-PGPUB; USPAT	OR	ON	2016/04/20 15:05
S126	9	Detrending same polynomial and (A61B5/0059,1455,14551,14552.cpc.)	US-PGPUB; USPAT	OR	ON	2016/04/20 13:44
S125	44	Detrending and (A61B5/0059,1455,14551,14552.cpc.)	US-PGPUB; USPAT	OR	ON	2016/04/20 13:42

EAST Search History (Interference)

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4/ 20/ 2016 4:25:21 PM
C:\ Users\ cliu\ Documents\ EAST\ Workspaces\ 13354941.wsp

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13354941	CHON ET AL.
	Examiner	Art Unit
	CHU CHUAN (JJ) LIU	3777

CPC- SEARCHED

Symbol	Date	Examiner
A61B5/1455	02/24/2015	CCL
A61B5/0002,0004,145,1455,14551	08/11/2015	CCL
A61B5/0059,1455	11/18/2015	CCL
A61B5/0059,1455,14551,14552	04/20/2016	CCL

CPC COMBINATION SETS - SEARCHED

Symbol	Date	Examiner

US CLASSIFICATION SEARCHED

Class	Subclass	Date	Examiner
600	300, 301, 309, 310, 322, 323, 324, 326, 330, 336, 473, 476, 500, 501, 502, 508, 509,518	10/24/2013	CCL
600	300, 301, 309, 310, 322, 323, 324, 326, 330, 336, 473, 476, 500, 501, 502, 508, 509,518	03/12/2014	CCL
600	300, 301, 309, 310, 322, 323, 324, 326, 330, 336, 473, 476, 500, 501, 502, 508, 509,518	09/16/2014	CCL
600	300, 301, 309, 310, 322, 323, 324, 326, 330, 336, 473, 476, 500, 501, 502, 508, 509,518	02/24/2015	CCL
600	300, 301, 309, 310, 322, 323, 324, 326, 330, 336, 473, 476, 500, 501, 502, 508, 509,518	8/11/2015	CCL
600	300, 301, 309, 310, 322, 323, 324, 326, 330, 336, 473, 476, 500, 501, 502, 508, 509,518	11/18/2015	CCL
600	300, 301, 309, 310, 322, 323, 324, 326, 330, 336, 473, 476, 500, 501, 502, 508, 509,518	04/20/2016	CCL

SEARCH NOTES

Search Notes	Date	Examiner
Inventor Name Search (PALM and EAST)	10/23/2013	CCL
EAST Search (TEXT, USPGPUB, USPAT) See Search History	10/24/2013	CCL
Google NPL Search	10/24/2013	CCL

/CHU CHUAN (JJ) LIU/ Examiner.Art Unit 3777	

SEARCH NOTES

Search Notes	Date	Examiner
Updated EAST Search (TEXT, USPGPUB, USPAT) See Search History	03/12/2014	CCL
Google NPL Search	03/12/2014	CCL
Updated EAST Search (TEXT, USPGPUB, USPAT) See Search History	09/16/2014	CCL
Updated EAST Search (TEXT, USPGPUB, USPAT, CPC) See Search History	02/24/2015	CCL
Google NPL Search	02/24/2015	CCL
Updated EAST Search (TEXT, USPGPUB, USPAT, CPC) See Search History	8/11/2015	CCL
NPL Search	8/11/2015	CCL
Updated EAST Search (TEXT, USPGPUB, USPAT, CPC) See Search History	11/18/2015	CCL
Google NPL Search	11/18/2015	CCL
Updated EAST Search (TEXT, USPGPUB, USPAT, CPC) See Search History	04/20/2016	CCL
Google NPL Search	04/20/2016	CCL

INTERFERENCE SEARCH

US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner

/CHU CHUAN (JJ) LIU/ Examiner.Art Unit 3777	

Doc Code: A.NE.AFCP
Document Description: After Final Consideration Pilot Program Request

PTO/SB/434 (05-13)

CERTIFICATION AND REQUEST FOR CONSIDERATION UNDER THE AFTER FINAL CONSIDERATION PILOT PROGRAM 2.0

Practitioner Docket No.:	Application No.:	Filing Date:
30210-201	13/354,941	January 20, 2012
First Named Inventor:	**Title:**	
Ki H. Chon	PHYSIOLOGICAL PARAMETER MONITORING WITH A MOBILE COMMUNICATION DEVICE	

APPLICANT HEREBY CERTIFIES THE FOLLOWING AND REQUESTS CONSIDERATION UNDER THE AFTER FINAL CONSIDERATION PILOT PROGRAM 2.0 (AFCP 2.0) OF THE ACCOMPANYING RESPONSE UNDER 37 CFR 1.116.

1. The above-identified application is (i) an original utility, plant, or design nonprovisional application filed under 35 U.S.C. 111(a) [a continuing application (*e.g.*, a continuation or divisional application) is filed under 35 U.S.C. 111(a) and is eligible under (i)], or (ii) an international application that has entered the national stage in compliance with 35 U.S.C. 371(c).
2. The above-identified application contains an outstanding final rejection.
3. Submitted herewith is a response under 37 CFR 1.116 to the outstanding final rejection. The response includes an amendment to at least one independent claim, and the amendment does not broaden the scope of the independent claim in any aspect.
4. This certification and request for consideration under AFCP 2.0 is the only AFCP 2.0 certification and request filed in response to the outstanding final rejection.
5. Applicant is willing and available to participate in any interview requested by the examiner concerning the present response.
6. This certification and request is being filed electronically using the Office's electronic filing system (EFS-Web).
7. Any fees that would be necessary consistent with current practice concerning responses after final rejection under 37 CFR 1.116, *e.g.*, extension of time fees, are being concurrently filed herewith. [There is no additional fee required to request consideration under AFCP 2.0.]
8. By filing this certification and request, applicant acknowledges the following:
    - Reissue applications and reexamination proceedings are not eligible to participate in AFCP 2.0.
    - The examiner will verify that the AFCP 2.0 submission is compliant, *i.e.*, that the requirements of the program have been met (see items 1 to 7 above). For compliant submissions:
        - The examiner will review the response under 37 CFR 1.116 to determine if additional search and/or consideration (i) is necessitated by the amendment and (ii) could be completed within the time allotted under AFCP 2.0. If additional search and/or consideration is required but cannot be completed within the allotted time, the examiner will process the submission consistent with current practice concerning responses after final rejection under 37 CFR 1.116, *e.g.*, by mailing an advisory action.
        - If the examiner determines that the amendment does not necessitate additional search and/or consideration, or if the examiner determines that additional search and/or consideration is required and could be completed within the allotted time, then the examiner will consider whether the amendment places the application in condition for allowance (after completing the additional search and/or consideration, if required). If the examiner determines that the amendment does not place the application in condition for allowance, then the examiner will contact the applicant and request an interview.
            - The interview will be conducted by the examiner, and if the examiner does not have negotiation authority, a primary examiner and/or supervisory patent examiner will also participate.
            - If the applicant declines the interview, or if the interview cannot be scheduled within ten (10) calendar days from the date that the examiner first contacts the applicant, then the examiner will proceed consistent with current practice concerning responses after final rejection under 37 CFR 1.116.

Signature	Date
/Orlando Lopez/	July 7, 2016
Name (Print/Typed) Orlando Lopez	**Practitioner Registration No.** 46,880

***Note**: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. Submit multiple forms if more than one signature is required, see below*.*

☐ * Total of _____ forms are submitted.

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
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5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
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8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants: Ki H. Chon et al.
Application Number: 13/354,941
Filed: January 20, 2012
Title: PHYSIOLOGICAL PARAMETER MONITORING WITH A MOBILE COMMUNICATION DEVICE

Examiner: LIU, CHU CHUAN
Group Art Unit: 3777
Confirmation No. 9133

BURNS & LEVINSON, LLP
125 Summer Street
Boston, MA 02110
(617) 345-3243

TO: Mail Stop AF
Commissioner for Patents
P.O. Box 1450,
Alexandria, VA 22313-1450

AMENDMENT AND RESPONSE TO FINAL OFFICE ACTION

Sir:

In reply to the Final Office Action dated April 28, 2016, Applicants submit the following amendments and remarks. An After Final Consideration Request form is attached hereto.

Amendments to the claims begin on page 2 of this paper.

Remarks begin on page 16 of this paper.

Attachments to this paper also include a copy of Form PTO/SB/434 (1 sheet).

Amendments to the Claims:

This listing of claims replaces all prior versions and listings of the claims.

1. (Currently amended) A method for physiological parameter monitoring, the method comprising:

providing a physiological indicator signal to a handheld mobile communication device;

analyzing, using the handheld mobile communication device, the physiological indicator signal;

obtaining, from said analyzing, measurements of one or more physiological parameters; and

detecting, using the handheld mobile communication device and using only the measurements of one or more physiological parameters, effects of motion artifacts in the measurements of the one or more physiological parameters and deciding whether to retain the measurements based on detected effects of motion artifacts;

wherein detecting effects of motion artifacts in the measurements comprises:

a. bandpass filtering and detrending a segment from the measurement of one physiological parameter; wherein a bandpass filtered and detrended segment is hereinafter referred to as a preprocessed segment;

b. obtaining a value of at least one indicator of volatility, used in determining whether motion artifacts are present, for the preprocessed segment; the at least one indicator of volatility being at least Shannon entropy for the preprocessed segment;

c. including the segment in analyses of physiological measurements, ~~if~~ when comparison of the value of the at least one indicator of volatility with a predetermined threshold indicates noise/motion artifacts are not present; and

d. selecting another segment of the signal from the physiological measurement and proceeding to step (a) when the value of the at least one indicator of volatility is less than a predetermined threshold and when another segment is available.

2. (Canceled)

Petitioner Ex-1004, 0593

3. (Previously presented) The method of claim 1 wherein said at least one indicator of volatility also comprises kurtosis.

4-5. (Canceled)

6. (Previously presented) The method of claim 1 wherein the predetermined threshold is determined using receiver operator characteristic (ROC) analysis.

7. (Previously presented) The method of claim 1 wherein providing a physiological indicator signal comprises:

placing a portion of a subject's body over an objective lens of a camera in a handheld mobile communication device; and

obtaining video images of the portion of the subject's body.

8. (Previously presented) The method of claim 1 wherein providing a physiological indicator signal comprises obtaining a signal from a physiological monitoring sensor.

9. (Previously presented) The method of claim 8 wherein the physiological monitoring sensor is a photoplethysmographic (PPG) sensor or an electrocardiogram sensor.

10. (Withdrawn) The method of claim 1 wherein the one or more physiological measurements comprise heart rate and heart rate variability.

11. (Withdrawn) The method of claim 10 wherein obtaining measurements of heart rate and heart rate variability comprise:

determining beats for the physiological indicator signal;

determining beat to beat intervals; and

applying a cubic spline algorithm to obtain a substantially continuous beat to beat interval signal indicative of heart rate.

Petitioner Ex-1004, 0594

12. (Withdrawn) The method of claim 1 wherein the one or more physiological measurements comprise respiratory rate.

13. (Withdrawn) The method of claim 12 wherein measurement of respiratory rate comprises:

obtaining time–frequency spectrum of the physiological indicator signal utilizing variable frequency complex demodulation (VFCDM); and

obtaining respiratory rates by extracting a frequency component that has a largest amplitude for each time point at a heart rate frequency band.

14. (Withdrawn) The method of claim 1 wherein the one or more physiological measurements comprise a measure of oxygen saturation.

15. (Withdrawn) The method of claim 14 wherein providing a physiological indicator signal comprises:

placing a portion of a subject's body over an objective lens of a camera in a mobile communication device; and

obtaining video images of the portion of the subject's body, and

wherein obtaining the measure of oxygen saturation comprises:

obtaining an average intensity of a red component and a blue component of the video images of the portion of the subject's body; the average intensity of the red component and the average intensity of the blue component constituting DC_{RED} and DC_{BLUE} respectively;

obtaining a standard deviation of the red component and the blue component; the standard deviation of the red component and the blue component constituting AC_{RED} and AC_{BLUE} respectively; and

obtaining the measure of oxygen saturation (SpO2) by

$$SpO2 = A - B\frac{AC_{RED}/DC_{RED}}{AC_{BLUE}/DC_{BLUE}}.$$

16. (Withdrawn) The method of claim 1 wherein the one or more physiological measurements comprise a measure of blood loss.

17. (Withdrawn) The method of claim 16 wherein obtaining the measure of blood loss comprises:

obtaining time–frequency spectrum of the physiological indicator signal utilizing variable frequency complex demodulation (VFCDM);

obtaining the amplitude modulation (AM) series from a set of the largest instantaneous amplitude at each time sample within the heart rate frequency band of the time–frequency spectrum; and

determining whether the amplitude modulation decreases; a decrease in the amplitude modulation indicating blood volume loss in subject.

18. (Previously presented) The method of claim 1 wherein the one or more physiological measurements comprise a measure of atrial fibrillation.

19. (Previously presented) A method for physiological parameter monitoring, the method comprising:

providing a physiological indicator signal to a handheld mobile communication device;

analyzing, using the handheld mobile communication device, the physiological indicator signal;

obtaining, from said analyzing, measurements of one or more physiological parameters; and

detecting, using the handheld mobile communication device and using only the measurements of one or more physiological parameters, effects of motion artifacts in the measurements of the one or more physiological parameters and deciding whether to retain the measurements based on effects of motion artifacts in the measurements;

wherein the one or more physiological measurements comprise a measure of atrial fibrillation;

wherein obtaining the measure of atrial fibrillation comprises:

obtaining a time-varying coherence function by multiplying two time-varying transfer functions (TVFTs), the two time-varying transfer functions obtained using two adjacent data segments, from the physiological indicator signal, one of the two adjacent data segment as an input signal and another of the two adjacent data segment as an output signal to produce a first TVTF; a second TVTF is produced by reversing the input and the output signals, using said another of the two adjacent data segment as the input signal and said one of the two adjacent data segment as the output signal; and

determining whether the time-varying coherence function is less than a predetermined quantity.

20. (Previously presented) The method of claim 19 wherein determining whether the time-varying coherence function is less than the predetermined quantity comprises:

obtaining one or more indicators of atrial fibrillation; and

determining whether the one or more indicators of atrial fibrillation exceed predetermined thresholds.

21. (Previously presented) The method of claim 20 wherein the one or more indicators of atrial fibrillation comprise a variance of the time-varying coherence function.

22. (Previously presented) The method of claim 21 wherein the one or more indicators of atrial fibrillation also comprise Shannon entropy.

23. (Previously presented) The method of claim 20 wherein the predetermined thresholds are determined using receiver operator characteristic (ROC) analysis.

24. (Currently amended) A system for physiological parameter monitoring, the system comprising:

a physiological indicator signal sensing component; and a handheld mobile communication device comprising:

at least one processor; and

at least one computer usable medium, the computer usable medium having computer readable code embodied therein, the computer readable code causing the at least one processor to:

analyze the physiological indicator signal;

obtain, from results of analyzing, measurements of one or more physiological parameters; and

detect effects of motion artifacts in the measurements of the one or more physiological parameters;

wherein the computer readable code, in causing the at least one processor to detect effects of motion artifacts, causes the at least one processor to:

a. bandpass filter and detrend a segment from the measurement of one physiological parameter; wherein a bandpass filtered and detrended segment is hereinafter referred to as a preprocessed segment;

b.

c. obtain a value of at least one indicator of volatility, used in determining whether motion artifacts are present, for the preprocessed segment; the at least one indicator of volatility being at least Shannon entropy for the preprocessed segment;

d. include the segment in analyses of physiological measurements when comparison of the value of the at least one indicator of volatility with a predetermined threshold indicates noise/motion artifacts are not present;

e. select another segment of the signal from the physiological measurement and proceeding to step (a) when the value of the at least one indicator of volatility is less than a predetermined threshold and another segment is available.

25-26. (Canceled)

27. (Previously presented) The system of claim 24 wherein said at least one indicator of volatility also comprises kurtosis.

28-29. (Canceled)

30. (Previously presented) The system of claim 24 wherein the predetermined threshold is determined using receiver operator characteristic (ROC) analysis.

31. (Previously presented) The system of claim 24 wherein the physiological indicator signal sensing component comprises an image acquisition component, said acquisition component capable of acquiring a number of frames, each frame acquired at a predetermined time.

32. (Previously presented) The system of claim 31 wherein the handheld mobile communications device comprises said image acquisition component.

33. (Previously presented) The system of claim 24 wherein the physiological indicator signal sensing component comprises a physiological monitoring sensor.

34. (Previously presented) The system of claim 33 wherein the physiological monitoring sensor is a photoplethysmographic (PPG) sensor or an electrocardiogram sensor.

35. (Withdrawn) The system of claim 25 wherein the physiological indicator signal sensing component comprises an image acquisition component, said acquisition component capable of acquiring a number of frames, each frame acquired at a predetermined time; wherein said image acquisition component acquires a color image having red, green and blue components; wherein one or more physiological measurements comprise a measure of oxygen saturation; and wherein the computer readable code, in causing the at least one processor to analyze the physiological indicator signal, causes the at least one processor to:

obtain an average intensity of a red component and a blue component of the images of a portion of a subject's body; the average intensity of the red component and the average intensity of the blue component constituting DC_{RED} and DC_{BLUE} respectively;

obtain a standard deviation of the red component and the blue component; the standard deviation of the red component and the blue component constituting AC_{RED} and AC_{BLUE} respectively; and

obtain the measure of oxygen saturation by

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$$SpO2 = A - B\frac{AC_{RED}/DC_{RED}}{AC_{BLUE}/DC_{BLUE}}.$$

36. (Withdrawn) The system of claim 25 wherein the one or more physiological measurements comprise heart rate and heart rate variability; and wherein the computer readable code, in causing the at least one processor to analyze the physiological indicator signal, causes the at least one processor to:

determine beats for the physiological indicator signal;

determine beat to beat intervals; and

apply a cubic spline algorithm to obtain a substantially continuous beat to beat interval signal indicative of heart rate.

37. (Withdrawn) The system of claim 25 wherein the one or more physiological measurements comprise respiratory rate; and wherein the computer readable code, in causing the at least one processor to analyze the physiological indicator signal, causes the at least one processor to:

obtain time–frequency spectrum of the physiological indicator signal utilizing variable frequency complex demodulation (VFCDM); and

obtain respiratory rates by extracting a frequency component that has a largest amplitude for each time point at a heart rate frequency band.

38. (Withdrawn) The system of claim 25 wherein the one or more physiological measurements comprise a measure of blood loss; and wherein the computer readable code, in causing the at least one processor to analyze the physiological indicator signal, causes the at least one processor to:

obtain time–frequency spectrum of the physiological indicator signal utilizing variable frequency complex demodulation (VFCDM);

obtain the amplitude modulation (AM) series from set of the largest instantaneous amplitude at each time sample within the heart rate frequency band of the time–frequency spectrum; and

determine whether the amplitude modulation decreases; a decrease in the amplitude modulation indicating blood volume loss in subject.

39. (Previously presented) A system for physiological parameter monitoring, the system comprising:

a physiological indicator signal sensing component; and a handheld mobile communication device comprising:

at least one processor; and

at least one computer usable medium, the computer usable medium having computer readable code embodied therein, the computer readable code causing the at least one processor to:

analyze the physiological indicator signal;

obtain, from results of analyzing, measurements of one or more physiological parameters; and

detect effects of motion artifacts, using only the measurements of one or more physiological parameters, in the measurements of the one or more physiological parameters; wherein the one or more physiological measurements comprise a measure of atrial fibrillation; and wherein the computer readable code, in causing the at least one processor to analyze the physiological indicator signal, causes the at least one processor to:

obtain a time-varying coherence function by multiplying two time-varying transfer functions (TVFTs), the two time-varying transfer functions obtained using two adjacent data segments , from the physiological indicator signal, one of the two adjacent data segment as an input signal and another of the two adjacent data segment as an output signal to produce a first TVTF; a second TVTF is produced by reversing the input and the output signals, using said another of the two adjacent data segment as the input signal and said one of the two adjacent data segment as the output signal; and

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determine whether the time-varying coherence function is less than a predetermined quantity.

40. (Previously presented) The system of claim 39 wherein the computer readable code, in causing the at least one processor to determine whether the time-varying coherence function is less than the predetermined quantity, causes the at least one processor to:

obtain one or more indicators of atrial fibrillation; and

determine whether the one or more indicators of atrial fibrillation exceed predetermined thresholds.

41. (Previously presented) The system of claim 40 wherein the one or more indicators of atrial fibrillation comprise a variance of the time-varying coherence function.

42. (Previously presented) The system of claim 41 wherein the one or more indicators of atrial fibrillation also comprise Shannon entropy.

43. (Previously presented) The system of claim 41 wherein the predetermined thresholds are determined using receiver operator characteristic (ROC) analysis.

44. (Currently amended) A non-transitory computer usable medium having computer readable code embodied therein, the computer readable code causing at least one processor to:

analyze the physiological indicator signal;

obtain, from said analyzing, measurements of one or more physiological parameters; and

detect, using only the measurements of one or more physiological parameters, effects of motion artifacts in the measurements of the one or more physiological parameters;

wherein the computer readable code, in causing the at least one processor to detect effects of motion artifacts, causes the at least one processor to:

a. bandpass filter and detrend a segment from the measurement of one physiological parameter; wherein a bandpass filtered and detrended segment is hereinafter referred to as a preprocessed segment;

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b. obtain a value of at least one indicator of volatility, used in determining whether motion artifacts are present, for the preprocessed segment; the at least one indicator of volatility being at least Shannon entropy for the preprocessed segment;
c. include the segment in analyses of physiological measurements when comparison of the value of the at least one indicator of volatility with a predetermined threshold indicates noise/motion artifacts are not present;
d. select another segment of the signal from the physiological measurement and proceeding to step (a) when the value of the at least one indicator of volatility is less than a predetermined threshold and another segment is available.

45. (Withdrawn) The computer usable medium of claim 44 wherein the physiological indicator signal comprises a video color image having red, green and blue components, the video color image being an image obtained from of a portion of a subject's body; wherein the measurements of one or more physiological parameters comprise a measure of oxygen saturation; and wherein the computer readable code, in causing the at least one processor to analyze the physiological indicator signal, causes the at least one processor to:

obtain an average intensity of the red component and a blue component of the video color image of a portion of a subject's body; the average intensity of the red component and the average intensity of the blue component constituting DC_{RED} and DC_{BLUE} respectively;

obtain a standard deviation of the red component and the blue component; the standard deviation of the red component and the blue component constituting AC_{RED} and AC_{BLUE} respectively; and

obtain the measure of oxygen saturation by

$$SpO2 = A - B\frac{AC_{RED}/DC_{RED}}{AC_{BLUE}/DC_{BLUE}}.$$

46. (Withdrawn) The computer usable medium of claim 44 wherein the one or more physiological measurements comprise heart rate and heart rate variability; and wherein the

computer readable code, in causing the at least one processor to analyze the physiological indicator signal, causes the at least one processor to:

determine beats for the physiological indicator signal;

determine beat to beat intervals; and

apply a cubic spline algorithm to obtain a substantially continuous beat to beat interval signal indicative of heart rate.

47. (Withdrawn) The computer usable medium of claim 44 wherein the one or more physiological measurements comprise respiratory rate; and wherein the computer readable code, in causing the at least one processor to analyze the physiological indicator signal, causes the at least one processor to:

obtain time–frequency spectrum of the physiological indicator signal utilizing variable frequency complex demodulation (VFCDM); and

obtain respiratory rates by extracting a frequency component that has a largest amplitude for each time point at a heart rate frequency band.

48. (Withdrawn) The computer usable medium of claim 44 wherein the one or more physiological measurements comprise a measure of blood loss; and wherein the computer readable code, in causing the at least one processor to analyze the physiological indicator signal, causes the at least one processor to:

obtain time–frequency spectrum of the physiological indicator signal utilizing variable frequency complex demodulation (VFCDM);

obtain the amplitude modulation (AM) series from set of the largest instantaneous amplitude at each time sample within the heart rate frequency band of the time–frequency spectrum; and

determine whether the amplitude modulation decreases; a decrease in the amplitude modulation indicating blood volume loss in subject.

49. (Previously presented) A non-transitory computer usable medium having computer readable code embodied therein, the computer readable code causing at least one processor to:

analyze the physiological indicator signal;

obtain, from said analyzing, measurements of one or more physiological parameters; and

detect, using only the measurements of one or more physiological parameters, effects of motion artifacts in the measurements of the one or more physiological parameters;

wherein the one or more physiological measurements comprise a measure of atrial fibrillation; and wherein the computer readable code, in causing the at least one processor to analyze the physiological indicator signal, causes the at least one processor to:

obtain a time-varying coherence function by multiplying two time-varying transfer functions (TVFTs), the two time-varying transfer functions obtained using two adjacent data segments, from the physiological indicator signal, one of the two adjacent data segment as an input signal and another of the two adjacent data segment as an output signal to produce a first TVTF; a second TVTF is produced by reversing the input and the output signals, using said another of the two adjacent data segment as the input signal and said one of the two adjacent data segment as the output signal; and

determine whether the time-varying coherence function is less than a predetermined quantity.

50. (Previously presented) The non-transitory computer usable medium of claim 44 wherein the computer readable code, in causing the at least one processor to determine whether the time-varying coherence function is less than the predetermined quantity, causes the at least one processor to:

obtain one or more indicators of atrial fibrillation; and

determine whether the one or more indicators of atrial fibrillation exceed predetermined thresholds.

51. (Previously presented) The non-transitory computer usable medium of claim 50 wherein the one or more indicators of atrial fibrillation comprise a variance of the time-varying coherence function.

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52. (Previously presented) The non-transitory computer usable medium of claim 51 wherein the one or more indicators of atrial fibrillation also comprise Shannon entropy.

53. (Previously presented) The computer usable medium of claim 50 wherein the predetermined thresholds are determined using receiver operator characteristic (ROC) analysis.

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REMARKS

Applicants have carefully reviewed the Final Office Action dated April 28, 2016, and this response addresses the Examiner's concerns. Applicants respectfully request reconsideration of the application.

I. STATUS OF THE CLAIMS

Claims 1, 3, 6-24, 27 and 10-17, 35-38 are pending in the application.

Claims 45-48 are withdrawn from consideration.

Claims 1, 3, 6-9, 18-24, 27, 30-34, 39-44 and 49-53 are rejected.

II. THE 35 U.S.C. 101 REJECTIONS

Claims 1, 3, 6-24, 27, and 30-53 are rejected under 35 U.S.C. 101 because the claimed inventions are directed to a judicial exception (i.e., a law of nature, a natural phenomenon, or an abstract idea) without significantly more.

The Examiner, in the Office Action, states that "Claims 1, 19, 24, 39, 44 and 49 are directed to an abstract idea. Instant claims 1, 19, 24, 39, 44, and 49 are drawn to "method(s) or system(s)" (prong 1 of the two-part test). In this case, the claims are directed to the judicial exception of **mathematical relationship and/ or ideas,** which is considered an abstract idea, or concepts similar to those found by the courts to be abstract, as they require mathematically relating data and/or comparing data (prong 2A of the two-part test)." The examiner does not cite any court decisions and does not explain why the purported abstract idea corresponds to a concept that the courts have identified as an abstract idea.

In *Diehr, 450 U.S. 175, 101 S. Ct. 1048, 67 L. Ed. 2d 155*, the US Supreme Court held that a computer-implemented process for curing rubber was patent eligible, but not because it involved a computer. The claim employed a "well-known" mathematical equation, but it used that equation in a process designed to solve a technological problem in "conventional industry practice." *Id., at 177, 178, 101 S. Ct. 1048, 67 L. Ed. 2d 155.*

Claim 1 is directed to a methods for physiological parameter monitoring, where the physiological parameter is a parameters such as blood loss, oxygen saturation heart rate variability, atrial fibrillation and others. There is a need for low-cost physiological monitoring solutions that are easy to use, accurate, and can be used in the home or in ambulatory situations. The method starts by providing a physiological indicator signal to a handheld communication device.

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Measurements of one or more physiological parameters are obtained from the physiological indicator signal. Motion artifacts can affect the results of standard PPG. In the case of a mobile device and where there is no physical device ensuring a stable connection as is the case with pulse-oximeter clips or EKG electrodes, motion artifacts can be of more concern. It is well known that the PPG is highly sensitive to artifacts, particularly those generated while the patient is in motion. This imposes a huge limitation on the usability of the PPG for ambulatory monitoring applications. Motion artifacts) distorting PPG recordings can cause erroneous estimation of HR and SpO2. In order to make a handheld mobile communication device useful in monitoring physiological parameters, the method proceeds to determine whether motion artifacts are present in the measurements in order to retain only those measurements where motion artifacts are not present. In determining the presence of motion artifacts, the method uses Shannon entropy as an indicator of motion artifacts. The method, system and computer program product of the claimed invention produces measurements of one or more physiological parameters using a system that can be used in the home or in ambulatory situations and eliminates the erroneous measurements due to motion artifacts. The claimed invention is an improvement in the technology of physiological parameter monitoring in home or ambulatory environments. In the present claimed invention, concepts are applied "'to a new and useful end,'"

Since the Courts have recognized that the two steps of the *Alice/Mayo* test "are easier to separate in recitation than in application," (see **Central District CA CASE NO. SACV 11-00189 AG (RNBx) AMERANTH v. GENESIS GAMING SOLUTIONS, ORDER DENYING MOTION FOR SUMMARY JUDGMENT OF INVALIDITY,** January 2, 2015) although Applicants do not acquiesce to the claims being directed to an abstract idea, applicants present the following arguments while not following sequentially the steps in the Alice/Mayo test.

Claims provide an improvement in another technology and a new and useful result

As stated above, the method, system and computer program product of the claimed invention produce measurements of one or more physiological parameters using a system that can be used in the home or in ambulatory situations and eliminate the erroneous measurements due to motion artifacts. The claimed invention is an improvement in the technology of

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physiological parameter monitoring in home or ambulatory environments. In the present claimed invention, concepts are applied "'to a new and useful end'"

The USPTO Guidelines on Subject Matter Eligibility state that limitations that may be enough to qualify as "significantly more" when recited in a claim with a judicial exception include improvements to another technology or technical field, citing *Alice Corp. Pty, Ltd. v. CLS Bank International, 134 S. Ct. 2347, 2357* (2014)) The Supreme Court in the *Alice* decision stated that

"Thus, an invention is not rendered ineligible for patent simply because it involves an abstract concept. "[A]pplication[s]" of such concepts "'to a new and useful end,'" we have said, remain eligible for patent protection. " *Alice*, 134 S. Ct. at 2354 (citations omitted).

The present claimed invention presents an improvement in in the technology of physiological parameter monitoring in home or ambulatory environments and produces measurements of one or more physiological parameters using a system that can be used in the home or in ambulatory situations and eliminates the erroneous measurements due to motion artifacts. The present claimed invention applies concepts to reach a new and useful end, measurements of one or more physiological parameters using a system that can be used in the home or in ambulatory situations and eliminates the erroneous measurements due to motion artifacts. Since the claimed invention is an improvement in another field of technology and it applies concepts to arrive at a new and useful end, the claimed invention is patent eligible subject matter.

The Examiner, in the Office Action, states that "The claim(s) does/do not include additional steps/elements that are sufficient to amount to significantly more than the judicial exception for the following reasons (prong2B of the two-part test). In particular, the claimed steps amount to nothing more than: routine data collection and/or insignificant extrasolution activity (e.g. "providing a physiological indicator signal; analyzing the signal by using a handheld mobile communication device; and obtaining one or more physiological parameters"); generic computer functions performing well-understood, routine, and conventional activities previously known to the industry (e.g. "using a handheld mobile communication devicefor detecting effects of motion artifacts and associated functions/steps and deciding whether to retain the measurements based on detected effects of motion artifacts; filtering and detrending

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measurements, obtaining/ comparing Shannon entropy of the processed segment, include or select segment based on the comparison of Shannon entropy"; see art rejections below); generic processing steps recited at a high level of generality such that substantially all practical applications of the judicial exception(s) are covered (e.g. "using a handheld mobile communication device for detecting effects of motion artifacts and associated functions/steps and deciding whether to retain the measurements based on detected effects of motion artifacts; filtering and detrending measurements, obtaining/ comparing Shannon entropy of the processed segment, include or select segment based on the comparison of Shannon entropy"; see art rejections below); and/or general instructions to apply or use the judicial exception(s) (e.g. "using a handheld mobile communication device for detecting effects of motion artifacts and associated functions/steps and deciding whether to retain the measurements based on detected effects of motion artifacts; filtering and detrending measurements, obtaining/ comparing Shannon entropy of the processed segment, include or select segment based on the comparison of Shannon entropy"; see art rejections below)."

The Examiner, in the Office Action, also states that "In regard to 35 USC 101 rejection, Applicant first alleged that the claims provide an improvement in a technology or technical field. In response, no specific technology or technical field is reflected in the claim(s). In pages 16 and 17 of Remarks filed on 03/01/2016, Applicant indicated that the physiological parameter includes blood loss, oxygen saturation heart rate variability, arterial fibrillation and others; PPG, EKG, HR and Sp02. However, the claim(s) recites physiological indicator signal and one or more physiological parameters, which are broad enough to cover all possible physiological signals/parameters in physiological and/ or all medical fields associated with physiological conditions. Therefore, the claimed invention is not considered as provide improvements in any specific technology or technical field."

Applicants respectfully state that the Examiner does not determine the scope of claims in patent applications not solely on the basis of the claim language, but upon giving claims their broadest reasonable construction "in light of the specification as it would be interpreted by one of ordinary skill in the art." *In re Am. Acad. of Sci. Tech. Ctr.*, 367 F.3d 1359, 1364[, 70 USPQ2d 1827, 1830] (Fed. Cir. 2004). MPEP 2111. The claims are directed to analyzing a physiological indicator signal in a handheld mobile communication device and detecting the effects of motion

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artifacts and deciding whether to retain the measurements based on that detection. Applicants respectfully state that the examiner's statements are not supported by substantial evidence.

Applicants also respectfully state that the examiner disregard that claims 19, 39 and 49 related to one specific physiological measurement-atrial fibrillation, and are an improvement in a specific technology. Applicants respectfully state that the examiner's statements are not supported by substantial evidence and kindly request the examiner to support his statements by substantial evidence as stated in MPEP 2144.0 3C.

As the Federal Circuit stated in BASCOM GLOBAL INTERNET v. AT&T MOBILITY LLC the examiner's analysis "looks similar to an obviousness analysis under 35 U.S.C. § 103, except lacking an explanation of a reason to combine the limitations as claimed. The inventive concept inquiry requires more than recognizing that each claim element, by itself, was known in the art. As is the case here, an inventive concept can be found in the non-conventional and non-generic arrangement of known, conventional pieces." BASCOM GLOBAL INTERNET v. AT&T MOBILITY LLC, opinion 2015-1763 (Federal Circuit June 27, 2016).

"Whether a claim is directed to statutory subject matter is a question of law. .. determination of this question may require findings of underlying facts specific to the particular subject matter and its mode of claiming" *Accenture Global Servs. GmbH v. Guidewire Software, Inc.*, 728 F.3d 1336, 1344 (Fed. Cir. 2013) as cited in **MORTGAGE GRADER, INC. v. FIRST CHOICE LOAN SERVICES INC.,** Opinion 2015-1415, January 20, 2016 (Fed. Cir.). Applicant respectfully kindly request the examiner to support his statements by substantial evidence as stated in MPEP 2144.0 3C.

<u>The claims do not unduly pre-empt others from applying the concept of Shannon entropy</u>

The Supreme Court, in *Alice*, stated that, "The concern that drives the exclusionary principle - exclude Laws of nature, natural phenomena, and abstract ideas - is one of pre-emption. *Alice*, 134 S. Ct. at 2354. Laws of nature, natural phenomena, and abstract ideas are basic tools. The Supreme Court, in *Alice*, stated that "monopolization of those tools through the grant of a patent might tend to impede innovation more than it would tend to promote it, thereby thwarting the primary object of the patent laws." *Alice*, 134 S. Ct. at 2354.

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However, the Court in *Alice* gave little insight as to how to determine if there is undue pre-emption of the field, since all claims pre-empt something. The Federal Circuit, in *Accenture*, provides guidance, stating that "In the case of abstractness, the court must determine whether the claim poses "any risk of preempting an abstract idea." To do so the court must first "identify and define whatever fundamental concept appears wrapped up in the claim." Then, proceeding with the preemption analysis, the balance of the claim is evaluated to determine whether "additional substantive limitations . . . narrow, confine, or otherwise tie down the claim so that, in practical terms, it does not cover the full abstract idea itself."" *ACCENTURE GLOBAL SERVICES, GMBH v. GUIDEWIRE SOFTWARE, INC.*, 728 F.3d 1336, 1341 (Fed. Cir. 2013).

The concept of Shannon entropy has been applied in communications, where it originated (see, for example, Without Shannon's information theory there would have been no internet, The Guardian, June 22, 2014, http://www.theguardian.com/science/2014/jun/22/shannon-information-theory , provided in the Appendix) , in the identification of putative drug targets (see The application of Shannon entropy in the identification of putative drug targets, BioSystems 55 (2000) 5–14), in quantifying the quality of mixing in various systems, including polymeric ones (see Quantifying Fluid Mixing with the Shannon Entropy, Macromolecular Theory and Simulations, Volume 15, Issue 8, pages 595–607, October 11, 200, both of which were provided in the Appendix in the response filed on March 1, 2016) and in a number of other applications, such as ALEXANDER, NEAL; PARRA-HENAO, GABRIEL, Uses of entropy in medical research, CES Medicina, vol. 21, núm. 1, enero-junio, 2007, pp. 65-75, a copy of which is included in the appendix. In the method of clam 1, the use of Shannon entropy is tied to the determination of whether the effects of motion artifacts are present in the measurement of the physiological parameter.

The Examiner, in the Office Action, also states that "Forth of all, applicant alleged that the claims do not preempt others from applying the concept of Shannon entropy. In response, the claims preempt others from applying the concept of Shannon entropy in all possible physiological signals/parameters in physiological and/ or all medical fields associated with physiological conditions (e.g. the claimed invention is applicable to a certain types of physiological signals/parameters)." Applicants respectfully state that the evidence present above contradicts the examiner's assertions and the examiner has not presented any evidence to support

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his statements. Applicant respectfully kindly request the examiner to support his statements by substantial evidence as stated in MPEP 2144.0 3C.

Furthermore, Applicants also respectfully state that the examiner disregard that claims 19, 39 and 49 related to one specific physiological measurement-atrial fibrillation, and are an improvement in a specific technology.

The method, system and computer program product of the claimed invention produces measurements of one or more physiological parameters using a system that can be used in the home or in ambulatory situations and eliminates the erroneous measurements due to motion artifacts. The claimed invention is an improvement in the technology of physiological parameter monitoring in home or ambulatory environments. In the present claimed invention, concepts are applied "'to a new and useful end,'" Since the method, system and computer program product of the claimed invention produces measurements of one or more physiological parameters using a system that can be used in the home or in ambulatory situations and eliminates the erroneous measurements due to motion artifacts, the claimed invention is an improvement in the technology of physiological parameter monitoring in home or ambulatory environments. In the present claimed invention, concepts are applied "'to a new and useful end,'" and these improvement are obtained through substantive limitations in the claimed invention, the claimed invention does not preempt the applying of the concept of Shannon entropy. Applicants respectfully state that the claimed invention recites patentable subject matter.

III. THE 35 U.S.C. 103 REJECTIONS

Claims 1, 3, 8-9, 24, 27, 33-34, and 44 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Greco et al., "Kurtosis, Renyi's Entropy and Independent Component Scalp Maps for the Automatic Artifact Rejection from EEG data" in view of Lichter et al. (USPN 6, 159,147 - cited in previous action) and further in view of Reisfeld et al. (USPGPUB 2007/0213624)..

Applicant respectfully state that a *prima facie* case of obviousness has not been established for Claims 1, 3-5, 8-9, 24, 27-29, 33-34, and 44.

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The factual inquiries set forth in *Graham v. John Deere Co.,* 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claim Construction

The first step in determining whether a claim is anticipated, or is obvious in view of prior art, is to interpret the claim. ("It is elementary in patent law that, in determining whether a patent is valid ....., the first step is to determine the meaning and scope of each claim in suit." *Lemelson v. Gen. Mills, Inc.*, 968 F.2d 1202, 1206, 23 U.S.P.Q.2D (BNA) 1284, 1287 (Fed. Cir. 1992).) When not defined by applicant in the specification, the words of a claim must be read as they would be interpreted by those of ordinary skill in the art. (MPEP 2111.01) (*Rexnord Corp. v. Laitram Corp.*, 274 F.3d 1336, 1342, 60 USPQ2d 1851, 1854 (Fed. Cir. 2001) ("explaining the court's analytical process for determining the meaning of disputed claim terms")). The US Patent and Trademark Office ("USPTO") determines the scope of claims in patent applications not solely on the basis of the claim language, but upon giving claims their broadest reasonable construction "in light of the specification as it would be interpreted by one of ordinary skill in the art." *In re Am. Acad. of Sci. Tech. Ctr.,* 367 F.3d 1359, 1364[, 70 USPQ2d 1827, 1830] (Fed. Cir. 2004). MPEP 2111.

One skilled in the art, upon reading the specification, would interpret kurtosis for the preprocessed segment and Shannon entropy for the preprocessed segment has been computed using the segment and equations (1) and (2) in paragraphs 48 and 49 of the specification.

The level of ordinary skill in the pertinent art

One skilled in the art has knowledge of signal processing, at an equivalent graduate-level, and knowledge of biomedical applications. One skilled in the art would be familiar with Independent Component Analysis (ICA). One skilled in the art would be familiar with Delorme

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et al, Automatic artifact rejection for EEG data using high-order statistics and independent component analysis, Proceedings of the 3rd International Workshop on ICA, San Diego, 457-462, 2015 (submitted in an IDS on January 8, 2015). Delorme teaches obtaining kurtosis from the raw data but obtaining the Shannon entropy for the components from the ICA since " it would be useful if we could isolate and measure these artifacts based on their projection to overlapping electrode subsets. This is what ICA does." (Delorme, section 3.1).

Determining the scope and contents of the prior art

Greco teaches a technique for the automatic artifact rejection, based on the Independent Component Analysis (ICA) for the artifact extraction and on the joint use of kurtosis and Renyi's entropy, rather than Shannon's entropy (Greco, p. 181, col. 1, lines 10-14). Greco teaches extracting a number of data segments of EEG data, removing electrical line noise, performing independent component analysis (ICA) on the data to extract the independent components (ICs) and computing the kurtosis and Renyi's entropy for each independent component (IC). Greco teaches that using Shannon entropy instead of Renyi's entropy does not result in all the artifact being detected (Greco, p. 183, section IV-Results). Greco teaches removing noise from the raw data by filtering the data with a notch filter (Greco Sec. IV on page 206).

Lichter teaches a real-time biological data processing PC card that is lightweight, cost effective, and portable. The real-time biological data processing PC card is capable of converting a host personal computer system into a powerful diagnostic instrument. Each real-time biological data processing PC card is adapted to input and process biological data from one or more biological data sensors, and is interchangeable with other real-time biological data processing PC cards.

Renfeld teaches capturing photoplethysmograph signals while the patient sleeps are analyzed in order to diagnose the patient's cardiorespiratory condition. In particular, the signals may be used to detect and assess the severity of conditions that are characteristic of heart failure (HF), such as premature ventricular contractions and Cheyne-Stokes breathing (Renfeld, Par. 15). Renfeld, also discloses identifying arrhythmias and detecting other characteristics indicative of restoration modulation (Renfeld, par. 68, 78-79). Renfeld states, in paragraph 80, that, in regards to identifying arrhythmias and detecting other characteristics indicative of restoration

modulation, "Similar procedures to those described above can be applied to the detrended AC photoplethysmograph signal. One way to perform detrending is to replace the photoplethysmograph signal with its amplitude feature (maximum minus minimum signal). Other methods include subtracting a polynomial that approximates the signal, or using local maxima or local minima features. Following detrending, the processor applies very-low-frequency filtering followed by outlier rejection, and then computes the median vasomotion of each sequence."

Muthuswamy et al., "Spectral analysis methods for neurological signals", Journal of Neuroscience Methods 83 (1998) 1-14), in finding the power spectrum of a segment of data, teaches that "The mean and any linear trend in the data are removed before multiplying the signal with a window whose length is the same as the length of the signal *x(n) (N* points)."

Ascertaining the differences between the prior art and the claims at issue

Band stop filters, if the stop band is very narrow and highly attenuated over a few hertz, are also known Notch filters (see, for example, http://www.electronics-tutorials.ws/filter/band-stop-filter.html). The Band Stop Filter, functions in exactly the opposite way to the Band Pass Filter (see, for example, http://www.electronics-tutorials.ws/filter/band-stop-filter.html).

Greco teaches removing noise from the raw data by filtering the data with a notch filter (Greco Sec. IV on page 206) and replacing the notch filter in Greco with the bandpass filter of the applicant will render Greco unsuitable for the purpose of intended for since it would lead in the noise that Greco was trying to notch filter and the additional noise would cover up the motion artifacts. Lichter also does not teach a bandpass filter. Reisfeld does not teach a bandpass filter for pre-processing.

Applicant respectfully states that neither Greco nor Lichter nor Reisfeld teach or suggest "wherein detecting effects of motion artifacts in the measurements comprises:

bandpass filtering and detrending a segment from the measurement of one physiological parameter; wherein a bandpass filtered and detrended segment is hereinafter referred to as a preprocessed segment," a limitation of independent claims 1, 24 and 44.

To establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974).

Applicants respectfully state that neither Greco nor Lichter nor Reisfeld teach or suggest all the limitations of the independent claims.

Applicants respectfully state that a prima facie case of obviousness has not been established for claims 1, 24 and 44.

Claims 3, 8-9 are dependent on claim 1. Claims 27, 33-34 are dependent on claim 24.

Applicants respectfully state that a prima facie case of obviousness has not been established for claims 1, 3, 8-9, 24, 27, 33-34 and 44.

Greco teaches away from the combination.

One skilled in the art would be familiar with Delorme et al, Automatic artifact rejection for EEG data using high-order statistics and independent component analysis, Proceedings of the 3rd International Workshop on ICA, San Diego, 457-462. Delorme teaches obtaining kurtosis from the raw data but obtaining the Shannon entropy for the components from the ICA since " it would be useful if we could isolate and measure these artifacts based on their projection to overlapping electrode subsets. This is what ICA does." (Delorme, section 3.1). One skilled in the art following Greco (and with knowledge of Delorme) will not use the Shannon entropy of the preprocessed segment, where the preprocessed segment is the bandpass filtered and detrended segment of the data, and would instead apply ICA and use the Shannon entropy of the components of the ICA.

One skilled in the art, after the teachings of Greco, would be discouraged from using Shannon entropy of the bandpass filtered and detrended data as an indicator of volatility, therefore the reference teaches away. *In re Gurley,* 27 F.3d 551, 553 (Fed. Cir. 1994).

In *KSR International Co. v. Teleflex Inc.*, 127 S. Ct. 1727, 1740 (2007), the Court identified "teaching away" as a strong indicator of nonobviousness.

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The examiner, in the office action, states that " It would have been obvious to one with ordinary skill in the art at the time of the invention was made to modify the method and system (Greco as modified by Lichter) to incorporate the detrending step/ function as taught by Reisfeld, since one ordinary would have recognized that both Greco as modified by Lichter and Reisfeld teach analyzing physiological data, signals, and parameters and it is commonly known in the art that detrending is a data preprocessing step for analyzing EEG signals (e.g. see Muthuswamy et al., "Spectral analysis methods for neurological signals", Journal of Neuroscience Methods 83 (1998) 1-14) for removing the mean and linear trends in the segment of the signal."

The examiner does not elucidate how to incorporate the detrending step/ function as taught by Reisfeld in Greco. The applicants claim recites that the at least one indicator of volatility being at least Shannon entropy for the bandpass filter and detrended segment of data. Greco teaches Shannon entropy of the components of the ICA. If incorporating the detrending step/ function as taught by Reisfeld in Greco requires detrending the ICA components, there is no motivation or reason to do so in either Greco or Reisfeld and detrending the ICA components could result in Greco not being suitable for the purpose it was intended for.

The examiner states that "it is commonly known in the art that detrending is a data preprocessing step for analyzing EEG signals (e.g. see Muthuswamy et al., "Spectral analysis methods for neurological signals", Journal of Neuroscience Methods 83 (1998) 1-14) for removing the mean and linear trends in the segment of the signal." Applicants respectfully state that that statement is not supported by substantial evidence. Muthuswamy uses detrending in finding the power spectrum of a segment of data, which is a completely different use from that in the applicants, there is no indication in Muthuswamy of using detrending for detecting effects of motion artifacts.

The Supreme Court has provided instruction that "a patent composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art" and further that "it can be important to identify a reason that would have

prompted a person of ordinary skill in the relevant field to combine the elements in the way the claimed new invention does." *KSR Int'l Co. v. Teleflex, Inc.*, 550 U.S. 398, 418 (2007).

Applicants respectfully state that a prima facie case of obviousness has not been established for claims 1, 3, 8-9, 24, 27, 33-34 and 44.

Claims 6 and 30 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over the combination of Greco, Lichter and Reisfeld as applied to claims 1 and 24 above, and further in view of Maier et al. (USPGPUB 2006/0253261 - cited in previous action).

Claim 6 depends on claim 1 and claims 30 depends on claim 24.

As stated above, Applicants respectfully state that neither Greco nor Lichter nor Reisfeld teach or suggest "wherein detecting effects of motion artifacts in the measurements comprises:

bandpass filtering and detrending a segment from the measurement of one physiological parameter; wherein a bandpass filtered and detrended segment is hereinafter referred to as a preprocessed segment," a limitation of independent claims 1, 24 and 44.

Applicants respectfully state that Maeir also does not teach or suggest "wherein detecting effects of motion artifacts in the measurements comprises:

bandpass filtering and detrending a segment from the measurement of one physiological parameter; wherein a bandpass filtered and detrended segment is hereinafter referred to as a preprocessed segment," a limitation of independent claims 1, 24 and 44.

Applicants respectfully state that neither Greco nor Lichter nor Reisfeld nor Maeir teach or suggest all the limitations of claims 6 or 30.

Applicants respectfully state that a prima facie case of obviousness has not been established for claims 6 and 30.

Claims 7 and 31-32 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over the combination of Greco, Lichter and Reisfeld as applied to claims 1 and 24 above, and further in view of Jacobsen et al. (USPN 6, 198,394 - cited in previous action).

Claim 7 depends on claim 1 and claims 31-32 depend on claim 24.

As stated above, Applicants respectfully state that neither Greco nor Lichter nor Reisfeld teach or suggest "wherein detecting effects of motion artifacts in the measurements comprises:

bandpass filtering and detrending a segment from the measurement of one physiological parameter; wherein a bandpass filtered and detrended segment is hereinafter referred to as a preprocessed segment," a limitation of independent claims 1, 24 and 44.

Applicants respectfully state that Jacobsen also does not teach or suggest "wherein detecting effects of motion artifacts in the measurements comprises:

bandpass filtering and detrending a segment from the measurement of one physiological parameter; wherein a bandpass filtered and detrended segment is hereinafter referred to as a preprocessed segment," a limitation of independent claims 1, 24 and 44.

Applicants respectfully state that a *prima facie* case of obviousness has not been established for claims 7 and 31-32.

Claim 18 is rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over the combination of Greco, Lichter and Reisfeld as applied to claim 1 above, and further in view of Zhang (USPGPUB 2009/0112110 - cited in previous action).

Claim 18 is dependent on claim 1.

As stated above, Applicants respectfully state that neither Greco nor Lichter nor Reisfeld teach or suggest "wherein detecting effects of motion artifacts in the measurements comprises:

bandpass filtering and detrending a segment from the measurement of one physiological parameter; wherein a bandpass filtered and detrended segment is hereinafter referred to as a preprocessed segment," a limitation of independent claims 1, 24 and 44.

Applicants respectfully state that Zhang also does not teach or suggest "wherein detecting effects of motion artifacts in the measurements comprises:

bandpass filtering and detrending a segment from the measurement of one physiological parameter; wherein a bandpass filtered and detrended segment is hereinafter referred to as a preprocessed segment," a limitation of independent claims 1, 24 and 44.

Applicants respectfully state that a *prima facie* case of obviousness has not been established for claim 18.

Claims 19-23, 39-43, and 49-53 are rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1-16 of U.S. Patent No. 8,755,876 in view of Greco and Lichter.

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While Applicants are not opposed to filing a terminal disclaimer, Applicants respectfully state that nonstatutory obviousness double patenting requires a prima facie case of obviousness. U.S. Patent No. 8,755,876 only claims the detection of atrial fibrillation while claim 19 recites "detecting, using the handheld mobile communication device and using **only** the measurements of one or more physiological parameters, effects of motion artifacts in the measurements of the one or more physiological parameters and deciding whether to retain the measurements based on effects of motion artifacts in the measurements." Claims 39 and 49 also recite detecting, using the handheld mobile communication device and using **only** the measurements of one or more physiological parameters, effects of motion artifacts. Greco teaches performing Independent Component Analysis on the preprocessed data in order to obtain independent components and obtaining a value of at least one indicator of volatility for the **independent component in** order to detect motion artifacts. Applicants respectfully state that Greco does not teach or suggest using **only** the measurements of one or more physiological parameters to detect the effect of motion artifacts and neither does Lichter. Applicants respectfully state that a *prima facie* case of obviousness has not been established for 19-23, 39-43, 49-53 and nonstatutory obviousness double patenting is not proper.

CONCLUSION

Any amendments to the claims as set forth herein, including the modification, addition, cancellation, or withdrawal of any claims, have been offered to advance this application to issue. None of the amendments made herein should be construed as an admission that the subject matter of the claims, as originally filed, is anticipated by or made obvious in light of any art of record whether considered singularly or in combinations. Applicants expressly reserve the right to pursue the originally filed claims in another co-pending application without being prejudiced by any amendments, including cancellation of claims, made herein.

The Director of Patents and Trademarks is hereby authorized to charge any underpayment of fees, or credit any overpayments, to Deposit Account 03-2410 (Order No. 30210-201).

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The following information is presented in the event that a call may be deemed desirable by the Examiner:

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Respectfully submitted,

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Artículo de Reflexión ▪

Uses of entropy in medical research

Usos de la entropía en la investigación médica

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Forma de citar: Alexander N, Parra G. Uses of entropy in Medical Research. Rev CES Med 2007; 21 (1): 65-75

SUMMARY

Entropy is a basic concept of physics, with analogues in communication theory and other fields. We review applications of entropy in medical research, under three headings of increasing scientific profundity. First, we consider the use of entropy as a summary statistic to measure the diversity of ecological and other systems. We emphasize the exponential of the Shannon entropy as a dispersion index, illustrated in sample size determination for pupal surveys of the dengue vector mosquito Aedes aegypti. Secondly, we review maximum entropy as a method of statistical modelling, illustrated by spatial analysis of the malaria vector mosquito Anopheles nuñeztovari. Finally, we review the postulate of Extreme Physical Information (EPI), which elegantly yields many key laws of physics, including general relativity. EPI has been applied to some biological problems, such as predicting rates of cancer growth, and we suggest that it may have fruitful applications in immunology.

KEY WORDS

Entropy
Information
Malaria

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Dengue
Biomedical research

RESUMEN

La entropía es un concepto básico en la física, con conceptos análogos en la teoría de las comunicaciones y en otros campos. Revisamos las aplicaciones de la entropía en la investigación médica, bajo tres lineamientos de creciente profundidad científica. Primero, consideramos el uso de la entropía como una herramienta estadística para medir la diversidad ecológica y de otros sistemas. Se enfatiza el carácter exponencial de la entropía de Shannon como un índice de dispersión, el cual es ilustrado por su uso en las encuestas de pupas del mosquito vector del dengue Aedes aegypti para la estimación de tamaños de muestra. Segundo, revisamos la entropía máxima como un método de modelación estadística. Se ilustra mediante el análisis espacial del mosquito vector de malaria Anopheles nuñeztovari. Finalmente, revisamos el postulado Información Física Extrema (EPI), el cual soporta varias leyes físicas, incluyendo la de la relatividad. EPI ha sido aplicado a algunos problemas biológicos, como por ejemplo para predecir tasas de crecimiento de cáncer. Sugerimos que puede tener aplicaciones útiles en inmunología.

PALABRAS CLAVE

Entropía
Información
Malaria
Dengue
Investigación médica

1. INTRODUCTION

The word entropy derives from the Greek *entropía*, meaning a turn inwards, a sense it retains in the ophthalmological term 'entropion'. In common use, entropy currently implies decay; a kind of inevitable ageing. Some philosophers and artists see it as a key concept for our current society, in which the control of information is vital, but inevitably imperfect (1,2). The art critic Robert Hughes said of Andy Warhol: "His ideal society has crystallized around him and learned to love his entropy" (3).

In science, the term 'entropy' was introduced by Clausius in 1865, meaning a ratio of heat to temperature, denoted S. According to the second law of thermodynamics, heat flows spontaneously from hot bodies to cold ones, and not the reverse, and this implies that S always increases. In 1877, Boltzmann used a molecular approach to derive an equivalent form, which depends on the number W of microscopic states consistent with the macroscopic state of a system: $S=k\log(W)$, where k is Boltzmann's constant. This can be interpreted as a measure of disorder in the system, or ignorance of it.

In the twentieth century the concept of entropy was used as a measure of information, which is currently applied in telecommunications and other information technologies (4). Recently a theory has been derived which encompasses these concepts as special cases of Fisher information (5).

In the current paper we describe uses of entropy in medical research. We start with its use as a simple summary statistic of disorder in a series of categories, and proceed to the postulate of Extreme Physical Information (EPI) as a basic scientific principle.

2. ENTROPY AS A MEASURE OF COMPLEXITY OF ECOLOGICAL SYSTEMS

In ecology, entropy is used under the name of Shannon-Wiener index to measure diversity, or niche breadth (6), and has the following form:

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$$H' = - \Sigma p \log(p)$$

The symbol Σ means a sum of the various values of p. For example, to measure species diversity, each p is the proportion of individuals in each species. The alternative Brillouin index has a different form, but Stirling's formula can be used to show that it is numerically similar to H´, especially for large sample sizes(7). Here we have included a negative sign in the definition of H´. Without this, H´ becomes a measure of information, which can be defined as the negative of entropy 'negentropy'(8). Similar applications have been made to antigenic and genetic diversity (9-11).

The index H´ is mathematically identical to the Shannon entropy (12). In communication theory, each p represents the relative frequency of a symbol, for example a letter of the alphabet. Whether in ecology or communication theory, the entropy is greater if the distribution is more uniform. The base of logarithms determines the units of H´. For base 2, the units are bits (abbreviation of 'binary digit'). For base 10, the units are decits, and for base e they are nats (13).

2.1 Application to sampling of Aedes breeding sites

Dengue is a viral illness with 50-100 million cases each year, of whom 0,25-0,5 million have the severe form, dengue haemorrhagic fever (14). Given the current lack of a vaccine, the only preventive method is control of the vectors, which are mosquitoes of the genus *Aedes*, principally *Aedes aegypti*. As breeding sites, these mosquitoes use a wide variety of water-holding containers. To make control more efficient, it is possible to think in terms of 'key' container types, which contain a majority of immature forms (larvae and pupae) (15). These key types would be the priorities for control efforts.

As part of an international project to develop methods for *Aedes* control (16), there arose a need for a method for determining sample size to confidently identify key container types. In statistical terms, this task was more complicated than most sample size calculations. It deals not with a single parameter (such as a mean or proportion) but, rather, a distribution over an indefinite number of container types. Moreover, the method had to be sufficiently simple for use by control personnel, who do not necessarily have mathematical or statistical training.

It was expected that, where pupae were more concentrated in fewer container types, the sample size would be smaller. The use of entropy (the Shannon-Wiener index, H) was investigated for measuring the concentration of pupae, and for predicting sample size. More specifically, the exponential of H´ was used; conventionally denoted N_1. The use of the exponential removes the dependency on the base of logarithms, and yields a dispersion index with the following simple characteristics:

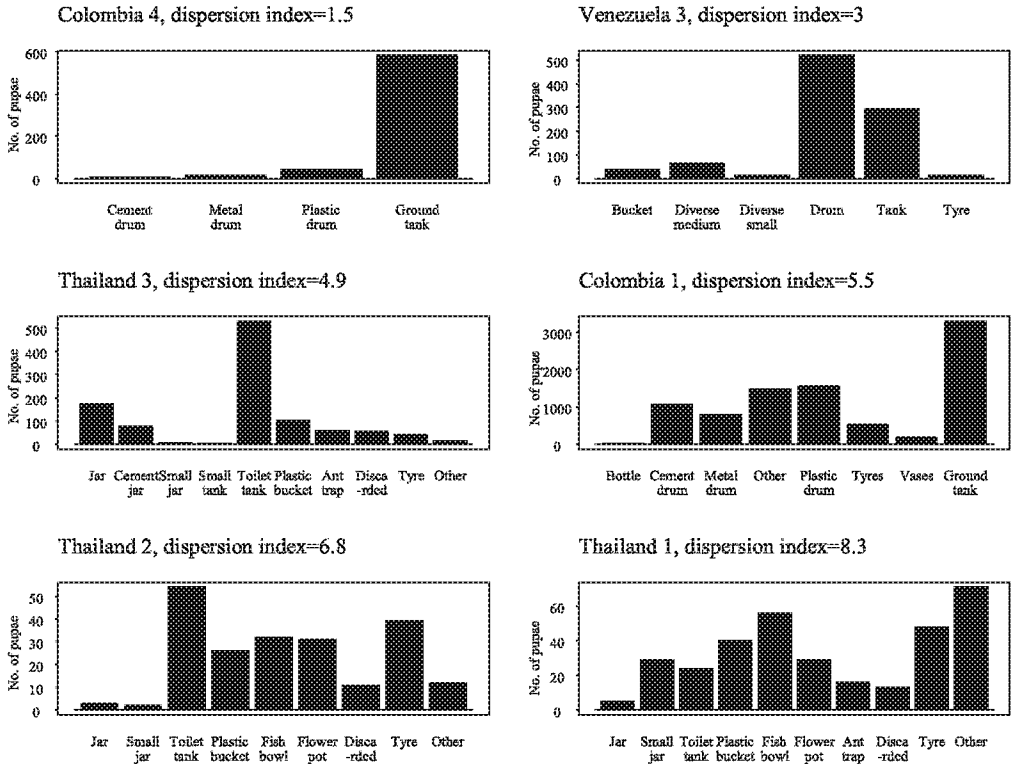
- The dispersion index N_1 is larger when the pupae are distributed more uniformly between the container types.
- The maximum value of N_1 equals the number of container types, and is reached when the same proportion of pupae are found in each type. For example, with four container types, an even distribution would have four proportions of 0,25, and N_1 would be $10^{-4 \times \log_{10}(4)/4} = 4$. Any other distribution gives a lower value. For example, 20 % in each of three types, and 40 % in the fourth, gives $N_1 = 10^{-(3 \times 0.2 \log_{10}(0.2) + 0.4 \log_{10}(0.4))} \approx 3.8$.
- A uniform distribution between a smaller number of container types yields a smaller value of N_1 than does a uniform distribution between a larger number of types. For example, we already saw that four container types, each with a quarter of pupae, would have $N_1 = 4$. Similarly, five container types each with a fifth of the pupae would have $N_1 = 5$.
- A container type with very few pupae does not substantially affect N_1.

Figure 1 shows examples of the dispersion index N_1 with data from studies done in Colombia (Barran-

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quilla) (17), Venezuela (Trujillo) (18) and Thailand (Chiang Mai and Khon Kaen) (19). Each study did multiple surveys. In the Colombian survey number 4, almost all the pupae were found in ground tanks (*albercas* or *tanques bajos*), and this survey has the smallest dispersion index among the six shown. At the other extreme, the highest dispersion index is $N_1 = 8,3$ found in the Thai survey number 1. In this survey, four container types had more than 10 % of pupae, although none had more than 22 %. It was expected that, in such situations of high dispersion index, it would be more difficult to define the key container types, i.e. that a larger sample size would be needed.

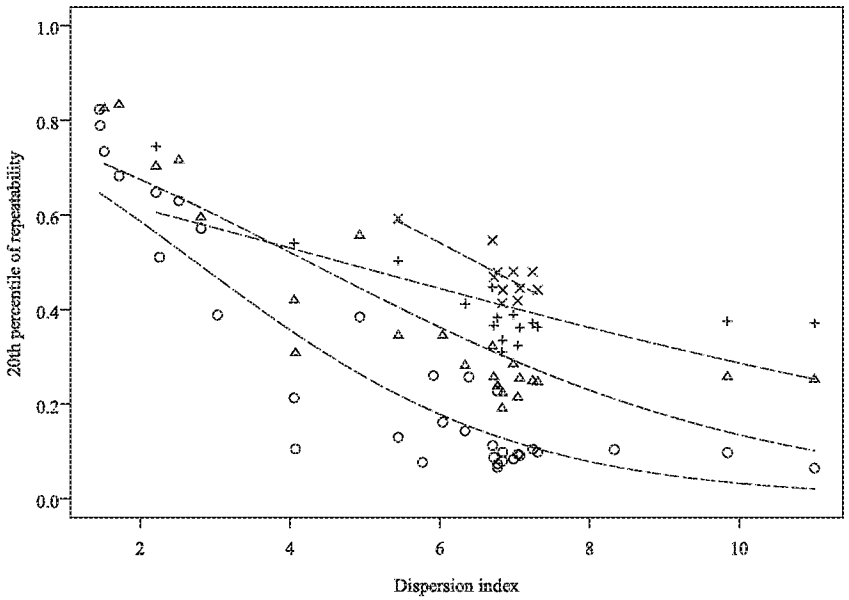
Figure 1. THE DISTRIBUTIONS OF A*edes aegypti* PUPAE OVER CONTAINER TYPES IN SIX SURVEYS. THE EXPONENTIAL OF SHANNON ENTROPY IS SHOWN AS A DISPERSION INDEX (N1).



In order to evaluate the use of the dispersion index (N_1) for determining sample size, the index was related to the repeatability of surveys. For this purpose, repeatability was defined in terms of two surveys which were simulated by drawing from the original data of each study. In the first simulated survey, the key container types were identified as those in which 70 % of pupae were found. The value of 70 % was a consensus value agreed by the investigators of the A*edes* control project. Then, the percentage of pupae in those same types was evaluated in the second simulated survey. This percentage was defined as the repeatability. The simulation process was repeated 1 000 times, in order to examine the distribution of repeatability. Ideally, the repeatability would almost always be close to 70 %: this would indicate the key contai-

ner types can be identified consistently between surveys. Figure 2 shows that the repeatability is greater a) If the sample size is greater, and b) if the dispersion index (entropy) is less.

Figure 2. INVERSE RELATION BETWEEN REPEATABILITY OF A*edes* PUPAL SURVEYS (VERTICAL AXIS) AND THE DISPERSION INDEX (N1, HORIZONTAL AXIS). FOR THE VERTICAL AXIS, A LOW VALUE PERCENTILE OF THE DISTRIBUTION WAS USED (ARBITRARILY CHOSEN AS THE 20TH), SO THAT THE REPEATABILITY HAS A HIGH PROBABILITY (80%) OF BEING AT LEAST AS HIGH AS THE VALUE PLOTTED. SAMPLES SIZES WERE 10 (O), 25 (D), 50 (+) OR 100 (×) HOUSES POSITIVE FOR PUPAE. THE DASHED LINES SHOW FITS FROM REGRESSING THE LOGISTIC TRANSFORMATION OF THE REPEATABILITY ON THE DISPERSION INDEX. SEE THE TEXT OF SECTION 2.1 FOR MORE DETAILS.



This analysis was used to construct a flow diagram for determination of sample size (20). It requires a minimum of 10 houses positive for pupae (i.e., with at least one pupa). If the pupae in these ten houses have a dispersion index (N_1) less than 2, the survey can be halted and the key container types identified. Otherwise, the survey should continue until a point defined by the values of N_1 at the following steps of the flow diagram (after 25, 50 and 100 positive houses). The method also permits the investigators to join categories. For example, in the Thai survey number 2, 'small jar' could be joined with 'jar'.

3. STATISTICAL ANALYSIS BY MAXIMUM ENTROPY

Likelihood is a fundamental concept in statistics (21), and means the probability of the data, under the assumption of a particular probability distribution. Analysis by maximum likelihood involves finding the parameters which maximize the likelihood of the data, for the assumed type of distribution. Analysis by maximum entropy is complementary. Rather than starting with a distribution and estimating

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parameters, it treats the parameters as constraints, and finds the distribution with the maximum entropy. For example, we may specify values of the mean and standard deviation (e.g. the sample mean and standard deviation of a particular dataset). Then, the normal (Gaussian) distribution has higher entropy than any other. More formally, certain types of problems yield equivalent solutions by maximum likelihood or maximum entropy (22), although one method or the other may be more convenient. Until recently, maximum entropy analysis has been used mostly in certain fields such as physics (23), linguistics (24) and bioinformatics (25).

Recently, Phillips et al (26,27) presented a method for spatial analysis by maximum entropy, for prediction of species' geographic distributions. The method requires a set of locations in which the species has been found. This type of data is called 'presence only', because it does not contain locations in which the species was sought but not found. Prediction is done on the basis of environmental or other geo-referenced variables, which are available in the region for which the predictions are to be made. The results are usually reported in terms of relative probability, so that the most likely predicted location for the species has a value of 100 %. One limitation of the method is possible sampling bias, i.e. the locations sampled tending to have certain environmental characteristics, perhaps associated with being more accessible. The authors state that their approach could, in the future, be extended to presence/absence data, although this is not done in their publications.

Phillips et al. illustrated their approach using data from South America on the sloth *Bradypus variegatus* and the rodent *Microryzomys minutus*. They compared the maximum entropy method to the Genetic Algorithm for Rule-Set Prediction (GARP), which can also use presence-only data, and which has been used to predict the distributions of several species, including those of insect vectors of leishmaniasis and Chagas' disease in South America (28,29). Phillips et al. found that, in their example, the maximum entropy method was generally superior to GARP in terms of a) the proportion of known localities which were successfully predicted, and b) the area under the curve (AUC) of the receiver operating characteristic (ROC), which is a summary measure of sensitivity and specificity. In the following section we will apply the same maximum entropy method to a mosquito vector of malaria.

3.1 *Prediction of the presence of* Anopheles (Nyssorhynchus) *nuñeztovari* Gabaldon, 1940.

Anopheles nuñeztovari is the principal malaria vector in western Venezuela and northern Colombia, and has been incriminated as a vector in Peru, Brazil and Surinam (30). Twenty-three georeferenced locations of *Anopheles nuñeztovari* in Colombia were obtained directly in the field using a GPS (Garmin III) in the departments of Antioquia and Cordoba. The adult mosquitoes were collected directly in houses resting on walls. Seventy-seven other locations were extracted from published reports (30,34).

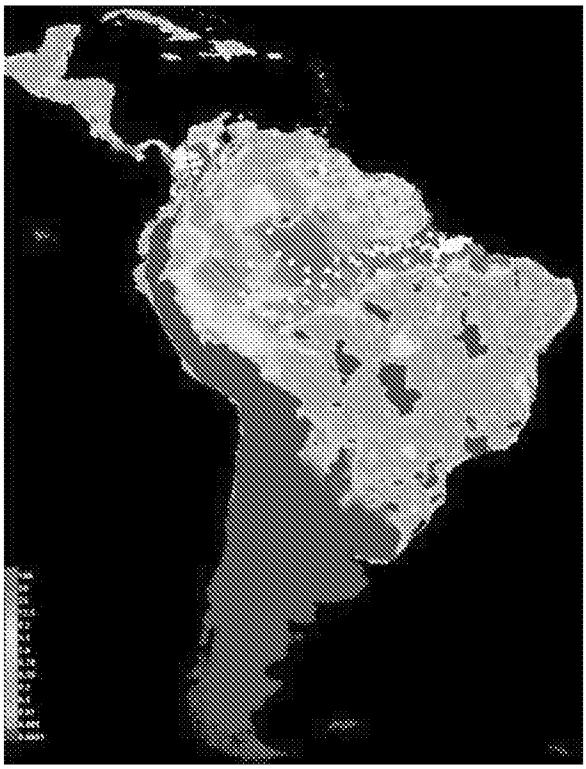
The analysis used the software made available by Phillips et al.(27), and with the same 14 predictor variables. Twelve of these were obtained from the Intergovernmental Panel on Climate Change and relate to temperature, precipitation, cloud cover, frost frequency, and vapour pressure. The remaining two variables were elevation, and a classification of 'major habitat type', which was intended to reflect vegetation. The map of predictions is shown in Figure 3.

The predictions of the distribution of *An. Nuñeztovari* show generally good agreement with the known distribution. In particular the predictions of presence in the east of Panama, northern Colombia, western Venezuela, the Guyanas and the Brazilian Amazonian basin coincided with almost all the known niches of the species. However, there are

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some exceptions. For the north of Peru and Bolivia the prediction is weak, possibly due to those areas' environmental conditions (mainly dry with xerophytic vegetation), which are totally different to those of other areas (tropical rain forests with high levels of precipitation). The actual presence of *An. nuñetovari* in those areas could be explained as a species complex with cryptic forms and different cytotypes. Finally, predictions in Central America and some Caribbean islands should be tested: those areas could be part of the species' fundamental niche.

Figure 3. PREDICTION BY MAXIMUM ENTROPY OF THE DISTRIBUTION OF THE MALARIA VECTOR *Anopheles nuñeztovari*. WHITE SQUARES INDICATE LOCATIONS WHERE THIS SPECIES WAS FOUND. WARMER COLOURS INDICATE A HIGHER PREDICTED LIKELIHOOD OF PRESENCE, NORMALIZED TO HAVE A MAXIMUM VALUE OF 100.



4. EXTREME PHYSICAL INFORMATION

So far we have seen the use of entropy in statistical methods. Now we will consider the application to medical research of a physical principle which is based on a concept closely linked to that of entropy.

4.1 Fisher Information

Named after the statistician and geneticist Ronald Fisher, Fisher information is best known as a measure of statistical uncertainty in the estimation of parameters. For example, in the case of a single parameter, the Fisher information is the reciprocal of the square of its standard error.

Frieden (5) shows that Fisher information is a generalization of the thermodynamic and Shannon entropies and therefore calls it a 'mother' information measure. He postulates the principle of Extreme Physical Information (EPI), which states that any measurement extracts a quantity of Fisher information from the observed object, and that this quantity is an *extremum* (a minimum or maximum), given the constraints of the problem. In physical applications, these constraints could be conservation principles. For example, from the principles of EPI and conservation of momentum, Frieden derives general relativity. Another example is the derivation of the Cramér-Rao lower bound (i.e. the lowest possible statistical variance of an unbiased parameter estimate) as an instance of the Heisenberg uncertainty principle (i.e. the quantum mechanical observation that, for example, the position and velocity of a particle cannot be simultaneously known with exact precision). That EPI can elegantly yield such important results suggests that it has an important role in physics.

Furthermore, Frieden and his colleagues have applied EPI to some examples in other fields, including biomedicine. Gatenby & Frieden (35) applied EPI to tumour growth. The 'information'

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in this case is signalled between malignant and healthy cells, and 'protons appear to be the dominant messengers because increased glucose uptake and excessive secretion of acid into the extracellular spaces are observed in the vast majority of clinical cancers.' The authors predicted that *in vivo* growth rate would follow a power law. This is less than the maximum possible rate, which would be exponential. The authors extrapolate their predictions to the distribution of tumour size, and show a close fit to published data. Their interpretation is that the malignant cells forego maximum growth in order to minimize the information available to their benign neighbours on the time at which they became malignant. This work suggests that EPI could have other physiological applications.

4.2. The immune system as an information processor

'Antigens bear Shannon-type information intrinsically, as a consequence of their particular molecular organization', according to Atlan and Cohen(36). Such statements seem to promise, for the immunological network, the same kind of informatic theory that Shannon developed for telecommunication networks. Unfortunately, however, much of this literature is rather verbose and does not attempt to quantify immunological phenomena. However, it may be possible to use the principle of EPI to make predictions and indicate new experimental directions.

Gatenby & Frieden's interpretation of their tumour growth analysis was that malign cells minimize the information they provide to their benign neighbours on the time of origin of the tumour. This may provide a clue to some aspects of parasite immunology. For example, parasite development and growth may be optimized to balance speed against stealth in evading the immune system. Immune evasion is ubiquitous in parasites (37), with its mode depending on the particular immune cells and molecules available to the host. These, together with the substances which the parasite exposes to the host, would constitute the signalling mechanism corresponding to the much simpler lactic acid molecules in the cancer growth example.

In order to investigate this, a useful model parasite would be one which occurs in different locations of the body in which different immune responses may be available. For example, metacercariae of the digenean helminth *Paragonimus westermani* usually develop into adults in the lungs of the host, but may do so in several other locations including muscle, subcutaneous tissues, spleen, liver, peritoneum, urinary tract, and central nervous system (38). Comparative data on the rates of development, and the signalling molecules present in different locations, could enable an analysis similar to that done for cancer growth, although most of the information-bearing molecules would be more complex. Finally, another possible application of EPI would be migration rates of parasites through tissue, and this is currently the subject of further investigation.

5. DISCUSSION

We have seen three uses of entropy in medical research, in order of increasing profundity. The first is the use of Shannon entropy as a summary statistic of dispersion across a number of categories (section 2). The second use of entropy is a principle of statistical analysis, known as maximum entropy (section 3). This approach seeks the distribution which has the maximum entropy, subject to the conditions of the problem. This is, in a strict sense, complementary to that of the more well known method of maximum likelihood. Although currently little known outside a few specialties, such as bioinformatics, we saw an application to spatial analysis in ecology (27). This powerful technique has several advantages over alternatives such as GARP, and is easily available via the software made freely available by the authors. Nevertheless, an obstacle to the wider use of the method is the complexity of identifying the distribution which has the maximum possible entropy. Algebraic solution

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requires mathematical techniques such as calculus of variations, and is more difficult than the typical maximum likelihood problem of estimating a small number of scalar parameters. On the other hand, in practice, solutions can be derived by numerical iteration.

A strong rationale for maximum entropy analysis is its correspondence to a principle which elegantly yields many basic components of physics, namely Extreme Physical Information (EPI). This states that any physical measurement extracts a quantity of Fisher information from the observed object, and that this quantity is an *extremum* (a minimum or maximum). This principle was postulated by Frieden (5), who has shown that Fisher information — a quantity better known in statistics — is a kind of 'mother' information which can be used to derive many physical laws, such as general relativity, and the Klein-Gordon equation. In biology, EPI has also had some successful applications, in particular in explaining rates of tumour growth, and we can look forward to its continued fruitful use in medical research.

ACKNOWLEDGEMENTS

Figures 1 and 2 are reproduced from the *Annals of Tropical Medicine and Parasitology*, 100 (Suppl. 1), S9, S13, with the permission of the Liverpool School of Tropical Medicine.

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Electronic Acknowledgement Receipt

EFS ID:	26278232
Application Number:	13354941
International Application Number:	
Confirmation Number:	9133
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First Named Inventor/Applicant Name:	Ki H. Chon
Customer Number:	26486
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FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	RATE ($)	FEE ($)
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☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	
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Independent (37 CFR 1.16(h))	* 6	Minus	***6	= 0	X $210 =	0
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Application Number	13354941
Filing Date	2012-01-20
First Named Inventor	Ki H. Chon
Art Unit	3777
Examiner Name	LIU, CHU CHUAN
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	Application Number	13354941
	Filing Date	2012-01-20
	First Named Inventor	Ki H. Chon
	Art Unit	3777
	Examiner Name	LIU, CHU CHUAN
	Attorney Docket Number	30210-201

	1	Rajet Krishnan et al; "Analysis and Detection of Motion Artifact in Photoplethysmographic Data Using Higher Order Statistics"; Acoustics, Speech and Signal Proceeding, IEEE 2008; pp. 613-616
	2	Delorme, A. et al; SNL, Salk University; "Automatic Artifact Rejection for EEG Data Using High-Order Statistics and Independent Component Analysis"; Proceedings of the 3rd International Workshop on ICA; San Diego, 2001; pp. 457–462
	3	Third Office Action (English translation also enclosed) dated February 29, 2016 in corresponding Chinese Application No. 201280014031.1, filed on January 20, 2012

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	Application Number	13354941
	Filing Date	2012-01-20
	First Named Inventor	Ki H. Chon
	Art Unit	3777
	Examiner Name	LIU, CHU CHUAN
	Attorney Docket Number	30210-201

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Signature	/Orlando Lopez/	Date (YYYY-MM-DD)	2016-07-08
Name/Print	Orlando Lopez	Registration Number	46880

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Electronic Patent Application Fee Transmittal

Application Number:	13354941
Filing Date:	20-Jan-2012
Title of Invention:	PHYSIOLOGICAL PARAMETER MONITORING WITH A MOBILE COMMUNICATION DEVICE
First Named Inventor/Applicant Name:	Ki H. Chon
Filer:	Orlando Lopez/Lisa Fralick
Attorney Docket Number:	30210-201

Filed as Small Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
Submission- Information Disclosure Stmt	2806	1	90	90
		Total in USD ($)		**90**

Electronic Acknowledgement Receipt

EFS ID:	26292883
Application Number:	13354941
International Application Number:	
Confirmation Number:	9133
Title of Invention:	PHYSIOLOGICAL PARAMETER MONITORING WITH A MOBILE COMMUNICATION DEVICE
First Named Inventor/Applicant Name:	Ki H. Chon
Customer Number:	26486
Filer:	Orlando Lopez/Lisa Fralick
Filer Authorized By:	Orlando Lopez
Attorney Docket Number:	30210-201
Receipt Date:	08-JUL-2016
Filing Date:	20-JAN-2012
Time Stamp:	11:37:16
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$90
RAM confirmation Number	9151
Deposit Account	032410
Authorized User	LOPEZ, ORLANDO

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	30210-201US_IDSCiteForm.pdf	612450 fd6584f6574c0669e18d1f61256fc56fbaae53e8	no	4
Warnings:					
Information:					
A U.S. Patent Number Citation or a U.S. Publication Number Citation is required in the Information Disclosure Statement (IDS) form for autoloading of data into USPTO systems. You may remove the form to add the required data in order to correct the Informational Message if you are citing U.S. References. If you chose not to include U.S. References, the image of the form will be processed and be made available within the Image File Wrapper (IFW) system. However, no data will be extracted from this form. Any additional data such as Foreign Patent Documents or Non Patent Literature will be manually reviewed and keyed into USPTO systems.					
2	Non Patent Literature	30210-201US_AnalysisAndDetection.pdf	353294 ee665fa9fcc20d6a490dac325af524ef149dd60c	no	4
Warnings:					
Information:					
3	Non Patent Literature	30210-201US_AutomaticArtifact.pdf	490266 a077cd4981f99d223f81789b7e296021a56e74be	no	6
Warnings:					
Information:					
4	Other Reference-Patent/App/Search documents	30210-102US_ChineseThirdOfficeAction.pdf	1035987 9f7973c363278c3d1ce8358342e117dabf4b86c0	no	15
Warnings:					
Information:					
5	Fee Worksheet (SB06)	fee-info.pdf	31006 7fd5c49783ce6b94b2dc4b78706afeaed82c3a10	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	2523003		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

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JUL 15 2016

PATENT APPLICATION
Attorney Docket No. 30210-201

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants: Ki H. Chon et al.
Application Number: 13/354,941
Filed: January 20, 2012
Title: PHYSIOLOGICAL PARAMETER MONITORING WITH A MOBILE COMMUNICATION DEVICE

Examiner: LIU, CHU CHUAN
Group Art Unit: 3777
Confirmation No. 9133

BURNS & LEVINSON, LLP
125 Summer Street
Boston, MA 02110
(617) 345-3243

AGENDA FOR TELEPHONE INTERVIEW

Note that applicants have submitted an After Final Consideration Request.

I. 101 rejection-review in view of USPTO May 4, 2016 memo, memo on Enfish, BASCOM GLOBAL INTERNET v. AT&T MOBILITY LLC, opinion 2015-1763 (Federal Circuit June 27, 2016), and correct claim construction

II. 103 rejection
   a. Amendments-. Bandpass filter is the opposite of the notch filter taught by Greco
   b. Greco teaches away in view of the knowledge in the art as exemplified by Delorme
   c. Obviousness double patenting rejection

4840-3913-7589.1

PAGE 2/2 * RCVD AT 7/15/2016 1:33:54 PM [Eastern Daylight Time] * SVR:W-PTOFAX-001/9 * DNIS:2738300 * CSID:6173453299 * DURATION (mm-ss):01-02

RECEIVED
CENTRAL FAX CENTER
JUL 15 2016

FACSIMILE TRANSMITTAL

Date: 7/15/2016

Attorney Docket No.: 30210-201

Appl Serial No.: 13/354,941

To	Facsimile Number:	Telephone Number:
Examiner Chu Chuan Liu UNITED STATES PATENT AND TRADEMARK OFFICE	Fax (571)273-8300	(571) 272-3672

From: Dr. Orlando Lopez

Number of Pages (including cover): 2

Message:
ReLine

4833-9148-3172.1

PRINTED IN
CENTRAL FAX
JUL 22 2016

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/354,941	01/20/2012	Ki H. Chon	30210-201	9133

26486 7590 07/22/2016

BURNS & LEVINSON, LLP
125 SUMMER STREET
BOSTON, MA 02110

EXAMINER
LIU, CHU CHUAN

ART UNIT	PAPER NUMBER
3777	

NOTIFICATION DATE	DELIVERY MODE
07/22/2016	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

docketing@burnslev.com

Advisory Action Before the Filing of an Appeal Brief	**Application No.** 13/354,941	**Applicant(s)** CHON ET AL.	
	Examiner CHU CHUAN (JJ) LIU	**Art Unit** 3777	**AIA (First Inventor to File) Status** No

--The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

THE REPLY FILED 07 July 2016 FAILS TO PLACE THIS APPLICATION IN CONDITION FOR ALLOWANCE.

NO NOTICE OF APPEAL FILED

1. ☒ The reply was filed after a final rejection. No Notice of Appeal has been filed. To avoid abandonment of this application, applicant must timely file one of the following replies: (1) an amendment, affidavit, or other evidence, which places the application in condition for allowance;

(2) a Notice of Appeal (with appeal fee) in compliance with 37 CFR 41.31; or (3) a Request for Continued Examination (RCE) in compliance with 37 CFR 1.114 if this is a utility or plant application. Note that RCEs are not permitted in design applications. The reply must be filed within one of the following time periods:

a) ☒ The period for reply expires *3* months from the mailing date of the final rejection.

b) ☐ The period for reply expires on: (1) the mailing date of this Advisory Action; or (2) the date set forth in the final rejection, whichever is later. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of the final rejection.

c) ☐ A prior Advisory Action was mailed more than 3 months after the mailing date of the final rejection in response to a first after-final reply filed within 2 months of the mailing date of the final rejection. The current period for reply expires months from the mailing date of *the prior Advisory Action* or SIX MONTHS from the mailing date of the final rejection, whichever is earlier.

Examiner Note: If box 1 is checked, check either box (a), (b) or (c). ONLY CHECK BOX (b) WHEN THIS ADVISORY ACTION IS THE FIRST RESPONSE TO APPLICANT'S FIRST AFTER-FINAL REPLY WHICH WAS FILED WITHIN TWO MONTHS OF THE FINAL REJECTION. ONLY CHECK BOX (c) IN THE LIMITED SITUATION SET FORTH UNDER BOX (c). See MPEP 706.07(f).

Extensions of time may be obtained under 37 CFR 1.136(a). The date on which the petition under 37 CFR 1.136(a) and the appropriate extension fee have been filed is the date for purposes of determining the period of extension and the corresponding amount of the fee. The appropriate extension fee under 37 CFR 1.17(a) is calculated from: (1) the expiration date of the shortened statutory period for reply originally set in the final Office action; or (2) as set forth in (b) or (c) above, if checked. Any reply received by the Office later than three months after the mailing date of the final rejection, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

NOTICE OF APPEAL

2. ☐ The Notice of Appeal was filed on _____. A brief in compliance with 37 CFR 41.37 must be filed within two months of the date of filing the Notice of Appeal (37 CFR 41.37(a)), or any extension thereof (37 CFR 41.37(e)), to avoid dismissal of the appeal. Since a Notice of Appeal has been filed, any reply must be filed within the time period set forth in 37 CFR 41.37(a).

AMENDMENTS

3. ☒ The proposed amendments filed after a final rejection, but prior to the date of filing a brief, will not be entered because
   a) ☒ They raise new issues that would require further consideration and/or search (see NOTE below);
   b) ☐ They raise the issue of new matter (see NOTE below);
   c) ☐ They are not deemed to place the application in better form for appeal by materially reducing or simplifying the issues for appeal; and/or
   d) ☐ They present additional claims without canceling a corresponding number of finally rejected claims.

   NOTE: *The amendments change the scopes of the claims and therefore require further consideration and/or search*. (See 37 CFR 1.116 and 41.33(a)).

4. ☐ The amendments are not in compliance with 37 CFR 1.121. See attached Notice of Non-Compliant Amendment (PTOL-324).

5. ☐ Applicant's reply has overcome the following rejection(s): _____.

6. ☐ Newly proposed or amended claim(s) _____ would be allowable if submitted in a separate, timely filed amendment canceling the non-allowable claim(s).

7. ☒ For purposes of appeal, the proposed amendment(s): (a) ☒ will not be entered, or (b) ☐ will be entered, and an explanation of how the new or amended claims would be rejected is provided below or appended.

AFFIDAVIT OR OTHER EVIDENCE

8. ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

9. ☐ The affidavit or other evidence filed after final action, but before or on the date of filing a Notice of Appeal will not be entered because applicant failed to provide a showing of good and sufficient reasons why the affidavit or other evidence is necessary and was not earlier presented. See 37 CFR 1.116(e).

10. ☐ The affidavit or other evidence filed after the date of filing the Notice of Appeal, but prior to the date of filing a brief, will not be entered because the affidavit or other evidence failed to overcome all rejections under appeal and/or appellant fails to provide a showing of good and sufficient reasons why it is necessary and was not earlier presented. See 37 CFR 41.33(d)(1).

11. ☐ The affidavit or other evidence is entered. An explanation of the status of the claims after entry is below or attached.

REQUEST FOR RECONSIDERATION/OTHER

12. ☒ The request for reconsideration has been considered but does NOT place the application in condition for allowance because: See Continuation Sheet.

13. ☐ Note the attached Information *Disclosure Statement*(s). (PTO/SB/08) Paper No(s). _____

14. ☒ Other: PTO-2323 form is attached.

STATUS OF CLAIMS

15. The status of the claim(s) is (or will be) as follows:

Claim(s) allowed: .

Claim(s) objected to: .

Claim(s) rejected: 1,3,6-24,27 and 30-53.

Claim(s) withdrawn from consideration: 10-17,35-38 and 45-48.

/TSE CHEN/ Supervisory Patent Examiner, Art Unit 3777	/CHU CHUAN (JJ) LIU/ Examiner, Art Unit 3777

Continuation of 12. does NOT place the application in condition for allowance because: The amendments change the scopes of the claims and therefore require further consideration and/or search.

DO NOT ENTER: /CCL/

PATENT APPLICATION
Attorney Docket No. 30210-201

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants: Ki H. Chon et al.
Application Number: 13/354,941
Filed: January 20, 2012
Title: PHYSIOLOGICAL PARAMETER MONITORING WITH A MOBILE COMMUNICATION DEVICE

Examiner: LIU, CHU CHUAN
Group Art Unit: 3777
Confirmation No. 9133

BURNS & LEVINSON, LLP
125 Summer Street
Boston, MA 02110
(617) 345-3243

TO: Mail Stop AF
Commissioner for Patents
P.O. Box 1450,
Alexandria, VA 22313-1450

AMENDMENT AND RESPONSE TO FINAL OFFICE ACTION

Sir:

In reply to the Final Office Action dated April 28, 2016, Applicants submit the following amendments and remarks. An After Final Consideration Request form is attached hereto.

Amendments to the claims begin on page 2 of this paper.

Remarks begin on page 16 of this paper.

Attachments to this paper also include a copy of Form PTO/SB/434 (1 sheet).

AFCP 2.0 Decision	Application No.	Applicant(s)
	13/354,941	CHON ET AL.
	Examiner	Art Unit
	CHU CHUAN (JJ) LIU	3777

This is in response to the After Final Consideration Pilot request filed 07 July 2016.

1. **Improper Request** – The AFCP 2.0 request is improper for the following reason(s) and the after final amendment submitted with the request will be treated under pre-pilot procedure.

   ☐ An AFCP 2.0 request form PTO/SB/434 (or equivalent document) was not submitted.

   ☐ A non-broadening amendment to at least one independent claim was not submitted.

   ☐ A proper AFCP 2.0 request was submitted in response to the most recent final rejection.

   ☐ Other:

2. **Proper Request**

   A. After final amendment submitted with the request will not be treated under AFCP 2.0.
   The after final amendment cannot be reviewed and a search conducted within the guidelines of the pilot program.

   ☒ The after final amendment will be treated under pre-pilot procedure.

   B. Updated search and/or completed additional consideration.
   The examiner performed an updated search and/or completed additional consideration of the after final amendment within the time authorized for the pilot program. The result(s) of the updated search and/or completed additional consideration are:

   ☐ 1. All of the rejections in the most recent final Office action are overcome and a Notice of Allowance is issued herewith.

   ☐ 2. The after final amendment would not overcome all of the rejections in the most recent final Office action. See attached interview summary for further details.

   ☐ 3. The after final amendment was reviewed, and it raises a new issue(s). See attached interview summary for further details.

   ☐ 4. The after final amendment raises new issues, but would overcome all of the rejections in the most recent final Office action. A decision on determining allowability could not be made within the guidelines of the pilot. See attached interview summary for further details, including any newly discovered prior art.

   ☐ 5. Other:

   Examiner Note: Please attach an interview summary when necessary as described above.

PTO/SB/30EFS (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

REQUEST FOR CONTINUED EXAMINATION(RCE)TRANSMITTAL
(Submitted Only via EFS-Web)

Application Number	13354941	Filing Date	2012-01-20	Docket Number (if applicable)	30210-201	Art Unit	3777
First Named Inventor	Ki H. Chon			Examiner Name	Chu Chuan Liu		

This is a Request for Continued Examination (RCE) under 37 CFR 1.114 of the above-identified application.
Request for Continued Examination (RCE) practice under 37 CFR 1.114 does not apply to any utility or plant application filed prior to June 8, 1995, or to any design application. The Instruction Sheet for this form is located at WWW.USPTO.GOV

SUBMISSION REQUIRED UNDER 37 CFR 1.114

Note: If the RCE is proper, any previously filed unentered amendments and amendments enclosed with the RCE will be entered in the order in which they were filed unless applicant instructs otherwise. If applicant does not wish to have any previously filed unentered amendment(s) entered, applicant must request non-entry of such amendment(s).

☒ Previously submitted. If a final Office action is outstanding, any amendments filed after the final Office action may be considered as a submission even if this box is not checked.

☐ Consider the arguments in the Appeal Brief or Reply Brief previously filed on _____

☐ Other _____

☐ Enclosed

☐ Amendment/Reply

☐ Information Disclosure Statement (IDS)

☐ Affidavit(s)/ Declaration(s)

☐ Other _____

MISCELLANEOUS

☐ Suspension of action on the above-identified application is requested under 37 CFR 1.103(c) for a period of months _____
(Period of suspension shall not exceed 3 months; Fee under 37 CFR 1.17(i) required)

☐ Other _____

FEES

The RCE fee under 37 CFR 1.17(e) is required by 37 CFR 1.114 when the RCE is filed.

☒ The Director is hereby authorized to charge any underpayment of fees, or credit any overpayments, to Deposit Account No 032410

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED

☒ Patent Practitioner Signature

☐ Applicant Signature

PTO/SB/30EFS (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Signature of Registered U.S. Patent Practitioner			
Signature	/Orlando Lopez/	Date (YYYY-MM-DD)	2016-07-28
Name	Orlando Lopez, Ph.D.	Registration Number	46880

This collection of information is required by 37 CFR 1.114. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Patent Application Fee Transmittal

Application Number:	13354941
Filing Date:	20-Jan-2012
Title of Invention:	PHYSIOLOGICAL PARAMETER MONITORING WITH A MOBILE COMMUNICATION DEVICE
First Named Inventor/Applicant Name:	Ki H. Chon
Filer:	Marlo Schepper Grolnic
Attorney Docket Number:	30210-201

Filed as Small Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
RCE- 2nd and Subsequent Request	2820	1	850	850
		Total in USD ($)		**850**

Electronic Acknowledgement Receipt

EFS ID:	26478150
Application Number:	13354941
International Application Number:	
Confirmation Number:	9133
Title of Invention:	PHYSIOLOGICAL PARAMETER MONITORING WITH A MOBILE COMMUNICATION DEVICE
First Named Inventor/Applicant Name:	Ki H. Chon
Customer Number:	26486
Filer:	Marlo Schepper Grolnic
Filer Authorized By:	
Attorney Docket Number:	30210-201
Receipt Date:	28-JUL-2016
Filing Date:	20-JAN-2012
Time Stamp:	09:52:41
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$850
RAM confirmation Number	9338
Deposit Account	032410
Authorized User	LOPEZ, ORLANDO

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

Charge any Additional Fees required under 37 CFR 1.16 (National application filing, search, and examination fees)

Charge any Additional Fees required under 37 CFR 1.17 (Patent application and reexamination processing fees)

Charge any Additional Fees required under 37 CFR 1.19 (Document supply fees)

Charge any Additional Fees required under 37 CFR 1.20 (Post Issuance fees)

Charge any Additional Fees required under 37 CFR 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Amendment Submitted/Entered with Filing of CPA/RCE	201RCETrans2.pdf	80200 acc0968ec9f3474edb93e2c294b9a6745afdee02	no	3
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	30794 e95f8f4cf87817cab6bc4b5dfe9a01cb3d8e4275	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	110994		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

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National Stage of an International Application under 35 U.S.C. 371

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New International Application Filed with the USPTO as a Receiving Office

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PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 13/354,941	Filing Date 01/20/2012	☐ To be Mailed

ENTITY: ☐ LARGE ☒ SMALL ☐ MICRO

APPLICATION AS FILED – PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).			
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL	

APPLICATION AS AMENDED – PART II

AMENDMENT **07/28/2016**

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	* 46	Minus	** 46	= 0	X $40 =	0
Independent (37 CFR 1.16(h))	* 6	Minus	***6	= 0	X $210 =	0
☐ Application Size Fee (37 CFR 1.16(s))						
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
					TOTAL ADD'L FEE	0

AMENDMENT

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =	
☐ Application Size Fee (37 CFR 1.16(s))						
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
					TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

LIE
CHERYL CLARK

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**
If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/354,941	01/20/2012	Ki H. Chon	30210-201	9133

26486 7590 08/03/2016

BURNS & LEVINSON, LLP
125 SUMMER STREET
BOSTON, MA 02110

EXAMINER
LIU, CHU CHUAN

ART UNIT	PAPER NUMBER
3777	

NOTIFICATION DATE	DELIVERY MODE
08/03/2016	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

docketing@burnslev.com

Applicant-Initiated Interview Summary	Application No.	Applicant(s)	
	13/354,941	CHON ET AL.	
	Examiner	Art Unit	
	CHU CHUAN (JJ) LIU	3777	

All participants (applicant, applicant's representative, PTO personnel):

(1) *Chu Chaun Liu*.

(2) *Tse Chen*.

(3) *Orlandi Lopez*.

(4) _____.

Date of Interview: *28 July 2016*.

Type: ☒ Telephonic ☐ Video Conference
☐ Personal [copy given to: ☐ applicant ☐ applicant's representative]

Exhibit shown or demonstration conducted: ☐ Yes ☐ No.
If Yes, brief description: _____.

Issues Discussed ☒101 ☐112 ☐102 ☒103 ☐Others
(For each of the checked box(es) above, please describe below the issue and detailed description of the discussion)

Claim(s) discussed: *1,32 and 34*.

Identification of prior art discussed: *Greco*.

Substance of Interview
(For each issue discussed, provide a detailed description and indicate if agreement was reached. Some topics may include: identification or clarification of a reference or a portion thereof, claim interpretation, proposed amendments, arguments of any applied references etc...)

See Continuation Sheet.

Applicant recordation instructions: The formal written reply to the last Office action must include the substance of the interview. (See MPEP section 713.04). If a reply to the last Office action has already been filed, applicant is given a non-extendable period of the longer of one month or thirty days from this interview date, or the mailing date of this interview summary form, whichever is later, to file a statement of the substance of the interview

Examiner recordation instructions: Examiners must summarize the substance of any interview of record. A complete and proper recordation of the substance of an interview should include the items listed in MPEP 713.04 for complete and proper recordation including the identification of the general thrust of each argument or issue discussed, a general indication of any other pertinent matters discussed regarding patentability and the general results or outcome of the interview, to include an indication as to whether or not agreement was reached on the issues raised.

☒ Attachment

/CHU CHUAN (JJ) LIU/ Examiner, Art Unit 3777	/TSE CHEN/ Supervisory Patent Examiner, Art Unit 3777

Summary of Record of Interview Requirements

Manual of Patent Examining Procedure (MPEP), Section 713.04, Substance of Interview Must be Made of Record
A complete written statement as to the substance of any face-to-face, video conference, or telephone interview with regard to an application must be made of record in the application whether or not an agreement with the examiner was reached at the interview.

Title 37 Code of Federal Regulations (CFR) § 1.133 Interviews
Paragraph (b)

In every instance where reconsideration is requested in view of an interview with an examiner, a complete written statement of the reasons presented at the interview as warranting favorable action must be filed by the applicant. An interview does not remove the necessity for reply to Office action as specified in §§ 1.111, 1.135. (35 U.S.C. 132)

37 CFR §1.2 Business to be transacted in writing.
All business with the Patent or Trademark Office should be transacted in writing. The personal attendance of applicants or their attorneys or agents at the Patent and Trademark Office is unnecessary. The action of the Patent and Trademark Office will be based exclusively on the written record in the Office. No attention will be paid to any alleged oral promise, stipulation, or understanding in relation to which there is disagreement or doubt.

The action of the Patent and Trademark Office cannot be based exclusively on the written record in the Office if that record is itself incomplete through the failure to record the substance of interviews.

It is the responsibility of the applicant or the attorney or agent to make the substance of an interview of record in the application file, unless the examiner indicates he or she will do so. It is the examiner's responsibility to see that such a record is made and to correct material inaccuracies which bear directly on the question of patentability.

Examiners must complete an Interview Summary Form for each interview held where a matter of substance has been discussed during the interview by checking the appropriate boxes and filling in the blanks. Discussions regarding only procedural matters, directed solely to restriction requirements for which interview recordation is otherwise provided for in Section 812.01 of the Manual of Patent Examining Procedure, or pointing out typographical errors or unreadable script in Office actions or the like, are excluded from the interview recordation procedures below. Where the substance of an interview is completely recorded in an Examiners Amendment, no separate Interview Summary Record is required.

The Interview Summary Form shall be given an appropriate Paper No., placed in the right hand portion of the file, and listed on the "Contents" section of the file wrapper. In a personal interview, a duplicate of the Form is given to the applicant (or attorney or agent) at the conclusion of the interview. In the case of a telephone or video-conference interview, the copy is mailed to the applicant's correspondence address either with or prior to the next official communication. If additional correspondence from the examiner is not likely before an allowance or if other circumstances dictate, the Form should be mailed promptly after the interview rather than with the next official communication.

The Form provides for recordation of the following information:
- Application Number (Series Code and Serial Number)
- Name of applicant
- Name of examiner
- Date of interview
- Type of interview (telephonic, video-conference, or personal)
- Name of participant(s) (applicant, attorney or agent, examiner, other PTO personnel, etc.)
- An indication whether or not an exhibit was shown or a demonstration conducted
- An identification of the specific prior art discussed
- An indication whether an agreement was reached and if so, a description of the general nature of the agreement (may be by attachment of a copy of amendments or claims agreed as being allowable). Note: Agreement as to allowability is tentative and does not restrict further action by the examiner to the contrary.
- The signature of the examiner who conducted the interview (if Form is not an attachment to a signed Office action)

It is desirable that the examiner orally remind the applicant of his or her obligation to record the substance of the interview of each case. It should be noted, however, that the Interview Summary Form will not normally be considered a complete and proper recordation of the interview unless it includes, or is supplemented by the applicant or the examiner to include, all of the applicable items required below concerning the substance of the interview.

A complete and proper recordation of the substance of any interview should include at least the following applicable items:
1) A brief description of the nature of any exhibit shown or any demonstration conducted,
2) an identification of the claims discussed,
3) an identification of the specific prior art discussed,
4) an identification of the principal proposed amendments of a substantive nature discussed, unless these are already described on the Interview Summary Form completed by the Examiner,
5) a brief identification of the general thrust of the principal arguments presented to the examiner,
   (The identification of arguments need not be lengthy or elaborate. A verbatim or highly detailed description of the arguments is not required. The identification of the arguments is sufficient if the general nature or thrust of the principal arguments made to the examiner can be understood in the context of the application file. Of course, the applicant may desire to emphasize and fully describe those arguments which he or she feels were or might be persuasive to the examiner.)
6) a general indication of any other pertinent matters discussed, and
7) if appropriate, the general results or outcome of the interview unless already described in the Interview Summary Form completed by the examiner.

Examiners are expected to carefully review the applicant's record of the substance of an interview. If the record is not complete and accurate, the examiner will give the applicant an extendable one month time period to correct the record.

Examiner to Check for Accuracy

If the claims are allowable for other reasons of record, the examiner should send a letter setting forth the examiner's version of the statement attributed to him or her. If the record is complete and accurate, the examiner should place the indication, "Interview Record OK" on the paper recording the substance of the interview along with the date and the examiner's initials.

Continuation of Substance of Interview including description of the general nature of what was agreed to if an agreement was reached, or any other comments: During the interview, 35 USC 101 and 103 rejections and proposed amendments were discussed. Examiner exaplained why the claims are considered the abstract idea in respect to the specific physiological signal, specific physiological sensors, and associated specific structure of the handheld mobile communication device. Attorney expressed his opinions in regards to the 101 rejection. No agreement was reached.

Attorney indicated there are three types of physiological signals and associated sensors (PPG sensor, EKG sensor, and a image acquisition component disposed on the handheld device) to provide physiological signal for the processing steps performed in the handheld mobile communication device (e.g. cellphone) and would considered to incorporated them into claim 1. Attorney indicated no one in the art knows to apply Shannon entroy analysis on a filtered and detrended data segment(s) to idnetify motion artifacts. Greco's teachings were discussed for the concept. No agreement was reached.

Attorney further asked the Examiner to read the specification for the missing elements (e.g. sensors or camera). Examiner indicated that it is improper to import limitations from the specification into the claims and the claims were given broadest reasonable interpretations.

Examiner further indicated that reconsideration and updated search would be conducted when the formal response has been filed.

The agenda for discussion is attached.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants: Ki H. Chon et al.
Application Number: 13/354,941
Filed: January 20, 2012
Title: PHYSIOLOGICAL PARAMETER MONITORING WITH A MOBILE COMMUNICATION DEVICE

Examiner: LIU, CHU CHUAN
Group Art Unit: 3777
Confirmation No. 9133

BURNS & LEVINSON, LLP
125 Summer Street
Boston, MA 02110
(617) 345-3243

AGENDA FOR TELEPHONE INTERVIEW

Note that applicants have submitted an After Final Consideration Request.

I. 101 rejection-review in view of USPTO May 4, 2016 memo, memo on Enfish, BASCOM GLOBAL INTERNET v. AT&T MOBILITY LLC, opinion 2015-1763 (Federal Circuit June 27, 2016), and correct claim construction

II. 103 rejection
   a. Amendments-. Bandpass filter is the opposite of the notch filter taught by Greco
   b. Greco teaches away in view of the knowledge in the art as exemplified by Delorme
   c. Obviousness double patenting rejection

4846-3913-7589.1

PATENT APPLICATION
Attorney Docket No. 30210-201

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Ki H. Chon et al.
Serial Number: 13/354,941
Filed: January 20, 2012
Title: PHYSIOLOGICAL PARAMETER MONITORING WITH A MOBILE COMMUNICATION DEVICE

Examiner: LIU, CHU CHUAN
Group Art Unit: 3777
Confirmation No. 9133

Burns & Levinson LLP
125 Summer Street
Boston, MA 02110
(617) 345-3000

To: Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

STATEMENT OF SUBSTANCE OF THE INTERVIEW

Sir:

Pursuant to 37 CFR 1.133, Applicants' attorney submits the following written statement of the substance of the telephone interview conducted on July 28, 2016 between Orlando Lopez, Applicants' representative, and Examiners Chu Chuan Liu and Tse Chen.

Claims discussed
Claims 1, 32 and 34

Prior Art discussed
Greco et al. (2008 publication)

Outcome
No agreement was reached.

In accordance with Section 714.01 of the MPEP, the following information is presented in the event that a call may be deemed desirable by the Examiner:
ORLANDO LOPEZ (617) 345-3243.

Respectfully submitted,

Dated: September 6, 2016

By: /Orlando Lopez/
Orlando Lopez
Reg. No. 46,880
Attorney for Patent Application Owner

Electronic Acknowledgement Receipt

EFS ID:	26840631
Application Number:	13354941
International Application Number:	
Confirmation Number:	9133
Title of Invention:	PHYSIOLOGICAL PARAMETER MONITORING WITH A MOBILE COMMUNICATION DEVICE
First Named Inventor/Applicant Name:	Ki H. Chon
Customer Number:	26486
Filer:	Marlo Schepper Grolnic
Filer Authorized By:	
Attorney Docket Number:	30210-201
Receipt Date:	06-SEP-2016
Filing Date:	20-JAN-2012
Time Stamp:	14:48:09
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Applicant summary of interview with examiner	201SOS.pdf	74742 f3abaa18b127c3eb2744925428a3f5a4d98d60f3	no	1

Warnings:

Information:	
Total Files Size (in bytes):	74742

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/354,941	01/20/2012	Ki H. Chon	30210-201	9133

26486 7590 09/22/2016

BURNS & LEVINSON, LLP
125 SUMMER STREET
BOSTON, MA 02110

EXAMINER
LIU, CHU CHUAN

ART UNIT	PAPER NUMBER
3777	

NOTIFICATION DATE	DELIVERY MODE
09/22/2016	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

docketing@burnslev.com

Office Action Summary	Application No. 13/354,941	Applicant(s) CHON ET AL.	
	Examiner CHU CHUAN (JJ) LIU	Art Unit 3777	AIA (First Inventor to File) Status No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *07/28/2016*.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

5)☒ Claim(s) *1,3,6-24,27 and 30-53* is/are pending in the application.

5a) Of the above claim(s) *10-17,35-38 and 45-48* is/are withdrawn from consideration.

6)☐ Claim(s) _____ is/are allowed.

7)☒ Claim(s) *1,3,6-9,18-24,27,30-34,39-44 and 49-53* is/are rejected.

8)☐ Claim(s) _____ is/are objected to.

9)☐ Claim(s) _____ are subject to restriction and/or election requirement.

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a)☐ All b)☐ Some** c)☐ None of the:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)

2) ☒ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date *07/08/2016*.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

4) ☐ Other: _____.

DETAILED ACTION

1. The present application is being examined under the pre-AIA first to invent provisions.

2. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 07/07/2016 has been entered.

3. Applicant's amendments and remarks filed on 07/07/2016 have been fully considered.

Status of Claims

4. Claims 1, 3, 6-24, 27, and 30-53 are pending for examination. Claims 10-17, 35-38, and 45-48 are withdrawn from consideration. Claims 2, 4-5, 25-26, and 28-29 are cancelled.

Claim Rejections - 35 USC § 101- abstract idea

5. 35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

6. Claims 1, 19, 24, 39, 44, and 49 are rejected under 35 U.S.C. 101 because the claimed inventions are directed to a judicial exception (i.e., a law of nature, a natural phenomenon, or an abstract idea) without significantly more.

Claim(s) 1, 19, 24, 39, 44, and 49 are drawn to a system(s) and a method(s) for physiological parameter monitoring, which is/are statutory categories of invention (Step 1: YES). In this case, the judicial exception relied upon by the instantly claimed invention is an abstract idea, and the limitation(s) that set(s) forth or describe(s) the abstract idea(s) is/are: *"...**analyzing**... the physiological indicator signal; and **detecting**..., using only the measurements of one or more physiological parameters, effects of motion artifacts in the measurements of the one or more physiological parameters and **deciding** whether to retain the measurements based on detected effects of motion artifacts; a. **bandpass filtering and detrending** a segment; **obtaining** a value of at least one indicator of volatility, used in determining whether motion artifacts are present, for the preprocessed segment; the at least one indicator of volatility being at least **Shannon entropy** for the preprocessed segment; including the segment in analyses of physiological measurements, when **comparison** of the value of the at least one indicator of volatility with a predetermined threshold indicates noise/motion artifacts are not present; and **selecting** another segment of the signal from the physiological measurement and proceeding to step (a) when the value of the at least one indicator of volatility is less than a predetermined threshold and when another segment is available" and "**obtaining** a time-varying coherence function by **multiplying** two time-varying transfer functions (TVFTs), ... to **produce** a first TVTF; a second TVTF is produced by*

reversing the input and the output signals, using said another of the two adjacent data segment as the input signal and said one of the two adjacent data segment as the output signal; and ***determining*** *whether the time-varying coherence function is less than a predetermined quantity".* The reason(s) that the limitation(s) are considered an abstract idea is because they are directed to functionally-described algorithmic processes that require performing mathematical calculations, and the Supreme Court has explicitly characterized mathematical relationships/formulas as abstract ideas (Federal Register, Vol. 79, No. 241, December 16, 2014 at 74622, column 2). The instantly claimed invention is similar to claims already found to be directed to an abstract idea and patent ineligible. See at least the following court decisions:

- *SmartGene, Inc. v Advanced Biological Labs.*, 555 Fed. Appx. 950 (Fed. Cir. 2014), directed to systems, methods and computer program products for guiding the selection of therapeutic treatment regimens (ineligible)
- *TLI Communications LLC v. A. V. Automotive, LLC* (Fed. Cir. May 17, 2016) directed to generalized steps for recording, administration and archiving of digital images, and classifying and storing digital images in an organized manner (ineligible)
- *Ariosa Diagnostics, Inc. v. Sequenom, Inc.*, 788 F.3d 1371 (Fed. Cir. 2015)., directed to a method of non-invasive prenatal diagnosis (ineligible)
- *Ultramercial, Inc. v. Hulu, LLC*, 772 F.3d 709 (Fed. Cir. 2014), directed to methods of payment of intellectual property royalties by interposed sponsor over a telecommunications network (ineligible)
- *Digitech Image Techs., LLC v Electronics for Imaging, Inc.*, 758 F.3d 1344 (Fed. Cir. 2014), drawn to device profiles for use in a digital image processing system (ineligible)

In addition, the courts have found that mathematical relationships and algorithms (e.g. *Benson, Flook, Diehr, Grams*) to be abstract ideas. For example, in Benson, a mathematical procedure for converting one form of numerical representation to another was found to be an exception, as was an algorithm for calculating parameters indicating

an abnormal condition in Grams. Thus, the claims are directed to a judicial exception and fall squarely within the realm of "abstract ideas", which is a patent-ineligible concept (Step 2A: YES).

Next, the claim as a whole is analyzed to determine whether it includes additional steps/elements that, when considered both individually and as an ordered combination, amount to significantly more than the judicial exception. In this case, the claimed steps for "**providing**" a physiological indicator signal (using a physiological indicator signal component) amount(s) to nothing more than routine data collection and/or insignificant extra-solution activity. The additional recited " **a physiological indicator signal component** " and " **a handheld mobile communication device** " do not amount to "significantly more" since they are recited at a high level of generality and perform nothing more than well-understood, routine, and conventional activities previously known to the industry. The claimed "**a handheld mobile communication device**" is nothing more than a nominal recitation of a computer covering an abstract concept, which is insufficient to make a claim patent eligible. See Bancorp Servs. v. Sun Life Assurance Co., 687 F.3d 1266, 1278 (Fed. Circ. 2012). See also Mayo, 132 S. Ct. at 1293 (a claim cannot simply state the abstract idea and add the words "'apply it.'"). Consideration of the additional step(s) and/or element(s) as a combination also adds no other meaningful limitations to the exception not already present when the elements are considered separately. Unlike the eligible claim in Diehr in which the elements limiting the exception are individually conventional, but taken together act in concert to improve a technical field, the claim here does not invoke any of the considerations that courts

have identified as providing significantly more than an exception. Even when viewed as a combination, the additional elements fail to transform the exception into a patent-eligible application of that exception. Thus, the claim as a whole does not amount to significantly more than the exception itself *(Step 2B: NO).* Therefore, the claim(s) is/are not patent eligible.

With regards to the instantly rejected dependent claim(s), these claims when analyzed as a whole are also held to be patent ineligible under 35 U.S.C. 101 because the additional recited limitation(s) fail(s) to establish that the claim(s) is/are not directed to an judicial exception and/or do not add significantly more to the judicial exception. Therefore, the claim(s) is/are not patent eligible.

Applicant is reminded that additional steps/elements may be enough to qualify as "significantly more" if they meaningfully limit the judicial exception, improve the technology or technical field, improve the functioning of a computer itself, or add a specific limitation other than what is well-understood, routine, conventional activity in the field or unconventional steps that confine the claim to a particular useful application. For additional guidance, applicant is directed generally to MPEP 2106 and to the USPTO's Guidance on Subject Matter Eligibility (May 2016 Update). This information can be found at: http://www.uspto.gov/patent/laws-and-regulations/examination-policy/2014-interim-guidance-subject-matter-eligibility-0.

Response to Arguments

7. Applicant's arguments filed on 07/07/2016 have been fully considered but they are not persuasive. In regard to 35 USC 101 rejection, Applicant first alleged that the claims provide an improvement in a technology or technical field. In response, no specific technology or technical field is reflected in the claim(s). In pages 16 and 17 of Remarks filed on 07/07/2016, Applicant indicated that the physiological parameter includes blood loss, oxygen saturation heart rate variability, arterial fibrillation and others; PPG, EKG, HR and SpO2. However, the claim(s) recites physiological indicator signal and one or more physiological parameters, which are broad enough to cover all possible physiological signals/parameters in physiological and/ or all medical fields associated with physiological conditions. In addition, the claimed " **a physiological indicator signal component** " and " **a handheld mobile communication device** " are nothing more than a nominal recitation of an **indicator signal component** for routine data collection and/or insignificant extra-solution activity and a computer covering an abstract concept, which is insufficient to make a claim patent eligible. Therefore, the claimed invention is not considered as provide improvements in any specific technology or technical field.

Secondly, Applicant alleged that claims 19, 39 and 49 related to one specific physiological measurement – atrial fibrillation. In response, no improvement(s) is/are reflected in the claims. First, the claims recite “detecting motion artifacts in the measurements of one or more physiological measurements” and “the one or more physiological measurements comprises a measure of atrial fibrillation”. The motion

artifact detection step/function is not specifically tied to the measure of atrial fibrillation (e.g. the claims do not recite to detect motion artifacts in each of the one or more physiological measurements). Secondly, the recited obtaining steps/functions of TVFTs and the determining steps/functions do not reflect improvement(s) in the measure of arterial fibrillation. In addition, applicant has failed to provide any evidence showing that the claimed invention results in an improvement to the technology, e.g. experimental data comparing applicant's method steps and results with those of the closest prior art. Therefore, applicant's assertion constitutes mere argument. See also *In re Linder, 457 F.2d 506, 508, 173 USPQ 356, 358 (CCPA 1972; Ex parte George, 21 USPQ2d 1058 (Bd. Pat. Appl. & Inter. 1991*). See MPEP § 716.01(c) for examples of attorney statements which are not evidence and which must be supported by an appropriate affidavit or declaration.

Third of all, applicant alleged that the claims do not preempt others from applying the concept of Shannon entropy. In response, the claims preempt others from applying the concept of Shannon entropy in all possible physiological signals/parameters in physiological and/ or all medical fields associated with physiological conditions (e.g. the claimed invention is applicable to a limited types of physiological signals/parameters, as indicated in pages 17 and 19 of Remarks filed on 07/07/2016, but the claim limitations are broad enough to cover all possible physiological signals/parameters in physiological and/ or all medical fields associated with physiological conditions).

In conclusion, the recent CAFC precedential decisions sets for the following standard: "Without additional limitations, a process that employs mathematical

algorithms to manipulate existing information to generate additional information is not patent eligible. "If a claim is directed essentially to a method of calculating, using a mathematical formula, even if the solution is for a specific purpose, the claimed method is nonstatutory." Parker v. Flook, 437 U.S. 584, 595 (1978) (internal quotations omitted)." (Precedential CAFC decision: Digitech Image Technologies, LLC. v. Electronics for Imaging, Inc., decided July 11, 2014). For these reasons, absent any evidence to the contrary, the rejection under 35 USC 101 is maintained.

Claim Rejections - 35 USC § 112

8. The following is a quotation of the first paragraph of 35 U.S.C. 112(a):

> (a) IN GENERAL.—The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor or joint inventor of carrying out the invention.

The following is a quotation of the first paragraph of pre-AIA 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor of carrying out his invention.

9. Claims 1, 19, 24, 31,39, 44, and 49 are rejected under 35 U.S.C. 112(a) or 35 U.S.C. 112 (pre-AIA), first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that

the inventor or a joint inventor, or for pre-AIA the inventor(s), at the time the application was filed, had possession of the claimed invention.

Claims 1, 19, 24, 39, 44, and 49 recite "…providing a physiological indicator signal to a handheld mobile communication device; analyzing… the physiological indicator signal; obtaining… one or more physiological parameters… and detecting… effects of motion artifacts in the measurements of the one or more physiological parameters". The specification does not provide adequate supports for motion artifact detections in **all possible** physiological signals/parameters and/ or **all types** of signals/parameters in medical fields associated with physiological conditions. As indicated in the page 17 of Remarks filed on 07/01/2016, the motion artifact detection is applicable to a limited types of physiological signals/parameters.

In regard to claims 8, 24 and 33, the specification does not provide adequate supports for all types of "physiological indicator signal components/ physiological monitoring sensor". The specification indicates limited supports for certain types of sensor only.

Claim 31 recites "an image acquisition component". The does not provide adequate supports for all possible image acquisition components/devices. The specification indicates limited supports for optical imaging device(s) only (e.g. camera or video camera). No support(s) of other types of image acquisition components/devices has been found in the specification.

10. The following is a quotation of 35 U.S.C. 112(b):

> (b) CONCLUSION.—The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the inventor or a joint inventor regards as the invention.

The following is a quotation of 35 U.S.C. 112 (pre-AIA), second paragraph:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

11. Claim 24 is rejected under 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA), second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventor or a joint inventor, or for pre-AIA the applicant regards as the invention.

Claim 24 recites step/function “b" in the body of the claim. It is unclear whether there is a missing step(s) or it is a typo. If the claim comprises any essential step/ function in “b”, the limitation should be set forth in the claim. Otherwise, step “b” should be deleted and steps “c”, “d”, and “e” should be set forth “b”, “c”, and d”, respectively. Clarification is requested by amendments.

Claim Rejections - 35 USC § 103

12. The following is a quotation of pre-AIA 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

13. Claims 1, 3, 8-9, 24, 27, 33-34, and 44 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Greco et al., “Kurtosis, Renyi's Entropy and

Independent Component Scalp Maps for the Automatic Artifact Rejection from EEG data". International Journal of Computer, Information, Systems and Control Engineering 2(9), January 2008: 180-184 – cited by applicant) in view of Lichter et al. (USPN 6,159,147 – cited in previous action) and further in view of Muthuswamy et al., "Spectral analysis methods for neurological signals", Journal of Neuroscience Methods 83 (1998) 1–14 – cited in previous action). In regard to claims 1, 3, 24, 27 and 44, Greco discloses a method and an apparatus for physiological parameter monitoring (abstract and associated descriptions), the method comprising: providing a physiological indicator signal (electric signals, Fig. 1 and associated descriptions in page 203) obtained from a physiological indicator signal sensing component (EEG sensors and a recording machine, Fig. 1 and associated descriptions in page 203) to a device (EEGLAB, pages 206 and 207; it is inherently that the downloaded program is executed by a computer); analyzing, using the device, the physiological indicator signal (amplifier, page 203 and Sec. IV, page 206); obtaining, from said analyzing, measurements of one or more physiological parameters (EEG signals and associated independent components/ ICs in page 206); and detecting, using the device and using only the measurements of the one or more physiological parameters (ICs in the detected EEG signals pages 205-206), effects of motion artifacts in the measurements of the one or more physiological parameters (first paragraph in the right column of page 203; Sec. IV on page 206) and deciding whether to retain the measurements based on detected effects of motion artifacts (reject an IC, Sec. IV on page 206), wherein the step of detecting effects of motion artifacts in the measurements comprises: a. preprocessing/ filtering a segment

from the measurement of one physiological parameter (remove noise with notch filter, Sec. IV on page 206); b. obtaining a value of at least one indicator of volatility, used in determining whether motion artifacts are present, for the preprocessed segment; the at least one indicator of volatility being at least one of kurtosis and Shannon entropy for the preprocessed segment (kurtosis and Shannon entropy, Sec. III, A and B, pages 205-206). c. including the segment in analyses of physiological measurements, when comparison of the value of the at least one indicator of volatility with a predetermined threshold (threshold of ± 1.64, Sec. III, A and B, pages 205-206) indicates noise/motion artifacts are not present (reject the ICs only when the volatility exceeds the threshold, Sec. III, A and B, pages 205-206; i.e. the ICs not exceeded the threshold is included); and d. selecting another segment of the signal from the physiological measurement and proceeding to step (a) when the value of the at least one indicator of volatility is less than a predetermined threshold and another segment is available (comparing all ICs extracted from the data segments/ trials with the threshold and rejecting the IC(s) exceed the threshold, Sec. III and IV on pages 205-207).

Greco does not specifically disclose the device is a handheld mobile communication device.

Lichter teaches a handheld mobile communication device (personal computer 27, Figs. 2-3) which can be connected to various sensors to measure and analyze the collected data (Figs. 16) including EEG (Fig. 16). One ordinary would have recognized that a personal computer is an alternative equivalent computing device. Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention

was made to substitute the device/ computer (Greco) with the handheld mobile communications device (Lichter) to yield predictable results.

Greco as modified by Lichter does not specifically disclose to bandpass filter/ filtering and detrend/ detrending a segment from the measurements of one physiological parameter.

Muthuswamy teaches to bandpass filter/ filtering and detrend/ detrending a segment from the measurements of one physiological parameter (detrend and bandpass filtering, see page 2).

It would have been obvious to one with ordinary skill in the art at the time of the invention was made to modify the method and system (Greco as modified by Lichter) to incorporate the bandpass filtering and detrending step/ function as taught by Muthuswamy, since one ordinary would have recognized that both Greco as modified by Lichter and Muthuswamy teach analyzing EEG signals and both methods analyze EEG signals in desired bands (e.g. 0.5 up to 35 Hz, see page 203 of Greco and 1.0 Hz-35Hz. see page 2 of Muthuswamy). The rationale would have been to preprocess the EEG data in order to obtain desired frequency band(s) for analyses.

In regard to claims 8-9 and 33-34, Greco as modified by Lichter and Muthuswamy discloses providing a physiological indicator signal comprises obtaining a signal from a physiological monitoring sensor (EEG sensors, Greco and EEG sensor, Fig. 16 of Lichter) which comprises a PPG sensor and an ECG sensor (Fig. 16 and associated descriptions of Lichter).

14. Claims 6 and 30 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over the combination of Greco, Lichter and Muthuswamy as applied to claims 1 and 24 above, and further in view of Maier et al. (USPGPUB 2006/0253261 - cited in previous action). In regard to claims 6 and 30, Greco as modified by Lichter and Muthuswamy discloses all the claimed limitation except the predetermined threshold is determined using receiver operator characteristic (ROC) analysis. Maier teaches a threshold value can be determined using receiver operator characteristic (ROC) analysis ([0235]) in order to have a constant false alarm rate ([0235]). Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention was made to modify the method and the apparatus (Greco as modified by Lichter and Muthuswamy) to incorporate the ROC determined threshold (Maier) in order to find the optimal threshold values for the comparison(s).

15. Claims 7 and 31-32 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over the combination of Greco, Lichter and Muthuswamy as applied to claims 1 and 24 above, and further in view of Jacobsen et al. (USPN 6,198,394 – cited in previous action). In regard to claims 7 and 31-32, Greco as modified by Lichter and Muthuswamy discloses all the claim limitation except placing a portion of a subject's body over an objective lens of a camera in a mobile communication device; and obtaining video images of the portion of the subject's body. Jacobsen teaches placing a portion of a subject's body over an objective lens of a camera in a mobile communication device (element 376, Fig. 5A; Fig. 8; Col 13 lines 55-67); and obtaining

video images of the portion of the subject's body (element 376, Fig. 5A; Fig. 8; Col 13 lines 55-67). The portable communication device taught by Jacobsen can be connected to various sensors applied to a user (Figs. 1-3, 5-7, and 8 and associated description) and provide video images associated with specific location of the user to the command center (Col 13 lines 55-67). Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention was made to modify the method and the apparatus (Greco as modified by Lichter and Muthuswamy) to incorporate the camera of the portable communication device (Jacobsen) in order to obtain video images associated with specific location of the user and transferring to a central monitoring system/ unit.

16. Claim 18 is rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over the combination of Greco, Lichter and Muthuswamy as applied to claim 1 above, and further in view of Zhang (USPGPUB 2009/0112110 – cited in previous action). In regard to claim 18, Greco as modified by Lichter and Muthuswamy discloses the measurement of ECG signals (Fig. 16 and associated descriptions of Lichter) but does not specifically discloses a measure of atrial fibrillation. Zhang teaches a measure of atrial fibrillation based on ECG signal analysis (abstract and Figs. 1-9). Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention was made to modify the method (Greco as modified by Lichter and Muthuswamy) to incorporate the ECG-based atrial fibrillation analysis (Zhang) in order to obtain more health information of the user.

Response to Arguments

17. Applicant's amendment and argument with respect to claims 1, 3-9, 18, 24, 31-32, 27-30, 33-34, and 44 filed on 07/07/2016 have been fully considered but they are deemed to be moot in views of the new grounds of rejection.

Double Patenting

18. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory double patenting rejection is appropriate where the claims at issue are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the reference application or patent either is shown to

be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement. A terminal disclaimer must be signed in compliance with 37 CFR 1.321(b).

The USPTO internet Web site contains terminal disclaimer forms which may be used. Please visit http://www.uspto.gov/forms/. The filing date of the application will determine what form should be used. A web-based eTerminal Disclaimer may be filled out completely online using web-screens. An eTerminal Disclaimer that meets all requirements is auto-processed and approved immediately upon submission. For more information about eTerminal Disclaimers, refer to http://www.uspto.gov/patents/process/file/efs/guidance/eTD-info-I.jsp.

19. Claims 19-23, 39-43, and 49-53 are rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1-16 of U.S. Patent No. 8,755,876 in view of Greco and Lichter. In regard to claims 19-23, 39-43, and 49-53 of present application, claims 1-16 of '876 recite all the limitations except a system and a method comprises providing a physiological indicator signal to a handheld mobile communication device; analyzing, using the device, the physiological indicator signal to obtain measurements of one or more physiological parameters; and detecting, using the a handheld mobile communication device and using only the measurements of the one or more physiological parameters, effects of motion artifacts in the measurements of the one or more physiological parameters and deciding whether to retain the measurements based on effects of motion artifacts in the measurements based on detected effects of motion artifacts. Greco discloses a method and an apparatus for physiological

parameter monitoring (abstract and associated descriptions), the method comprising: providing a physiological indicator signal (electric signals, Fig. 1 and associated descriptions in page 203) obtained from a physiological indicator signal sensing component (EEG sensors and a recording machine, Fig. 1 and associated descriptions in page 203) to a device (EEGLAB, pages 206 and 207; it is inherently that the downloaded program is executed by a computer); analyzing, using the device, the physiological indicator signal (amplifier, page 203 and Sec. IV, page 206) to obtain measurements of one or more physiological parameters (EEG signals and associated independent components/ ICs in page 206); and detecting, using the device and using only the measurements of the one or more physiological parameters (ICs in the detected EEG signals pages 205-206), effects of motion artifacts in the measurements of the one or more physiological parameters (first paragraph in the right column of page 203; Sec. IV on page 206) and deciding whether to retain the measurements based on detected effects of motion artifacts (reject an IC, Sec. IV on page 206). Claims 1-16 of '876 recite a processor to process data related to R-R intervals (claims 1, 2, 6, 7, 12 and 13) but do not recite the processor is in part of a computing device. Greco discloses an artifact rejection method for biomedical signal processing (abstract and Sec. II, IV and V). Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention was made to modify the method and the apparatus (claims 1-16 of '876) to incorporate the artifact rejection method (Greco) in order to better reject artifacts contained in the signal. Claims 1-16 of '876 as modified by Greco does not specifically recite the device is a handheld mobile communication device. Lichter teaches a

handheld mobile communication device (personal computer 27, Figs. 2-3) which can be connected to various sensors to measure and analyze the collected data (Figs. 16) including ECG signals obtained from ECG sensor (Fig. 15). Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention was made to substitute the computer (Claims 1-16 of '876 as modified by Greco) with the handheld mobile communications device (Lichter) to yield predictable results.

Response to Arguments

20. Applicant's arguments filed on 07/07/2016 have been fully considered but they are not persuasive. In regard to the double patenting rejection, applicant alleged Greco does not teach or suggest using **only** the measurements of one or more physiological parameters to detect the effect of motion artifacts. In response, Greco discloses using **only the measurements** (**ICs extracted from the EEG data**, see section III, page 205) to detect the effect of motion artifacts (first paragraph in the right column of page 203; Sec. IV on page 206 and ICs in section IV. Results of page 206). There is no additional signal(s) used in the motion artifact analysis of the EEG data. The measurements taught by Greco comprise the EEG data and associated ICs contained in the EEG data. Therefore, the rejections are maintained for the reason of record.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to CHU CHUAN (JJ) LIU whose telephone number is (571)270-5507. The examiner can normally be reached on M-TH 8:00am~4:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tse Chen can be reached on (571)272-3672. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/CHU CHUAN (JJ) LIU/
Examiner, Art Unit 3777

/TSE CHEN/
Supervisory Patent Examiner, Art Unit 3777

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L10	1	9 and detrend$3	US-PGPUB; USPAT	OR	ON	2016/09/13 12:50
L9	5	8 and (bandpass band adj pass)	US-PGPUB; USPAT	OR	ON	2016/09/13 12:50
L8	14	7 and (motion noise artifact movement)	US-PGPUB; USPAT	OR	ON	2016/09/13 12:50
L7	17	Shannon with entropy and A61B5/0002,0059,1455,14551,14552.cpc.	US-PGPUB; USPAT	OR	ON	2016/09/13 12:50
L6	3	5 and detrend$3	US-PGPUB; USPAT	OR	ON	2016/09/13 12:45
L5	33	3 and (bandpass band adj pass)	US-PGPUB; USPAT	OR	ON	2016/09/13 12:45
L3	143	2 and (motion noise artifact movement)	US-PGPUB; USPAT	OR	ON	2016/09/13 12:44
L2	155	Shannon with entropy and "600".clas.	US-PGPUB; USPAT	OR	ON	2016/09/13 12:44
L1	1	(13/354941).APP.	US-PGPUB; USPAT	OR	OFF	2016/09/13 11:51

EAST Search History (Interference)

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Doc description: Information Disclosure Statement (IDS) Filed

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	13354941
Filing Date	2012-01-20
First Named Inventor	Ki H. Chon
Art Unit	3777
Examiner Name	LIU, CHU CHUAN
Attorney Docket Number	30210-201

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ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /CCL/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
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	First Named Inventor	Ki H. Chon
	Art Unit	3777
	Examiner Name	LIU, CHU CHUAN
	Attorney Docket Number	30210-201

	1	Rajet Krishnan et al; "Analysis and Detection of Motion Artifact in Photoplethysmographic Data Using Higher Order Statistics"; Acoustics, Speech and Signal Proceeding, IEEE 2008; pp. 613-616
	2	Delorme, A. et al; SNL, Salk University; "Automatic Artifact Rejection for EEG Data Using High-Order Statistics and Independent Component Analysis"; Proceedings of the 3rd International Workshop on ICA; San Diego, 2001; pp. 457–462
	3	Third Office Action (English translation also enclosed) dated February 29, 2016 in corresponding Chinese Application No. 201280014031.1, filed on January 20, 2012

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EXAMINER SIGNATURE

Examiner Signature	/Chu Chuan Liu/	Date Considered	09/13/2016

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /CCL/

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	Filing Date	2012-01-20
	First Named Inventor	Ki H. Chon
	Art Unit	3777
	Examiner Name	LIU, CHU CHUAN
	Attorney Docket Number	30210-201

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Orlando Lopez/	Date (YYYY-MM-DD)	2016-07-08
Name/Print	Orlando Lopez	Registration Number	46880

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ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /CCL/

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13354941	CHON ET AL.
	Examiner	**Art Unit**
	CHU CHUAN (JJ) LIU	3777

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	10/24/2013	03/12/2014	09/16/2014	02/24/2015	08/11/2015	11/18/2015	04/20/2016	09/13/2016	09/13/2016
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	35	N	N	N	N	N	N	N	N	
	36	N	N	N	N	N	N	N	N	

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13354941	CHON ET AL.
	Examiner	**Art Unit**
	CHU CHUAN (JJ) LIU	3777

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
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☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	10/24/2013	03/12/2014	09/16/2014	02/24/2015	08/11/2015	11/18/2015	04/20/2016	09/13/2016	09/13/2016
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	38	N	N	N	N	N	N	N	N	
	39	✓	✓	✓	✓	✓	✓	✓	✓	
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	41	✓	✓	✓	✓	✓	✓	✓	✓	
	42	✓	✓	✓	✓	✓	✓	✓	✓	
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	48	N	N	N	N	N	N	N	N	
	49	✓	✓	✓	✓	✓	✓	✓	✓	
	50	✓	✓	✓	✓	✓	✓	✓	✓	
	51	✓	✓	✓	✓	✓	✓	✓	✓	
	52	✓	✓	✓	✓	✓	✓	✓	✓	
	53	✓	✓	✓	✓	✓	✓	✓	✓	

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13354941	CHON ET AL.
	Examiner	Art Unit
	CHU CHUAN (JJ) LIU	3777

CPC- SEARCHED

Symbol	Date	Examiner
A61B5/1455	02/24/2015	CCL
A61B5/0002,0004,145,1455,14551	08/11/2015	CCL
A61B5/0059,1455	11/18/2015	CCL
A61B5/0059,1455,14551,14552	04/20/2016	CCL
A61B5/0059,1455,14551,14552	9/13/2016	CCL

CPC COMBINATION SETS - SEARCHED

Symbol	Date	Examiner

US CLASSIFICATION SEARCHED

Class	Subclass	Date	Examiner
600	300, 301, 309, 310, 322, 323, 324, 326, 330, 336, 473, 476, 500, 501, 502, 508, 509,518	10/24/2013	CCL
600	300, 301, 309, 310, 322, 323, 324, 326, 330, 336, 473, 476, 500, 501, 502, 508, 509,518	03/12/2014	CCL
600	300, 301, 309, 310, 322, 323, 324, 326, 330, 336, 473, 476, 500, 501, 502, 508, 509,518	09/16/2014	CCL
600	300, 301, 309, 310, 322, 323, 324, 326, 330, 336, 473, 476, 500, 501, 502, 508, 509,518	02/24/2015	CCL
600	300, 301, 309, 310, 322, 323, 324, 326, 330, 336, 473, 476, 500, 501, 502, 508, 509,518	8/11/2015	CCL
600	300, 301, 309, 310, 322, 323, 324, 326, 330, 336, 473, 476, 500, 501, 502, 508, 509,518	11/18/2015	CCL
600	300, 301, 309, 310, 322, 323, 324, 326, 330, 336, 473, 476, 500, 501, 502, 508, 509,518	04/20/2016	CCL
600	300, 301, 309, 310, 322, 323, 324, 326, 330, 336, 473, 476, 500, 501, 502, 508, 509,518	9/13/2016	CCL

SEARCH NOTES

Search Notes	Date	Examiner

/CHU CHUAN (JJ) LIU/ Examiner.Art Unit 3777	

SEARCH NOTES

Search Notes	Date	Examiner
Inventor Name Search (PALM and EAST)	10/23/2013	CCL
EAST Search (TEXT, USPGPUB, USPAT) See Search History	10/24/2013	CCL
Google NPL Search	10/24/2013	CCL
Updated EAST Search (TEXT, USPGPUB, USPAT) See Search History	03/12/2014	CCL
Google NPL Search	03/12/2014	CCL
Updated EAST Search (TEXT, USPGPUB, USPAT) See Search History	09/16/2014	CCL
Updated EAST Search (TEXT, USPGPUB, USPAT, CPC) See Search History	02/24/2015	CCL
Google NPL Search	02/24/2015	CCL
Updated EAST Search (TEXT, USPGPUB, USPAT, CPC) See Search History	8/11/2015	CCL
NPL Search	8/11/2015	CCL
Updated EAST Search (TEXT, USPGPUB, USPAT, CPC) See Search History	11/18/2015	CCL
Google NPL Search	11/18/2015	CCL
Updated EAST Search (TEXT, USPGPUB, USPAT, CPC) See Search History	04/20/2016	CCL
Google NPL Search	04/20/2016	CCL
Updated EAST Search (TEXT, USPGPUB, USPAT, CPC) See Search History	9/13/2016	CCL
Google NPL Search	9/13/2016	CCL

INTERFERENCE SEARCH

US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner

/CHU CHUAN (JJ) LIU/ Examiner.Art Unit 3777	

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants: Ki H. Chon et al.
Application Number: 13/354,941
Filed: January 20, 2012
Title: PHYSIOLOGICAL PARAMETER MONITORING WITH A MOBILE COMMUNICATION DEVICE

Examiner: LIU, CHU CHUAN
Group Art Unit: 3777
Confirmation No. 9133

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Boston, MA 02110
(617) 345-3243

TO: Mail Stop Amendments
Commissioner for Patents
P.O. Box 1450,
Alexandria, VA 22313-1450

AMENDMENT AND RESPONSE TO OFFICE ACTION

Sir:

In reply to the Office Action dated September 22, 2016, Applicants submit the following amendments and remarks. A declaration under 37 CFR 1.132 is enclosed.

Amendments to the claims begin on page 2 of this paper.

Remarks begin on page 17 of this paper.

Amendments to the Claims:

This listing of claims replaces all prior versions and listings of the claims.

1. (Currently amended) A method for physiological parameter monitoring, the method comprising:

providing a physiological indicator signal to a handheld mobile communication device; the physiological indicator signal being obtained from one of an image acquisition component, a photoplethysmographic (PPG) sensor and an electrocardiogram sensor;

analyzing, using the handheld mobile communication device, the physiological indicator signal;

obtaining, from said analyzing, measurements of one or more physiological parameters; and

detecting, using the handheld mobile communication device and using only the measurements of one or more physiological parameters, effects of motion artifacts in the measurements of the one or more physiological parameters and deciding whether to retain the measurements based on detected effects of motion artifacts;

wherein detecting effects of motion artifacts in the measurements comprises:

a. bandpass filtering and detrending a segment from the measurement of one physiological parameter; wherein a bandpass filtered and detrended segment is hereinafter referred to as a preprocessed segment;

b. obtaining a value of at least one indicator of volatility, used in determining whether motion artifacts are present, for the preprocessed segment; the at least one indicator of volatility being at least Shannon entropy (SE) for the preprocessed segment; where

$$SE = -\sum_{i=1}^{k} \frac{p(i)*\log(p(i))}{\log(\frac{1}{k})}$$

and where i represents the bin number, and $p(i)$ is the probability distribution of the preprocessed segment;

c. including the segment in analyses of physiological measurements, ~~if~~ when comparison of the value of the at least one indicator of volatility with a predetermined threshold indicates noise/motion artifacts are not present; and

d. selecting another segment of the signal from the physiological measurement and proceeding to step (a) when the value of the at least one indicator of volatility is less than a predetermined threshold and when another segment is available.

2. (Canceled)

3. (Previously presented) The method of claim 1 wherein said at least one indicator of volatility also comprises kurtosis.

4-5. (Canceled)

6. (Previously presented) The method of claim 1 wherein the predetermined threshold is determined using receiver operator characteristic (ROC) analysis.

7. (Previously presented) The method of claim 1 wherein providing a physiological indicator signal comprises:

placing a portion of a subject's body over an objective lens of a camera in a handheld mobile communication device; and

obtaining video images of the portion of the subject's body.

8. (Previously presented) The method of claim 1 wherein providing a physiological indicator signal comprises obtaining a signal from a physiological monitoring sensor.

9. (Previously presented) The method of claim 8 wherein the physiological monitoring sensor is a photoplethysmographic (PPG) sensor or an electrocardiogram sensor.

10. (Withdrawn) The method of claim 1 wherein the one or more physiological measurements comprise heart rate and heart rate variability.

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11. (Withdrawn) The method of claim 10 wherein obtaining measurements of heart rate and heart rate variability comprise:

determining beats for the physiological indicator signal;

determining beat to beat intervals; and

applying a cubic spline algorithm to obtain a substantially continuous beat to beat interval signal indicative of heart rate.

12. (Withdrawn) The method of claim 1 wherein the one or more physiological measurements comprise respiratory rate.

13. (Withdrawn) The method of claim 12 wherein measurement of respiratory rate comprises:

obtaining time--frequency spectrum of the physiological indicator signal utilizing variable frequency complex demodulation (VFCDM); and

obtaining respiratory rates by extracting a frequency component that has a largest amplitude for each time point at a heart rate frequency band.

14. (Withdrawn) The method of claim 1 wherein the one or more physiological measurements comprise a measure of oxygen saturation.

15. (Withdrawn) The method of claim 14 wherein providing a physiological indicator signal comprises:

placing a portion of a subject's body over an objective lens of a camera in a mobile communication device; and

obtaining video images of the portion of the subject's body, and

wherein obtaining the measure of oxygen saturation comprises:

obtaining an average intensity of a red component and a blue component of the video images of the portion of the subject's body; the average intensity of the red component and the average intensity of the blue component constituting DC_{RED} and DC_{BLUE} respectively;

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obtaining a standard deviation of the red component and the blue component; the standard deviation of the red component and the blue component constituting AC_{RED} and AC_{BLUE} respectively; and

obtaining the measure of oxygen saturation (SpO2) by

$$SpO2 = A - B\frac{AC_{RED}/DC_{RED}}{AC_{BLUE}/DC_{BLUE}},$$

16. (Withdrawn) The method of claim 1 wherein the one or more physiological measurements comprise a measure of blood loss.

17. (Withdrawn) The method of claim 16 wherein obtaining the measure of blood loss comprises:

obtaining time–frequency spectrum of the physiological indicator signal utilizing variable frequency complex demodulation (VFCDM);

obtaining the amplitude modulation (AM) series from a set of the largest instantaneous amplitude at each time sample within the heart rate frequency band of the time–frequency spectrum; and

determining whether the amplitude modulation decreases; a decrease in the amplitude modulation indicating blood volume loss in subject.

18. (Previously presented) The method of claim 1 wherein the one or more physiological measurements comprise a measure of atrial fibrillation.

19. (Currently amended) A method for physiological parameter monitoring, the method comprising:

providing a physiological indicator signal to a handheld mobile communication device; the physiological indicator signal being obtained from one of an image acquisition component, a photoplethysmographic (PPG) sensor and an electrocardiogram sensor;

analyzing, using the handheld mobile communication device, the physiological indicator signal; wherein analysis does not include Independent Component Analysis;

obtaining, from said analyzing, measurements of one or more physiological parameters; and

detecting, using the handheld mobile communication device and using only the measurements of one or more physiological parameters, effects of motion artifacts in the measurements of the one or more physiological parameters and deciding whether to retain the measurements based on effects of motion artifacts in the measurements;

wherein the one or more physiological measurements comprise a measure of atrial fibrillation;

wherein obtaining the measure of atrial fibrillation comprises:

obtaining a time-varying coherence function by multiplying two time-varying transfer functions (TVFTs), the two time-varying transfer functions obtained using two adjacent data segments, from the physiological indicator signal, one of the two adjacent data segment as an input signal and another of the two adjacent data segment as an output signal to produce a first TVTF; a second TVTF is produced by reversing the input and the output signals, using said another of the two adjacent data segment as the input signal and said one of the two adjacent data segment as the output signal; and

determining whether the time-varying coherence function is less than a predetermined quantity.

20. (Previously presented) The method of claim 19 wherein determining whether the time-varying coherence function is less than the predetermined quantity comprises:

obtaining one or more indicators of atrial fibrillation; and

determining whether the one or more indicators of atrial fibrillation exceed predetermined thresholds.

21. (Previously presented) The method of claim 20 wherein the one or more indicators of atrial fibrillation comprise a variance of the time-varying coherence function.

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22. (Previously presented) The method of claim 21 wherein the one or more indicators of atrial fibrillation also comprise Shannon entropy.

23. (Previously presented) The method of claim 20 wherein the predetermined thresholds are determined using receiver operator characteristic (ROC) analysis.

24. ((Currently amended) A system for physiological parameter monitoring, the system comprising:

a physiological indicator signal sensing component; the physiological indicator signal sensing component being one of an image acquisition component, a photoplethysmographic (PPG) sensor and an electrocardiogram sensor; and a handheld mobile communication device comprising:

at least one processor; and

at least one computer usable medium, the computer usable medium having computer readable code embodied therein, the computer readable code causing the at least one processor to:

analyze the physiological indicator signal;

obtain, from results of analyzing, measurements of one or more physiological parameters; and

detect effects of motion artifacts in the measurements of the one or more physiological parameters;

wherein the computer readable code, in causing the at least one processor to detect effects of motion artifacts, causes the at least one processor to:

a. bandpass filter and detrend a segment from the measurement of one physiological parameter; wherein a bandpass filtered and detrended segment is hereinafter referred to as a preprocessed segment;

[[b.]]

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[[c.]]b. obtain a value of at least one indicator of volatility, used in determining whether motion artifacts are present, for the preprocessed segment; the at least one indicator of volatility being at least Shannon entropy (SE) for the preprocessed segment;
where

$$SE = -\sum_{i=1}^{k} \frac{p(i)*\log(p(i))}{\log(\frac{1}{k})}$$

and where i represents the bin number, and $p(i)$ is the probability distribution of the preprocessed segment;

[[d.]]c. include the segment in analyses of physiological measurements when comparison of the value of the at least one indicator of volatility with a predetermined threshold indicates noise/motion artifacts are not present;
[[e.]]d. select another segment of the signal from the physiological measurement and proceeding to step (a) when the value of the at least one indicator of volatility is less than a predetermined threshold and another segment is available.

25-26. (Canceled)

27. (Previously presented) The system of claim 24 wherein said at least one indicator of volatility also comprises kurtosis.

28-29. (Canceled)

30. (Previously presented) The system of claim 24 wherein the predetermined threshold is determined using receiver operator characteristic (ROC) analysis.

31. (Previously presented) The system of claim 24 wherein the physiological indicator signal sensing component comprises an image acquisition component, said acquisition component capable of acquiring a number of frames, each frame acquired at a predetermined time

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32. (Previously presented) The system of claim 31 wherein the handheld mobile communications device comprises said image acquisition component.

33. (Previously presented) The system of claim 24 wherein the physiological indicator signal sensing component comprises a physiological monitoring sensor.

34. (Previously presented) The system of claim 33 wherein the physiological monitoring sensor is a photoplethysmographic (PPG) sensor or an electrocardiogram sensor.

35. (Withdrawn) The system of claim 25 wherein the physiological indicator signal sensing component comprises an image acquisition component, said acquisition component capable of acquiring a number of frames, each frame acquired at a predetermined time; wherein said image acquisition component acquires a color image having red, green and blue components; wherein one or more physiological measurements comprise a measure of oxygen saturation; and wherein the computer readable code, in causing the at least one processor to analyze the physiological indicator signal, causes the at least one processor to:

obtain an average intensity of a red component and a blue component of the images of a portion of a subject's body; the average intensity of the red component and the average intensity of the blue component constituting DC_{RED} and DC_{BLUE} respectively;

obtain a standard deviation of the red component and the blue component; the standard deviation of the red component and the blue component constituting AC_{RED} and AC_{BLUE} respectively; and

obtain the measure of oxygen saturation by

$$SpO2 = A - B\frac{AC_{RED}/DC_{RED}}{AC_{BLUE}/DC_{BLUE}},$$

36. (Withdrawn) The system of claim 25 wherein the one or more physiological measurements comprise heart rate and heart rate variability; and wherein the computer readable

code, in causing the at least one processor to analyze the physiological indicator signal, causes the at least one processor to:

determine beats for the physiological indicator signal;

determine beat to beat intervals; and

apply a cubic spline algorithm to obtain a substantially continuous beat to beat interval signal indicative of heart rate.

37. (Withdrawn) The system of claim 25 wherein the one or more physiological measurements comprise respiratory rate; and wherein the computer readable code, in causing the at least one processor to analyze the physiological indicator signal, causes the at least one processor to:

obtain time–frequency spectrum of the physiological indicator signal utilizing variable frequency complex demodulation (VFCDM); and

obtain respiratory rates by extracting a frequency component that has a largest amplitude for each time point at a heart rate frequency band.

38. (Withdrawn) The system of claim 25 wherein the one or more physiological measurements comprise a measure of blood loss; and wherein the computer readable code, in causing the at least one processor to analyze the physiological indicator signal, causes the at least one processor to:

obtain time–frequency spectrum of the physiological indicator signal utilizing variable frequency complex demodulation (VFCDM);

obtain the amplitude modulation (AM) series from set of the largest instantaneous amplitude at each time sample within the heart rate frequency band of the time–frequency spectrum; and

determine whether the amplitude modulation decreases; a decrease in the amplitude modulation indicating blood volume loss in subject.

39. (Currently amended) A system for physiological parameter monitoring, the system comprising:

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a physiological indicator signal sensing component; and a handheld mobile communication device comprising:

at least one processor; and

at least one computer usable medium, the computer usable medium having computer readable code embodied therein, the computer readable code causing the at least one processor to:

analyze the physiological indicator signal; the physiological indicator signal being obtained from one of an image acquisition component, a photoplethysmographic (PPG) sensor and an electrocardiogram sensor;

wherein analysis does not include Independent Component Analysis;

obtain, from results of analyzing, measurements of one or more physiological parameters; and

detect effects of motion artifacts, using only the measurements of one or more physiological parameters, in the measurements of the one or more physiological parameters; wherein the one or more physiological measurements comprise a measure of atrial fibrillation; and wherein the computer readable code, in causing the at least one processor to analyze the physiological indicator signal, causes the at least one processor to:

obtain a time-varying coherence function by multiplying two time-varying transfer functions (TVFTs), the two time-varying transfer functions obtained using two adjacent data segments , from the physiological indicator signal, one of the two adjacent data segment as an input signal and another of the two adjacent data segment as an output signal to produce a first TVTF; a second TVTF is produced by reversing the input and the output signals, using said another of the two adjacent data segment as the input signal and said one of the two adjacent data segment as the output signal; and

determine whether the time-varying coherence function is less than a predetermined quantity.

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40. (Previously presented) The system of claim 39 wherein the computer readable code, in causing the at least one processor to determine whether the time-varying coherence function is less than the predetermined quantity, causes the at least one processor to:

obtain one or more indicators of atrial fibrillation; and

determine whether the one or more indicators of atrial fibrillation exceed predetermined thresholds.

41. (Previously presented) The system of claim 40 wherein the one or more indicators of atrial fibrillation comprise a variance of the time-varying coherence function.

42. (Previously presented) The system of claim 41 wherein the one or more indicators of atrial fibrillation also comprise Shannon entropy.

43. (Previously presented) The system of claim 41 wherein the predetermined thresholds are determined using receiver operator characteristic (ROC) analysis.

44. (Currently amended) A non-transitory computer usable medium having computer readable code embodied therein, the computer readable code causing at least one processor to:

analyze ~~the~~ a physiological indicator signal; the physiological indicator signal being obtained from one of an image acquisition component, a photoplethysmographic (PPG) sensor and an electrocardiogram sensor;

obtain, from said analyzing, measurements of one or more physiological parameters; and

detect, using only the measurements of one or more physiological parameters, effects of motion artifacts in the measurements of the one or more physiological parameters;

wherein the computer readable code, in causing the at least one processor to detect effects of motion artifacts, causes the at least one processor to:

a. bandpass filter and detrend a segment from the measurement of one physiological parameter; wherein a bandpass filtered and detrended segment is hereinafter referred to as a preprocessed segment;

b. obtain a value of at least one indicator of volatility, used in determining whether motion artifacts are present, for the preprocessed segment; the at least one indicator of volatility being at least Shannon entropy (SE) for the preprocessed segment; where

$$SE = -\sum_{i=1}^{k} \frac{p(i)*\log(p(i))}{\log(\frac{1}{k})}$$

and where i represents the bin number, and $p(i)$ is the probability distribution of the preprocessed segment;

c. include the segment in analyses of physiological measurements when comparison of the value of the at least one indicator of volatility with a predetermined threshold indicates noise/motion artifacts are not present;

d. select another segment of the signal from the physiological measurement and proceeding to step (a) when the value of the at least one indicator of volatility is less than a predetermined threshold and another segment is available.

45. (Withdrawn) The computer usable medium of claim 44 wherein the physiological indicator signal comprises a video color image having red, green and blue components, the video color image being an image obtained from of a portion of a subject's body; wherein the measurements of one or more physiological parameters comprise a measure of oxygen saturation; and wherein the computer readable code, in causing the at least one processor to analyze the physiological indicator signal, causes the at least one processor to:

obtain an average intensity of the red component and a blue component of the video color image of a portion of a subject's body; the average intensity of the red component and the average intensity of the blue component constituting DC_{RED} and DC_{BLUE} respectively;

obtain a standard deviation of the red component and the blue component; the standard deviation of the red component and the blue component constituting AC_{RED} and AC_{BLUE} respectively; and

obtain the measure of oxygen saturation by

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$$SpO2 = A - B\frac{AC_{RED}/DC_{RED}}{AC_{IR(or\ IR)}/DC_{IR(or\ IR)}}$$

46. (Withdrawn) The computer usable medium of claim 44 wherein the one or more physiological measurements comprise heart rate and heart rate variability; and wherein the computer readable code, in causing the at least one processor to analyze the physiological indicator signal, causes the at least one processor to:

determine beats for the physiological indicator signal;

determine beat to beat intervals; and

apply a cubic spline algorithm to obtain a substantially continuous beat to beat interval signal indicative of heart rate.

47. (Withdrawn) The computer usable medium of claim 44 wherein the one or more physiological measurements comprise respiratory rate; and wherein the computer readable code, in causing the at least one processor to analyze the physiological indicator signal, causes the at least one processor to:

obtain time–frequency spectrum of the physiological indicator signal utilizing variable frequency complex demodulation (VFCDM); and

obtain respiratory rates by extracting a frequency component that has a largest amplitude for each time point at a heart rate frequency band.

48. (Withdrawn) The computer usable medium of claim 44 wherein the one or more physiological measurements comprise a measure of blood loss; and wherein the computer readable code, in causing the at least one processor to analyze the physiological indicator signal, causes the at least one processor to:

obtain time–frequency spectrum of the physiological indicator signal utilizing variable frequency complex demodulation (VFCDM);

obtain the amplitude modulation (AM) series from set of the largest instantaneous amplitude at each time sample within the heart rate frequency band of the time--frequency spectrum; and

determine whether the amplitude modulation decreases; a decrease in the amplitude modulation indicating blood volume loss in subject.

49. (Currently amended) A non-transitory computer usable medium having computer readable code embodied therein, the computer readable code causing at least one processor to:

analyze the physiological indicator signal; the physiological indicator signal being obtained from one of an image acquisition component, a photoplethysmographic (PPG) sensor and an electrocardiogram sensor;

wherein analysis does not include Independent Component Analysis;

obtain, from said analyzing, measurements of one or more physiological parameters; and

detect, using only the measurements of one or more physiological parameters, effects of motion artifacts in the measurements of the one or more physiological parameters;

wherein the one or more physiological measurements comprise a measure of atrial fibrillation; and wherein the computer readable code, in causing the at least one processor to analyze the physiological indicator signal, causes the at least one processor to:

obtain a time-varying coherence function by multiplying two time-varying transfer functions (TVFTs), the two time-varying transfer functions obtained using two adjacent data segments, from the physiological indicator signal, one of the two adjacent data segment as an input signal and another of the two adjacent data segment as an output signal to produce a first TVTF; a second TVTF is produced by reversing the input and the output signals, using said another of the two adjacent data segment as the input signal and said one of the two adjacent data segment as the output signal; and

determine whether the time-varying coherence function is less than a predetermined quantity.

50. (Previously presented) The non-transitory computer usable medium of claim 44 wherein the computer readable code, in causing the at least one processor to determine whether the time-

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varying coherence function is less than the predetermined quantity, causes the at least one processor to:

obtain one or more indicators of atrial fibrillation; and

determine whether the one or more indicators of atrial fibrillation exceed predetermined thresholds.

51. (Previously presented) The non-transitory computer usable medium of claim 50 wherein the one or more indicators of atrial fibrillation comprise a variance of the time-varying coherence function.

52. (Previously presented) The non-transitory computer usable medium of claim 51 wherein the one or more indicators of atrial fibrillation also comprise Shannon entropy.

53. (Previously presented) The computer usable medium of claim 50 wherein the predetermined thresholds are determined using receiver operator characteristic (ROC) analysis.

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REMARKS

Applicants have carefully reviewed the Office Action dated September 22, 2016, and this response addresses the Examiner's concerns. Applicants respectfully request reconsideration of the application.

I. STATUS OF THE CLAIMS

Claims 1, 3, 6-24, 27, and 30-53 are pending for examination.

Claims 10-17, 35- 38, and 45-48 are withdrawn from consideration.

Claims 2, 4-5, 25-26, and 28-29 are cancelled.

Claims 1, 19, 24, 39, 44, and 49 are amended.

Amendments to claims 1, 19, 24, 39, 44, and 49 find support in origin of claims 31-34 and in paragraph 49 of the specification.

Regarding the negative limitation in claims 19, 39 and 49, the Federal Circuit has recently stated that there is not "a heightened written description standard for negative claim limitations." *Inphi Corporation v. Netlist, Inc.*, 805 F.3d 1350, 1357 (Fed. Cir. 2015). As stated in *Inphi*, "the specification need only satisfy the requirements of *§ 112*, paragraph 1 as described in this court's existing jurisprudence, including through compliance with MPEP § 2173.05(i) ("If alternative elements are positively recited in the specification, they may be explicitly excluded in the claims.") and *In re Johnson, 558 F.2d at 1018* ("It is for the inventor to decide what bounds of protection he will seek.")." *Id.* Assuming, for argument's sake, that Greco discloses or suggest the Shannon entropy (SE) for the preprocessed segment; where

$$SE = -\sum_{i=1}^{k} \frac{p(i)*\log(p(i))}{\log(\frac{1}{k})}$$

and where i represents the bin number, and $p(i)$ is the probability distribution of the preprocessed segment, then, by reciprocity, the applicants' disclosure discloses or suggest the Shannon entropy for the Independent Components in the Independent Component Analysis and the applicants can decide what bounds of protection to seek and can decide, within their written description requirement, to exclude Independent Component Analysis.

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II. THE 35 U.S.C. 101 REJECTIONS

Claims 1, 19, 24, 39, 44, and 49 are rejected under 35 U.S.C. 101 because the claimed inventions are directed to a judicial exception (i.e., a law of nature, a natural phenomenon, or an abstract idea) without significantly more.

As stated in the PCT application, "there is growing interest in the real-time, wearable and ambulatory monitoring of vital signs using a PPG sensor. However, motion and noise artifacts (hereafter simply referred to as artifacts) are a serious obstacle in realizing this quest." (PCT, page 1). While the number of attempts have been made to detect and reduce the effects of motion/noise artifacts, approaches to motion/noise artifact reduction, at the time of this application, had a number of shortfalls.

"The motion artifact has been recognized as the intrinsic weakness of PPG signal and as a serious obstacle to reliable use of PPG for real-time and continuous monitoring applications. The motion artifacts are more likely in clinical situations where the patient is awake due to voluntary or involuntary movements of the patient which obviously limit the practical accuracy of PPG technique and hence a robust computational technique is warranted that can be used to accurately detect the motion artifacts and assess the severity of noise." (PCT, page 2).

The present claimed invention is directed to methods and systems for rendering a physiological measurement sensor usable for real-time, wearable and ambulatory monitoring of vital signs by detection and amelioration of the effects of motion/noise artifacts in physiological measurements.

The present claimed invention is directed to an improvement in a computer related technology and is not directed to an abstract idea.

Applicants respectfully state that, for the reasons given below, claims 1, 19, 24, 39, 44, and 49 are directed to patentable subject matter.

Section 101 permits the patenting of "any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof." 35 U.S.C. § 101. The Supreme Court has interpreted Section 101 to contain "an important implicit exception: Laws of nature, natural phenomena, and abstract ideas are not patentable." *Alice Corp. v. CLS Bank Int'l*, 134 S. Ct. 2347, 2354 (2014) (quoting *Ass'n for Molecular Pathology v. Myriad Genetics*, Inc., 133 S. Ct. 2107, 2116 (2013)).

In *Mayo* and in *Alice*, the Supreme Court set forth a two-step analytical framework to identify patents that, in essence, claim nothing more than abstract ideas. The court must first "determine whether the claims at issue are directed to a patent-ineligible concept." *Alice*, 134 S.Ct. at 2355. If it is determined that the claims are directed to a patent ineligible concept, the analysis proceeds to step two where one must "consider the elements of each claim both individually and 'as an ordered combination' to determine whether the additional elements 'transform the nature of the claim' into a patent-eligible application." *Id.* (quoting *Mayo*, 132 S. Ct. at 1298, 1297).

Step one

Starting with step one, as stated in *Alice* and as the Federal Circuit has stated in *Enfish, Rapid Litigation* and *McRo*, the inquiry should be whether the claims are directed a judicial exception. The directed to inquiry is based on whether the character of the claim as a whole is directed to a judicial exception (find a focus of the claimed advance over the prior art). *Enfish, LLC v. Microsoft Corp.* 822 F.3d 1327 (Fed. Cir. 2016); *Rapid Litigation Management v. CellzDirect*, 827 F.3d 1042, 1048 (Fed. Cir. 2016); *Mcro, Inc. v. Bandai Namco Games America,* slip opinion 2015-1080, -1081 to -1090,-1092 to – 1101 (Federal Circuit September 13, 2016). The inquiry under step one look to whether the claims in these patents focus on a specific means or method that improves the relevant technology or are instead directed to a result or effect that itself is the abstract idea and merely invoke generic processes and machinery. *Enfish,* 822 F.3d at 1336; *Rapid Litig. Mgmt.,* 827 F.3d at 1048; as cited in *McRo*, slip opinion 2015-1080, -1081 to -1090,-1092 to –1101 (Federal Circuit September 13, 2016).

The applicants claimed invention is directed to methods and systems for rendering a physiological measurement sensor usable for real-time, wearable and ambulatory monitoring of vital signs by detection and amelioration of the effects of motion/noise artifacts in physiological measurements. Applicants respectfully state that the claims are not directed to mathematical calculations.

Although the Supreme Court has not established a definitive rule to determine what constitutes an "abstract idea," both the Federal Circuit and the Supreme Court have found it sufficient to compare claims at issue to those claims already found to be directed to an abstract idea in previous cases. *Enfish,* 822 F.3d at 1334 (citing *Alice*, 134 S.Ct. at 2357).

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The Examiner, in the Final Office Action dated April 18, 2016, states that the Applicants' claims recite an abstract idea, "because they are directed to functionally-described algorithmic processes that require performing mathematical calculations, and the Supreme Court has explicitly characterized mathematical relationships/formulas as abstract ideas." Applicant respectfully states that although there Supreme Court cases that have found abstract claims that are directed to a mathematical relationship, there are no Supreme Court cases that state that all claims that required mathematical calculations, although directed to a useful purpose, are abstract. In Benson, the Court stated that tha claimds "would wholly pre-empt the mathematical formula [for converting BCD numerals to pure binary numerals] and in practical effect would be a patent on the algorithm itself." Benson, 409 U.S. at 71-72. In contrast in Diehr, the Court stated that the claims acted "only to foreclose from others the use of that equation in conjunction with all of the other steps in claimed process." Diehr, 450 U.S. at 187.

The examiner, in the office action, cites the following cases:

at least the following court decisions:

- *SmartGene, Inc. v Advanced Biological Labs.*, 555 Fed. Appx. 950 (Fed. Cir. 2014), directed to systems, methods and computer program products for guiding the selection of therapeutic treatment regimens (ineligible)
- *TL/ Communications LLC v. A. V. Automotive, LLC* (Fed. Cir. May 17, 2016) directed to generalized steps for recording, administration and archiving of digital images, and classifying and storing digital images in an organized manner (ineligible)
- *Ariosa Diagnostics, Inc. v. Sequenom, Inc.*, 788 F.3d 1371 (Fed. Cir. 2015)., directed to a method of non-invasive prenatal diagnosis (ineligible)
- *Ultramercial, Inc. v. Hulu, LLC* , 772 F.3d 709 (Fed. Cir. 2014), directed to methods of payment of intellectual property royalties by interposed sponsor over a telecommunications network (ineligible)
- *Digitech Image Techs., LLC v Electronics for Imaging, Inc.*, 758 F.3d 1344 (Fed. Cir. 2014), drawn to device profiles for use in a digital image processing system (ineligible)

Applicant respectfully states that not one of those cases is directed to methods and systems for rendering a physiological measurement sensor usable for real-time, wearable and

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ambulatory monitoring of vital signs by detection and amelioration of the effects of motion/noise artifacts in physiological measurements, which is the claimed advance over the prior art.

In *McRo*, "the claimed improvement [was] allowing computers to produce 'accurate and realistic lip synchronization and facial expressions in animated characters,'' which is performed using a computer (and mathematical algorithms) but is not a computer improvement as in *Enfish*. *McRo*, slip opinion 2015-1080, -1081 to -1090,-1092 to –1101, p. 23 (Federal Circuit September 13, 2016). The Applicants' claimed invention uses technology and computers to render a physiological measurement sensor usable for real-time, wearable and ambulatory monitoring of vital signs by detection and amelioration of the effects of motion/noise artifacts in physiological measurements.

Applicants respectfully state that the Examiner's statements are not based on law or substantial evidence.

Applicants respectfully state that the end result of the Applicants' patent claims an advance the prior art by providing better methods and systems for rendering a physiological measurement sensor usable for real-time, wearable and ambulatory monitoring of vital signs by detection and amelioration of the effects of motion/noise artifacts in physiological measurements, and achieve that by a technological process that is defined in the claims.

Applicants respectfully state that the Applicants' claims are not directed to an abstract idea and therefore the claims recite patentable subject matter.

Step two

Since the Courts have recognized that the two steps of the *Alice/Mayo* test "are easier to separate in recitation than in application," (see Central District CA CASE NO. SACV 11-00189 AG (RNBx) Ameranth v. GENESIS GAMING SOLUTIONS, ORDER DENYING MOTION FOR SUMMARY JUDGMENT OF INVALIDITY, January 2, 2015; *BASCOM Glob. Internet Servs., Inc. v. AT&T Mobility LLC*, 827 F.3d 1341, 1349 (Fed. Cir. 2016)) although Applicants do not acquiesce to the claims being directed to an abstract idea, Applicants present the following arguments for step two of the *Alice/Mayo* test.

The Supreme Court in the *Alice* decision stated that "Thus, an invention is not rendered ineligible for patent simply because it involves an abstract concept. "[A]pplication[s]" of such

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concepts "'to a new and useful end,'" we have said, remain eligible for patent protection." *Alice*, 134 S. Ct. at 2354 (citations omitted).

As the Federal Circuit stated in *Rapid Litigation Management*, under step two, claims that are "directed to" a patent-ineligible concept, yet also "improve[] an existing technological process," are sufficient to "transform[] the process into an inventive application" of the patent-ineligible concept. *Rapid Litigation Management*,., 827 F.3d at 1050 (citing *Alice*, 134 S. Ct. at 2358 (quoting *Mayo*, 132 S. Ct. at 1299) (discussing *Diamond v. Diehr*, 450 U.S. 175 (1981)).

As stated above, the Applicants' claimed invention renders a physiological measurement sensor usable for real-time, wearable and ambulatory monitoring of vital signs by detection and amelioration of the effects of motion/noise artifacts in physiological measurements. The present claimed invention is an improvement in physiological measurement technology and applies concepts to reach a new and useful end.

Applicants respectfully state that since the claimed invention improves an existing technological process, the elements of the claimed invention are sufficient to transform the process into an inventive application of the abstract concept, if an abstract concept was present.

Applicants respectfully state that, if considered under the second step of the *Alice* method, the claimed invention also meets the second step of the *Alice* method.

Applicant respectfully states that the claimed invention is patent eligible.

III. THE 35 U.S.C. 112 REJECTIONS

Claims 1, 19, 24, 31, 39, 44, and 49 are rejected under 35 U.S.C. 112(a) or 35 U.S.C. 112 (pre-AIA), first paragraph, as failing to comply with the written description requirement.

A disclosure, including the original claims, meets the written description requirement if the disclosure disclose the claimed invention to the public in such a manner as to allow "a person of skill in the art to recognize that the patentee invented what is claimed." *Synthes USA, LLC v. Spinal Kinetics, Inc.*, 734 F.3d 1332, 1341 (Fed. Cir. 2013) (citing *Ariad Pharms., Inc. v. Eli Lilly & Co.*, 598 F.3d 1336, 1351 (Fed. Cir. 2010). A determination that a disclosure, including the original claims, meets the written description requirement depends on "the nature and scope of the claims and on the complexity and

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predictability of the relevant technology." *Id.* (citing *Capon v. Eshhar*, 418 F.3d 1349, 1357-58 (Fed. Cir. 2005)).

Applicants have amended claims 1, 19, 24, 31, 39, 44, and 49 to recite the physiological indicator signal being obtained from one of an image acquisition component, a photoplethysmographic (PPG) sensor and an electrocardiogram sensor, as disclosed in the specification and the original claims.

The Examiner, in the office action, states that "Claims 1, 19, 24, 39, 44, and 49 recite "...providing a physiological indicator signal to a handheld mobile communication device; analyzing ... the physiological indicator signal; obtaining ... one or more physiological parameters ... and detecting ... effects of motion artifacts in the measurements of the one or more physiological parameters". The specification does not provide adequate supports for motion artifact detections in **all possible** physiological signals/parameters and/ or **all types** of signals/parameters in medical fields associated with physiological conditions."

Applicants respectfully state that amended claims 1, 19, 24, 39, 44, and 49 describe a signal for which there is support in the specification and in original claims for motion artifact detection. Applicants respectfully state that the disclosure disclose the claimed invention to the public in such a manner as to allow "a person of skill in the art to recognize that the patentee invented what is claimed." the disclosure disclose the claimed invention to the public in such a manner as to allow "a person of skill in the art to recognize that the patentee invented what is claimed."

Regarding claim 31, the Examiner, in the office action states that "Claim 31 recites "an image acquisition component". The specification does not provide adequate supports for all possible image acquisition components/devices. The specification indicates limited supports for optical imaging device(s) only (e.g. camera or video camera). No support(s) of other types of image acquisition components/devices has been found in the specification."

"Written description is a question of fact, judged from the perspective of one of ordinary skill in the art as of the relevant filing date." *Falko-Gunter Falkner v. Inglis*, 448 F.3d 1357, 1363 (Fed. Cir. 2006) (citing *Vas-Cath, Inc. v. Mahurkar*, 935 F.2d 1555, 1563-64 (Fed. Cir. 1991))

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As stated in the 1.132 declaration, an image acquisition component is a term of art and a camera is not a sensor but the image acquisition component in the camera is a sensor. As stated in the 1.132 declaration, "that the term "image acquisition component" is a term of art, as can be seen from Image Acquisition: Handbook of machine vision engineering:, Volume 1, page 107 (describing image acquisition subsystems), B. Wadell et al., Common Principles of Image Acquisition Systems and Biological Vision, PROCEEDINGS OF THE IEEE, VOL. 90, NO. 1, JANUARY 2002, p. 11, (describing the Stanford CMOS sensor as a system for image acquisition), Information Technology and Computer Application Engineering, edited by Hsiang-Chuan Liu, Wen-Pei Sung, Wenli Yao, p. 38. One skilled in the art would know that an image acquisition component is part of a camera, that a camera can include a CMOS image acquisition sensor, a CCD image acquisition sensor or even an IR image acquisition sensor, that the difference between a still camera and a video camera is that, in a video camera, the image acquisition sensor is configured to have frames acquired at a predetermined time. (see, for example, The Image Sensor's Role in Video, available at https://www.videomaker.com/article/f6/17249-the-image-sensors-role-in-video, Image Introduction, RPI available at https://www.ecse.rpi.edu/Homepages/qji/CV/image_intro.pdf , a copy of which is attached, and Basic Introduction to Still Digital System, Electronic Imaging Seminar, 1992, RIT, a copy of which is also attached). One skilled in the art would know that while a camera is not a sensor, the image acquisition component in a camera is a sensor, since the image acquisition component produces signals in response to the incoming photons."

The original claims recite an image acquisition component. In the cameras described in the specification, image acquisition components are used to obtain video signals.

Applicants respectfully state that one skilled in the art, upon reading the specification and the original claims, would find that the specification and the original claims disclose the claimed invention to the public in such a manner as to allow "a person of skill in the art to recognize that the patentee invented what is claimed."

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Claim 24 is rejected under 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA), second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventor or a joint inventor, or for pre-AIA the applicant regards as the invention. disclose the claimed invention to the public in such a manner as to allow "a person of skill in the art to recognize that the patentee invented what is claimed."

Applicants respectfully state that the written description requirement has been met.

Claim 24 is rejected under 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA), second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventor or a joint inventor, or for pre-AIA the applicant regards as the invention. disclose the claimed invention to the public in such a manner as to allow "a person of skill in the art to recognize that the patentee invented what is claimed."

The examiner, in the office action, states that "Claim 24 recites step/function "b" in the body of the claim. It is unclear whether there is a missing step(s) or it is a typo. If the claim comprises any essential step/ function in "b", the limitation should be set forth in the claim. Otherwise, step "b" should be deleted and steps "c", "d", and "e" should be set forth "b", "c", and d", respectively. Clarification is requested by amendments."

Claim 24 has been amended.

IV. THE 35 U.S.C. 103 REJECTIONS

The factual inquiries set forth in *Graham v. John Deere Co.,* 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claim Construction

The first step in determining whether a claim is anticipated, or is obvious in view of prior art, is to interpret the claim. ("It is elementary in patent law that, in determining whether a patent is valid ....., the first step is to determine the meaning and scope of each claim in suit." *Lemelson v. Gen. Mills, Inc.*, 968 F.2d 1202, 1206, 23 U.S.P.Q.2D (BNA) 1284, 1287 (Fed. Cir. 1992).) When not defined by applicant in the specification, the words of a claim must be read as they would be interpreted by those of ordinary skill in the art. (MPEP 2111.01) (*Rexnord Corp. v. Laitram Corp.*, 274 F.3d 1336, 1342, 60 USPQ2d 1851, 1854 (Fed. Cir. 2001) ("explaining the court's analytical process for determining the meaning of disputed claim terms")). The US Patent and Trademark Office ("USPTO") determines the scope of claims in patent applications not solely on the basis of the claim language, but upon giving claims their broadest reasonable construction "in light of the specification as it would be interpreted by one of ordinary skill in the art." *In re Am. Acad. of Sci. Tech. Ctr.*, 367 F.3d 1359, 1364[, 70 USPQ2d 1827, 1830] (Fed. Cir. 2004). MPEP 2111.

One skilled in the art, upon reading the specification, would interpret kurtosis for the preprocessed segment and Shannon entropy for the preprocessed segment has been computed using the segment and equations (1) and (2) in paragraphs 48 and 49 of the specification.

The level of ordinary skill in the pertinent art

One skilled in the art has knowledge of signal processing, at an equivalent graduate-level, and knowledge of biomedical applications. One skilled in the art would be familiar with Independent Component Analysis (ICA). One skilled in the art would be familiar with Delorme et al, Automatic artifact rejection for EEG data using high-order statistics and independent component analysis, Proceedings of the 3rd International Workshop on ICA, San Diego, 457-462, 2015 (submitted in an IDS on January 8, 2015). Delorme teaches obtaining kurtosis from the raw data but obtaining the Shannon entropy for the components from the ICA since " it would be useful if we could isolate and measure these artifacts based on their projection to overlapping electrode subsets. This is what ICA does." (Delorme, section 3.1).

Determining the scope and contents of the prior art

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Greco teaches a technique for the automatic artifact rejection, based on the Independent Component Analysis (ICA) for the artifact extraction and on the joint use of kurtosis and Renyi's entropy, rather than Shannon's entropy (Greco, p. 181, col. 1, lines 10-14). Greco teaches extracting a number of data segments of EEG data, removing electrical line noise, performing independent component analysis (ICA) on the data to extract the independent components (ICs) and computing the kurtosis and Renyi's entropy for each independent component (IC). Greco teaches that using Shannon entropy instead of Renyi's entropy does not result in all the artifact being detected (Greco, p. 183, section IV-Results). Greco teaches removing noise from the raw data by filtering the data with a notch filter (Greco Sec. IV on page 206).

Lichter teaches a real-time biological data processing PC card that is lightweight, cost effective, and portable. The real-time biological data processing PC card is capable of converting a host personal computer system into a powerful diagnostic instrument. Each real-time biological data processing PC card is adapted to input and process biological data from one or more biological data sensors, and is interchangeable with other real-time biological data processing PC cards.

Renfeld teaches capturing photoplethysmograph signals while the patient sleeps are analyzed in order to diagnose the patient's cardiorespiratory condition. In particular, the signals may be used to detect and assess the severity of conditions that are characteristic of heart failure (HF), such as premature ventricular contractions and Cheyne-Stokes breathing (Renfeld, Par. 15). Renfeld, also discloses identifying arrhythmias and detecting other characteristics indicative of restoration modulation (Renfeld, par. 68, 78-79). Renfeld states, in paragraph 80, that, in regards to identifying arrhythmias and detecting other characteristics indicative of restoration modulation, "Similar procedures to those described above can be applied to the detrended AC photoplethysmograph signal. One way to perform detrending is to replace the photoplethysmograph signal with its amplitude feature (maximum minus minimum signal). Other methods include subtracting a polynomial that approximates the signal, or using local maxima or local minima features. Following detrending, the processor applies very-low-frequency filtering followed by outlier rejection, and then computes the median vasomotion of each sequence."

Muthuswamy et al., "Spectral analysis methods for neurological signals", Journal of Neuroscience Methods 83 (1998) 1-14), in finding the power spectrum of a segment of data, teaches that "The mean and any linear trend in the data are removed before multiplying the signal with a window whose length is the same as the length of the signal *x(n) (N* points)."

Claims 1, 3, 8-9, 24, 27, 33-34, and 44 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Greco et al., "Kurtosis, Renyi's Entropy and Independent Component Scalp Maps for the Automatic Artifact Rejection from EEG data," International Journal of Computer, Information, Systems and Control Engineering 2(9), January 2008: 180-184 – cited by applicant) in view of Lichter et al. (USPN 6,159,147 – cited in previous action) and further in view of Muthuswamy et al., "Spectralanalysis methods for neurological signals", Journal of Neuroscience Methods 83 (1998)1-14 – cited in previous action)..

One skilled in the art would be familiar with Delorme et al, Automatic artifact rejection for EEG data using high-order statistics and independent component analysis, Proceedings of the 3rd International Workshop on ICA, San Diego, 457-462. Delorme teaches obtaining kurtosis from the raw data but obtaining the Shannon entropy for the components from the ICA since " it would be useful if we could isolate and measure these artifacts based on their projection to overlapping electrode subsets. This is what ICA does." (Delorme, section 3.1). Greco teaches "

An approximation of the (13) was used:

$$H^i(j) = -\sum_{x \in j} f_j^i(x) \log\left(f_j^i(x)\right) \qquad (14)$$

which is the entropy of the *ICi* in the trial *j*, and $f_j^i(x)$ is the pdf of the component *ICi* during trial *j*.

In order to detect the artifactual components, entropy was computed for each trial and for all the ICs and it was normalized, to 0-mean and standard deviation 1, with respect to all the ICs, the threshold was set at ±1 .64 [6], if a component exceeded the threshold in more than 20% of the trials, the component was marked for rejection because it was very likely to be an artifact."

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(Greco, p. 181, right column).

Applicants respectfully state that Greco does not teach or suggest (in fact teaches away from) obtaining a value of at least one indicator of volatility, used in determining whether motion artifacts are present, for the preprocessed segment; the at least one indicator of volatility being at least Shannon entropy (SE) for the preprocessed segment; where

$$SE = -\sum_{i=1}^{k} \frac{p(i)*\log(p(i))}{\log(\frac{1}{k})}$$

and where i represents the bin number, and $p(i)$ is the probability distribution of the preprocessed segment, a limitation of independent claims 1, 24 and 44, and that Lichter and Muthuswamy also do not teach or suggest this limitation.

To establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974).

Applicants respectfully state that a prima facie case of obviousness has not been established for claims 1, 24 and 44.

Claims 3, 8-9 are dependent on claim 1. Claims 27 and 33-34 are dependent on claim 24.

Applicants respectfully state that a prima facie case of obviousness has not been established for claims 1, 3, 8-9, 24, 27, 33-34 and 44.

Claims 6 and 30 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over the combination of Greco, Lichter and Muthuswamy as applied to claims 1 and 24 above, and further in view of Maier et al. (USPGPUB 2006/0253261 - cited in previous action).

Claim 6 is dependent on claim 1 and claim 30 is dependent on claim 24.

As stated above, Applicants respectfully state that Greco does not teach or suggest (in fact teaches away from) obtaining a value of at least one indicator of volatility, used in determining whether motion artifacts are present, for the preprocessed segment; the at least one indicator of volatility being at least Shannon entropy (SE) for the preprocessed segment; where

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$$SE = -\sum_{i=1}^{k} \frac{p(i)*\log(p(i))}{\log(\frac{1}{k})}$$

and where i represents the bin number, and $p(i)$ is the probability distribution of the preprocessed segment, a limitation of independent claims 1, 24 and 44, and that Lichter and Muthuswamy also do not teach or sugest this limitation.

Applicants respectfully state that Maier also does not teach or suggest the missing limitations.

Applicants respectfully state that a prima facie case of obviousness has not been established for claims 6 and 30.

Claims 7 and 31-32 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over the combination of Greco, Lichter and Muthuswamy as applied to claims 1 and 24 above, and further in view of Jacobsen et al. (USPN 6, 198,394 - cited in previous action).

Claim 7 is dependent on claim 1 and claims 31-32 are dependent on claim 24.
As stated above, Applicants respectfully state that Greco does not teach or suggest (in fact teaches away from) obtaining a value of at least one indicator of volatility, used in determining whether motion artifacts are present, for the preprocessed segment; the at least one indicator of volatility being at least Shannon entropy (SE) for the preprocessed segment; where

$$SE = -\sum_{i=1}^{k} \frac{p(i)*\log(p(i))}{\log(\frac{1}{k})}$$

and where i represents the bin number, and $p(i)$ is the probability distribution of the preprocessed segment, a limitation of independent claims 1, 24 and 44, and that Lichter and Muthuswamy also do not teach or suggest this limitation.

Applicants respectfully state that Jacobsen also does not teach or suggest the missing limitations.

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Applicants respectfully state that a prima facie case of obviousness has not been established for claims 7 and 31-32.

Claim 18 is rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over the combination of Greco, Lichter and Muthuswamy as applied to claim 1 above, and further in view of Zhang (USPGPUB 2009/0112110 - cited in previous action).

Claim 18 is dependent on claim 1.

As stated above, Applicants respectfully state that Greco does not teach or suggest (in fact teaches away from) obtaining a value of at least one indicator of volatility, used in determining whether motion artifacts are present, for the preprocessed segment; the at least one indicator of volatility being at least Shannon entropy (SE) for the preprocessed segment; where

$$SE = -\sum_{i=1}^{k} \frac{p(i)\cdot\log(p(i))}{\log(\frac{1}{k})}$$

and where i represents the bin number, and $p(i)$ is the probability distribution of the preprocessed segment, a limitation of independent claims 1, 24 and 44, and that Lichter and Muthuswamy also do not teach or suggest this limitation.

Applicants respectfully state that Zhang also does not teach or suggest the missing limitations.

Applicants respectfully state that a prima facie case of obviousness has not been established for claim 18.

V. DOUBLE PATENTING

Claims 19-23, 39-43, and 49-53 are rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1-16 of U.S. Patent No. 8,755,876 in view of Greco and Lichter.

Applicants respectfully state that Greco does not teach or suggest analyze the physiological indicator signal; the physiological indicator signal being obtained from one of an image acquisition component, a photoplethysmographic (PPG) sensor and an electrocardiogram sensor;

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wherein analysis does not include Independent Component Analysis; obtain, from results of analyzing, measurements of one or more physiological parameters; and detect effects of motion artifacts, using only the measurements of one or more physiological parameters, in the measurements of the one or more physiological parameters, limitations of independent claims 19, 39 and 49, and neither does U.S. Patent No. 8,755,876, or Lichter.

Applicants respectfully state that a prima facie case of obviousness has not been established for claims 19-23, 39-43, and 49-53 and establishing a prima facie case of obviousness is necessary for nonstatutory double patenting.

Applicants respectfully state that the nonstatutory double patenting rejection should be withdrawn.

CONCLUSION

Any amendments to the claims as set forth herein, including the modification, addition, cancellation, or withdrawal of any claims, have been offered to advance this application to issue. None of the amendments made herein should be construed as an admission that the subject matter of the claims, as originally filed, is anticipated by or made obvious in light of any art of record whether considered singularly or in combinations. Applicants expressly reserve the right to pursue the originally filed claims in another co-pending application without being prejudiced by any amendments, including cancellation of claims, made herein.

The Director of Patents and Trademarks is hereby authorized to charge any underpayment of fees, or credit any overpayments, to Deposit Account 03-2410 (Order No. 30210-201).

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The following information is presented in the event that a call may be deemed desirable by the Examiner: ORLANDO LOPEZ (617) 345-3000.

Respectfully submitted,

Dated: December 22, 2016

By: /Orlando Lopez/
Orlando Lopez, Ph.D.
Reg. No. 46,880
Attorney for Patent Application Owners

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of Ki H. Chon et al.	)	Confirmation No.: 9133
	)	
Application No.: 13/354,941	)	Group Art Unit: 3777
	)	
Filing Date: January 20, 2012	)	Docket No.: 30210-201
	)	
Title: PHYSIOLOGICAL PARAMETER MONITORING WITH A MOBILE COMMUNICATION DEVICE	)	Examiner: LIU, CHU CHUAN

Assistant Commissioner of Patents
Alexandria, VA 22313-1450
DECLARATION UNDER 37 CFR 1.132

To: Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

I, Orlando Lopez, declare and state that:

(1) I am a person of ordinary skill in the art of imaging systems by my Education and Experience

Education:

Ph.D., EE, University of Colorado, 1982
M.Phil., Eng. & Applied Science, Yale University, 1972
S.M., EE, M.I.T.,1967
B.S.E.E., University of Puerto Rico, 1965

Software Engineering Courses – Brandeis University – 4 graduate courses (1997-1999)
Other courses in Electronic Design (Harvard extension), Statistics (Boston University)

J.D. - New England School of Law – 2005

Work Experience

2006-present Burns and Levinson LLP
Partner (2007 –present), Associate (2006-2007)

2001- 2006 Perkins, Smith & Cohen Boston, MA
Associate (2005-2006), Patent Agent (2001-2005)

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1986-2001 Polaroid Corporation Cambridge, MA

Technical Manager/ Patent Agent, Law and Patent Department (1999 – 2001)

Technical Manager, Optical Storage Department

Manager, Imaging System Research Laboratory

The laboratory was responsible for the first prototype of innovative printers and digital cameras. The laboratory had groups in electronic design, software, IC design, mechanical design and systems integration. The laboratory produced prototypes of the first digital camera at Polaroid, and the first digital camera with the capability to transmit the captured image.

Senior Principal Engineer

- Project Engineer – Graphics Imaging
  - leading system development of a printer using lasers to write on a new film.
- Senior Principal Engineer- Helios Medical
  contributed to the imaging and system development of a printer using lasers to write on a new film.

  Group Leader – Magnetic Recording

1985-1986 Data General

MANAGER, ADVANCED MAGNETIC COMPONENTS

1981- 1986 Magnetic Peripherals, Inc. (Control Data)

Senior Consultant, Advanced Component Technology

Manager, Recording Physics Group

Project engineer, Cricket drive development (first 3 ½ in. Rigid disk drive)
the drive had a new positioning system (servo) and ASICs for the positioning as well as a new media, heads and head suspension

1979-1981 Shugart Associates

Senior Advisory Engineer, Head Engineering

Other experience in Applied physics ***(electromagnetics, plasmas and beams) at Physics International Company and Science Applications, Inc.***

and others.

Publications and Other Activities

see attached list of publications

- Member of K. Nelson's doctoral committee at Boston University (thesis defense - Spring 2000)

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Dr. Lopez has been listed in Who's Who in Frontiers of Science and Technology

(2) I am also an attorney contributing to the prosecution of the above-referenced patent application..

(3) I have reviewed the above-referenced patent application, independent claims 1, 19, 24, 31, 39, 44, and 49 as presented in the response filed on July 6, 2016, the Rejection dated September 22, 2016.

(4) Based thereon, I further declare and state that, as Laboratory Manager and project engineer in projects that used image acquisition components, I have been concerned with systems that use image acquisition components. I further declare that the term "image acquisition component" is a term of art, as can be seen from Image Acquisition: Handbook of machine vision engineering:, Volume 1, page 107 (describing image acquisition subsystems), B. Wadell et al., Common Principles of Image Acquisition Systems and Biological Vision, PROCEEDINGS OF THE IEEE, VOL. 90, NO. 1, JANUARY 2002, p. 11, (describing the Stanford CMOS sensor as a system for image acquisition), Information Technology and Computer Application Engineering, edited by Hsiang-Chuan Liu, Wen-Pei Sung, Wenli Yao, p. 38. One skilled in the art would know that an image acquisition component is part of a camera, that a camera can include a CMOS image acquisition sensor, a CCD image acquisition sensor or even an IR image acquisition sensor, that the difference between a still camera and a video camera is that, in a video camera, the image acquisition sensor is configured to have frames acquired at a predetermined time. (see, for example, The Image Sensor's Role in Video, available at https://www.videomaker.com/article/f6/17249-the-image-sensors-role-in-video, Image Introduction, RPI available at https://www.ecse.rpi.edu/Homepages/qji/CV/image_intro.pdf , a copy of which is attached, and Basic Introduction of Still Digital System, Electronic Imaging Seminar, 1992, RIT, a copy of which is also attached). One skilled in the art would know that while a camera is not a sensor, the image acquisition component in a camera is a sensor, since the image acquisition component produces signals in response to the incoming photons.

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(5) I further declare and state that all statements made herein of my own knowledge are true and all statements made on information and belief are believed to be true, these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Date: Dec 22, 2016

Orlando Lopez

PUBLICATIONS

"Effect of Partial crystallization in AgInSbTe on Forming Amorphous Marks" (with K. Nelson et al.), presented at the Optical Data Storage Conference 2001, April 2001, Santa Fe, NM

"Effect of Partial Crystallization on Forming Amorphous Marks" (with K. Nelson et al.), presented at presented at the Optical Data Storage Conference 2000, May 2000, Whistler, B.C., Canada

"Immersion Microscope for Static Testing of Near Field Phase Change Optical Disks" (with K. Nelson et al,), presented at the SPIE Annual Meeting 1999, July 1999, Denver, CO

" Periodic Image Artifacts in Digital Halftone Prints ",
SPIE/SPSE Electronic Imaging'90 Conference, Feb. 1990 , Santa Clara, Ca.

"Barium Ferrite Particulate Flexible Disk Media-Recording Characteristics"(with B.J.Fallabela et al.), Invited paper presented at the 4th Joint MMM-intermag Conference, Vancouver, B.C., Canada, July I I-15, 1988.

"A Comparison of Perpendicular and Longitudinal Recording" (with C.M. Perlov and J.A. Christner), J. Appl. Phys., Vol. 63, No. 8, part IIB, 1988, pp. 2902-2904.

"Characteristics of Magneto-Optic Media" (with R.W. Wang and D.A. Ahonen). Invited paper, Workshop on Magneto-optics, 1986, Saratoga Springs, New York.

"On Demagnetization Induced Boosting of the Short Wavelength in Perpendicular Recording" (with V.B. Mihunin and C.M. Perlov), IEEE Trans. on Mag., Vol MAG-21, Nov. 1985, pp. 2688-2689.

"On the Transition Length in Perpendicular Recording" (with D.A. Clark), IEEE Trans. on Ma g., Vol MAG-21, Sept. 1985, pp. 1401-1403,

"On the Perpendicular Recording Process" J. Appl. Phys. Vol. 57, No. 8,
April 15, 1985, pp. 3943-3945.

"Analytical Calculations of Write-Induced Separation Losses," IEEE Trans. on Mag. Vol MAG-20, Sept. 1984.

"Reproducing Vertically Recorded Information-Double Layer Media," IEEE Trans. on Mag., Vol MAG-19, No. 5, 1983, pp. 1614-1616.

"Theory of Playback of Vertically Recorded Information-Double Layer Media" (with V.B. Mihunin), 1983 Intermag Conference, April 5-8, 1983.

"Interaction of a Ring Head and Double Layer Media-Field Calculations," IEEE Trans. on Mag., Vol MAG-18, No. 6, 1982, pp. 1179-118 1.

"Effects of Magnetic Fields on Flexible Drive Performance" (with T. Lam and R. Stromsta), IEEE Trans. on Mag. Vol MAG-17, No. 4, 1981, pp_ 1417-1420.

"Conceptual Design of a Small, Shock Heated, Wall Confined Fusion Reactor" (with R. Cooper, R. Aronstein, A. Nagy, and E. Weber), Proc. of the 1979 Conf. on Engineering Problems of Fusion Reactors, IEEE, 1979, pp. 888892.

"Expansion of a Plasma into a Finite Chamber" (with V. Bailey, M. DiCapua), Conf. Record of the 1978 IEEE Intl. Conf on Plasma Science, IEEE Catalog No. 78CH1357-3NPS, p. 219.

"Shock Heated, Wall Confined Reactor Concept" (with V. Bailey, M. DiCapua, R. Cooper), Conf. Record of the 1978 IEEE Intl. Conf. on Plama Science, 1978,p. 220.

"Advances in Intense Relativistic Electron Beam Characterization in Bz 'T'ransport Systems" (with B. Buck, T.S.T. Young, B. Chao), Conf. Record of the 1978 IEEE Intl. Conf on Plasma Science, 1978, p. 226.

"'Electron beam Solenoid Reactor Concept" (with `v. Bailey, J. Benturd,

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R. Cooper, D. Dakin, et al.), Proc. of the 2nd Intl. Topical Conference on High Power Electron and Con Beam Technology, Oct. 3-5, 1977, Cornell Univ., pp. 301-317.

"A Simple Analytical Calculation of X-Ray Photoemission," J. of Appl. Physics, June 1975.

"1-D, 2-D, 3-D, IEMP Calculation - Comparison with Experiments" (with C.W. Wilson), presented at Joint AEC DNA SGEMPITree Symposium, Los Alamos, NM, Jan. 1975.

"Multidimensional IEMP Calculations" (with C.A. Clarke, W.F. Rich), presented at the 1974 IEEE Conference on Nuclear and Space Radiation Effects, Ft. Collins, CO, July 1974.

"Plasma Effects in Irradiated Cavities (with C.A. Clarke, W.F. Rich), presented at the 1974 IEEE Conference on Nuclear and Space Radiation Effects, F. Collins, CO, July 1974.

"Dynamic Internal EM Pulse Calculations in Three Dimensions" (with W.F. Rich) IEEE Trans. On NS Vol. NS-12, Dec. 1973, (invited paper).

"EMP Coupling Through a Flush Mounted Coaxial Aperture," Joing EMP Technical Meeting, Sept. 1974.

"Photocurrents and Self Consistent Fields in Cavities," Joint EMP Technical Meeting, Sept. 1974.

"Calculation of IEMP Currents and Fields in a Three Dimensional Concentric Geometry-Comparison of UGT Data" (with W.F. Rich), presented at the DNA IEMP Symposium, San Diego, CA, Feb. 1973.

"Field Penetration Through a Flush Mounted Coaxial Aperture-Variational Calculation," presented at the IEEE Region 3 Conference, Louisville, KY, May 1973.

"Cyclotron Heating Due to a Modulated Electron Beam in a Mirror Machine," Plasma Physics, Vol. 11, No. 8, 1969, pp. 681.

4834-2502-2485.1
4830-0136-7614.3

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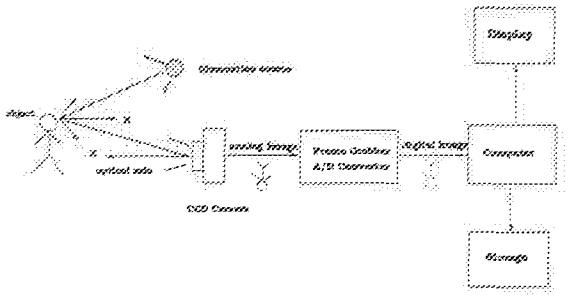
Slide 1

Image Acquisition and Representation

- how digital images are produced
- how digital images are represented
- photometric models-basic radiometry
- image noises and noise suppression methods

Slide 2

Image Acquisition Hardware



Note a digital camera represents a camera system with a built-in digitizer.

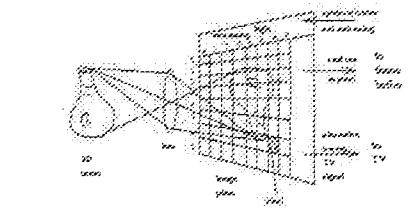
Slide 3

Camera

- First photograph was due to Niepce of France in 1827.
- Basic abstraction is the pinhole camera
  - lenses required to ensure image is not too dark
  - various other abstractions can be applied

Slide 4

CCD Camera



CCD (Charged Couple Device) camera consists of a lens and an image plane (chip array) containing tiny solid cells that convert light energy into electrical charge. The output is analog image. The key camera parameters include

- image plane geometries: rectangle, circular, or liner.

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- chip array size (e.g. 512×512, also referred to as camera resolution, i.e., the number of cells horizontally and vertically).
- cell size (e.g., $16.6 \times 12.4 \mu m$, aspect ratio=4:3, not square)
- Spectral response (28%(450nm), 45%(550nm), 62%(650nm))
  visible light: 390-750 nm, IR light 750 nm and higher
- Aperture

Slide 6

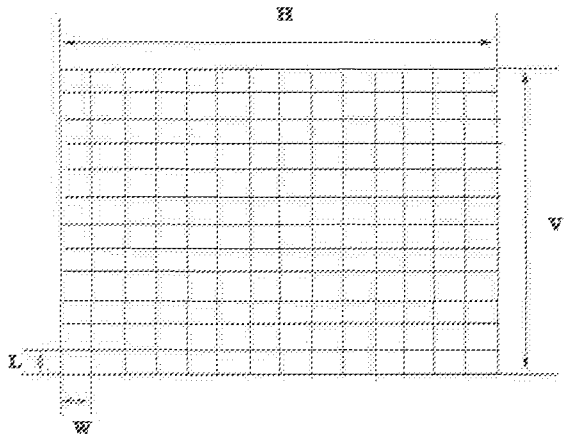
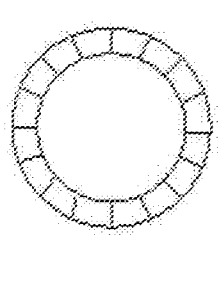


Figure 1: CCD camera image plane layout

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Other CCD array geometries





Usually, $H \times W/V \times L$=4:3. This aspect ratio is more suitable for human viewing. For machine vision, aspect ratio of 1:1 is preferred.

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Analog Image

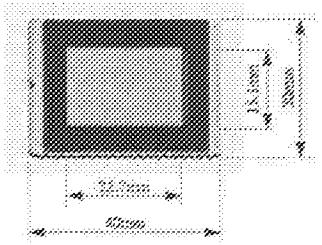
An analog image is a 2D image $F(x, y)$ which has infinite precision in spatial parameters x and y and infinite precision in intensity at each point (x,y).

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CMOS Camera

A CMOS (Complementary Metal Oxide Silicon) camera is an alternative image sensor.



It follows the same principle as CCD by converting photons into electrical changes. But it uses different technologies in converting and transporting the electrical charges. Compared to CCD, it's speed is faster and consume less power, and is smaller in size. But its light sensitivity is lower and its image is more noisy. CMOS

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camera is mainly for low-end consumer applications.

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Frame Grabber

An A/D converter that spatially **samples** the camera image plane and **quantizes** the voltage of into a numerical intensity value.

- Sample frequency (sampling interval) v. image resolution through spatial sampling
- Range of intensity value through amplitude quantization
- On-board memory and processing capabilities

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Spatial sampling process

Let (x,y) and (c,r) be the image coordinates before and after sampling

$$\begin{pmatrix} c \\ r \end{pmatrix} = \begin{pmatrix} s_x & 0 \\ 0 & s_y \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} \quad (1)$$

where s_x and s_y are sampling frequency ($pixels/mm$) due to spatial quantization. They are also referred to as scale factors. The sampling frequency determines the image resolution. The higher sampling frequency, the higher image resolution. But the image resolution is limited by camera resolution. Oversampling by the frame grabber requires interpolation and does not necessarily improve image perception.

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Amplitude Quantization

In addition to spatial sampling, frame grabber also performs quantization of the magnitude of the signal F(x,y). The magnitude quantization is achieved by dividing the range of F(x,y) into intervals and representing each interval with an integer number. The number of intervals to represent F(x,y) is determined by the number of bits allocated to represent F(x,y). For example, if 8-bit is used, then F(x,y) can be divided into 256 intervals with the first interval represented by 0 and the last interval represented by 255. The quantized value of F(x,y) therefore ranges from 0 to 255.

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Computer

Computer (including CPU and monitor): used to access images stored in the frame grabber, process them, and display the results on a monitor

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Digital Image

The result of digitization of an analog image F(x,y) is a digital image I(c,r). $I(c,r)$ represented by a discrete 2D array of intensity samples, each of which is represented using a limited precision determined by the number of bits for each pixel.

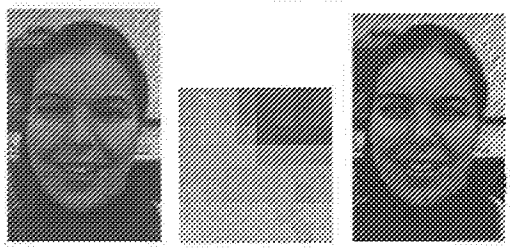
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Digital Image (cont'd)

- Image resolution
- Intensity range
- Color image

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Digital Representation



	0	1	2	3	4	5	6	7
0	136	136	136	136	136	136	136	136
1	136	136	136	136	136	136	136	136
2	136	136	136	136	136	136	136	136
3	136	136	136	136	136	136	136	136
4	136	136	136	136	136	136	136	136
5	136	136	136	136	136	136	136	136
6	136	136	136	136	136	136	136	136
7	136	136	136	136	136	136	136	136

Figure 1.1: Image of a face (top left), subimage from the right eye region (top center), eye location detected by a computer program (top right), and intensity values from the eye subimage (bottom).

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Different coordinate systems used for images

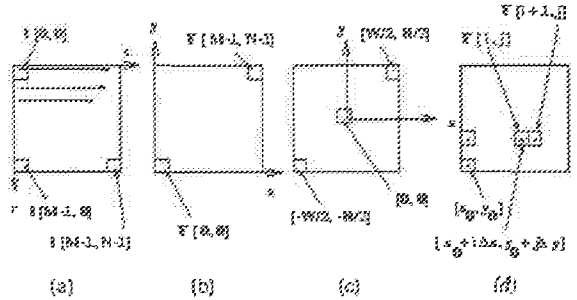
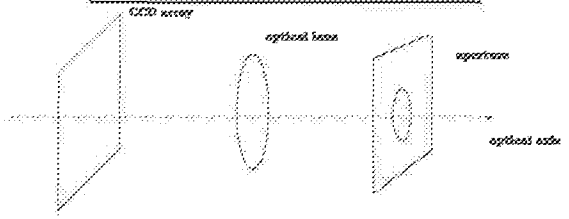


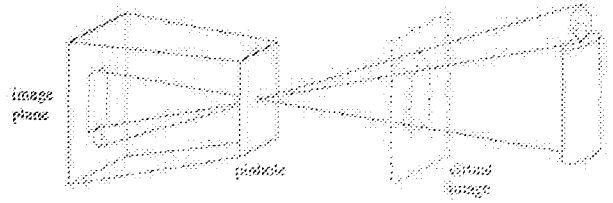
Figure 2.7: Different coordinate systems used for images: (a) raster oriented axes row and column coordinates starting at [0,0] from the top left; (b) Cartesian coordinate frame with [0,0] at the lower left; (c) Cartesian coordinate frame with [0,0] at the image center. (d) Relationship of pixel center point $[x, y]$ to area element sampled in array element $I[i, j]$.

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Basic Optics: Pinhole model



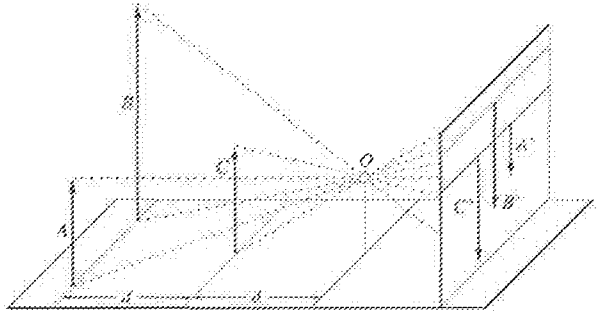
Reducing the camera's aperture to a point so that one ray from any given 3D point can enter the camera and create a one-to-one correspondence between visible 3D points and image points.



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Pinhole model (cont'd)

Distant objects are smaller due to perspective projection. Larger objects appear larger in the image.



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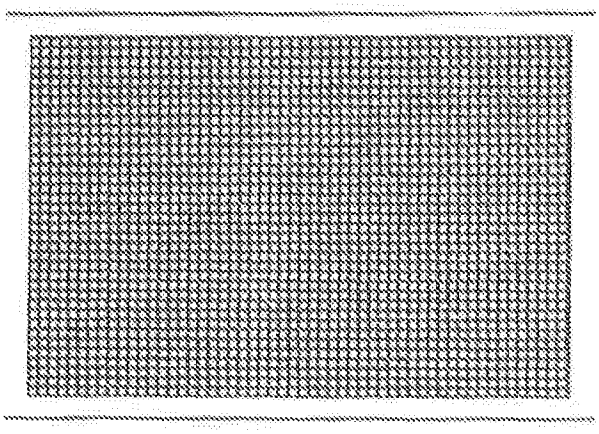
Basic Overview of Still Digital System
Douglas Ford Rea
Electronic Imaging Seminar - 1992. R•I•T

1. Light (photons) from a scene strikes the camera's CCD (charge coupled device) and a minute series of electrical signals are produced.

2. These electrical signals are transferred off (full frame transfer) the CCD to an analog-to-digital converter where the voltage level (for each pixel) is measured. [This process is known as 'quantization'. In other words, each pixel in the scene is described and then recorded in terms of its brightness.]

3. After the analog-to-digital process is completed, the information is saved as a RAW file to some storage device such as an IC (integrated circuit), or a hard disk (fixed magnetic media).

4. Each digital picture is defined by the number of pixels high (Y axis) by the number of pixels wide (X axis). See illustration below:



for example:

GRAYSCALE (luminance information only)

1000 pixels on the Y axis
1500 pixels on the X axis
1,500,000 pixels
1.5 mb of information (at 8 bits per pixel)

COLOR (RGB filtering over columns of pixels to define chrominance)

1.5 mb X 3 = 4.5 mb of information (3 X 8 = 24 bits per pixel)

Electronic Acknowledgement Receipt

EFS ID:	27881157
Application Number:	13354941
International Application Number:	
Confirmation Number:	9133
Title of Invention:	PHYSIOLOGICAL PARAMETER MONITORING WITH A MOBILE COMMUNICATION DEVICE
First Named Inventor/Applicant Name:	Ki H. Chon
Customer Number:	26486
Filer:	Marlo Schepper Grolnic
Filer Authorized By:	
Attorney Docket Number:	30210-201
Receipt Date:	22-DEC-2016
Filing Date:	20-JAN-2012
Time Stamp:	14:45:24
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		201ROADecl.pdf	2401957 db29a251fef0d2d3c333e3041175d30635155bff	yes	45

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Amendment/Req. Reconsideration-After Non-Final Reject	1	1
	Claims	2	16
	Applicant Arguments/Remarks Made in an Amendment	17	33
	Affidavit-traversing rejectns or objectns rule 132	34	45
Warnings:			
Information:			
	Total Files Size (in bytes):	2401957	

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 13/354,941	Filing Date 01/20/2012	☐ To be Mailed

ENTITY: ☐ LARGE ☒ SMALL ☐ MICRO

APPLICATION AS FILED – PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).			
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL	

APPLICATION AS AMENDED – PART II

AMENDMENT **12/22/2016**

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	* 46	Minus	** 46	= 0	X $40 =	0
Independent (37 CFR 1.16(h))	* 6	Minus	***6	= 0	X $210 =	0
☐ Application Size Fee (37 CFR 1.16(s))						
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
					TOTAL ADD'L FEE	0

AMENDMENT

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =	
☐ Application Size Fee (37 CFR 1.16(s))						
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
					TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

LIE
ANITA JOHNSON

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**
If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

NOTICE OF ALLOWANCE AND FEE(S) DUE

26486 7590 03/10/2017

BURNS & LEVINSON, LLP
125 SUMMER STREET
BOSTON, MA 02110

EXAMINER
LIU, CHU CHUAN

ART UNIT	PAPER NUMBER
3735	

DATE MAILED: 03/10/2017

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/354,941	01/20/2012	Ki H. Chon	30210-201	9133

TITLE OF INVENTION: PHYSIOLOGICAL PARAMETER MONITORING WITH A MOBILE COMMUNICATION DEVICE

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	$480	$0	$0	$480	06/12/2017

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

Petitioner Ex-1004, 0749

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail **Mail Stop ISSUE FEE**
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

26486 7590 03/10/2017
BURNS & LEVINSON, LLP
125 SUMMER STREET
BOSTON, MA 02110

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission
I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/354,941	01/20/2012	Ki H. Chon	30210-201	9133

TITLE OF INVENTION: PHYSIOLOGICAL PARAMETER MONITORING WITH A MOBILE COMMUNICATION DEVICE

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	$480	$0	$0	$480	06/12/2017

EXAMINER	ART UNIT	CLASS-SUBCLASS
LIU, CHU CHUAN	3735	600-323000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).
- ❑ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
- ❑ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.
1 _____
2 _____
3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ❑ Individual ❑ Corporation or other private group entity ❑ Government

4a. The following fee(s) are submitted:
- ❑ Issue Fee
- ❑ Publication Fee (No small entity discount permitted)
- ❑ Advance Order - # of Copies _____

4b. Payment of Fee(s): **(Please first reapply any previously paid issue fee shown above)**
- ❑ A check is enclosed.
- ❑ Payment by credit card. Form PTO-2038 is attached.
- ❑ The director is hereby authorized to charge the required fee(s), any deficiency, or credits any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)
- ❑ Applicant certifying micro entity status. See 37 CFR 1.29 — NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.
- ❑ Applicant asserting small entity status. See 37 CFR 1.27 — NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.
- ❑ Applicant changing to regular undiscounted fee status. — NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature _____ Date _____

Typed or printed name _____ Registration No. _____

Petitioner Ex-1004, 0750

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/354,941	01/20/2012	Ki H. Chon	30210-201	9133

26486 7590 03/10/2017

BURNS & LEVINSON, LLP
125 SUMMER STREET
BOSTON, MA 02110

EXAMINER	
LIU, CHU CHUAN	

ART UNIT	PAPER NUMBER
3735	

DATE MAILED: 03/10/2017

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(Applications filed on or after May 29, 2000)

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

Petitioner Ex-1004, 0751

OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Notice of Allowability	Application No. 13/354,941	Applicant(s) CHON ET AL.	
	Examiner CHU CHUAN (JJ) LIU	Art Unit 3735	AIA (First Inventor to File) Status No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *the response filed on 12/22/2016*.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on_____.
2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.
3. ☒ The allowed claim(s) is/are *1,3,6-24,27 and 30-53*. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.
4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   Certified copies:

   a) ☐ All b) ☐ Some *c) ☐ None of the:
      1. ☐ Certified copies of the priority documents have been received.
      2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
      3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
5. ☒ Examiner's Amendment/Comment
6. ☐ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

EXAMINER'S AMENDMENT

1. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in an interview with Orlando Lopez on 02/28/2017. Amendments were made to correct the dependency of the claims.

2. The application has been amended as follows:

Claim 35, line 1, "25" was replaced by -- 24 --.

Claim 36, line 1, "25" was replaced by -- 24 --.

Claim 37, line 1, "25" was replaced by -- 24 --.

Claim 38, line 1, "25" was replaced by -- 24 --.

Claim 50, line 1, "44" was replaced by -- 49 --.

3. The following is an examiner's statement of reasons for allowance: The arguments filed on 12/22/2016 are persuasive. The double patenting rejection and 35 USC 101, 103 and 112 rejections are withdrawn. The non-elected species, i.e. claims 10-17, 35-38 and 45-48, require all the limitations of allowable generic claims as provided by 37 CFR 1.141. Therefore, the claims are rejoined and allowed.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to CHU CHUAN (JJ) LIU whose telephone number is (571)270-5507. The examiner can normally be reached on M-TH 8:30am~5:00pm.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at http://www.uspto.gov/interviewpractice.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, JACQUELINE CHENG can be reached on (571)272-5596. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Eric Winakur/
Primary Examiner, Art Unit 3735

/CHU CHUAN (JJ) LIU/
Examiner, Art Unit 3735

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L8	10	7 and (motion movement artifact) and band adj pass	US-PGPUB; USPAT	OR	ON	2017/02/28 10:03
L7	45	2 and (ppg pleth plethysmograph$2 ecg imag$3)	US-PGPUB; USPAT	OR	ON	2017/02/28 10:03
L2	49	Shannon with entropy and a61B5/0002,0059,0205,02405,1455,14551,14552.cpc.	US-PGPUB; USPAT	OR	ON	2017/02/28 09:59
L1	24	(Chon near2 Ki Lee near2 Jinseok Selvaraj near2 Nandakumar).in. and "600".clas.	US-PGPUB; USPAT	OR	ON	2017/02/28 09:30
S151	24	(Chon near2 Ki Lee near2 Jinseok Selvaraj near2 Nandakumar).in. and "600".clas.	US-PGPUB; USPAT	OR	ON	2017/02/27 15:59
S150	1	("20130190638").PN.	US-PGPUB; USPAT	OR	OFF	2017/02/27 15:58
S149	0	("2011055989").PN.	US-PGPUB; USPAT	OR	OFF	2017/02/27 15:57
S148	9	kimball.in. and 600/310-344.ccls.	US-PGPUB; USPAT	OR	ON	2017/02/27 15:47
S147	37	S146 and "600".clas.	US-PGPUB; USPAT	OR	ON	2017/02/27 14:57
S146	67	S145 not S141	US-PGPUB; USPAT	OR	ON	2017/02/27 12:57
S145	113	Shannon$2 with entropy and (ECG PPG)	US-PGPUB; USPAT	OR	ON	2017/02/27 12:57
S144	1	("20060122476").PN.	US-PGPUB; USPAT	OR	OFF	2017/02/27 12:40
S143	1	("6,341,179").PN.	US-PGPUB; USPAT	OR	OFF	2017/02/27 12:15
S142	1	("20110124979").PN.	US-PGPUB; USPAT	OR	OFF	2017/02/27 12:00
S141	46	Shannon$2 with entropy and (ECG PPG) and motion	US-PGPUB; USPAT	OR	ON	2017/02/27 11:55

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L6	2	5 and detrend$3	US-PGPUB; USPAT	OR	ON	2017/02/28 10:02
L5	10	4 and (motion movement artifact) and band adj pass	US-PGPUB; USPAT	OR	ON	2017/02/28 10:01
L4	45	3 and (ppg pleth plethysmograph$2 ecg imag$3)	US-PGPUB; USPAT	OR	ON	2017/02/28 10:01
L3	49	Shannon with entropy and a61B5/0002,0059,0205,02405,1455,14551,14552.cpc.	US-PGPUB; USPAT	OR	ON	2017/02/28 10:00

2/ 28/ 2017 10:03:44 AM
C:\ Users\ cliu\ Documents\ EAST\ Workspaces\ 13354941.wsp

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13354941	CHON ET AL.
	Examiner	Art Unit
	CHU CHUAN (JJ) LIU	3777

CPC- SEARCHED

Symbol	Date	Examiner
A61B5/1455	02/24/2015	CCL
A61B5/0002,0004,145,1455,14551	08/11/2015	CCL
A61B5/0059,1455	11/18/2015	CCL
A61B5/0059,1455,14551,14552	04/20/2016	CCL
A61B5/0059,1455,14551,14552	9/13/2016	CCL
A61B5/0002,0059,0205,02405,1455,14551,14552	2/28/2017	CCL

CPC COMBINATION SETS - SEARCHED

Symbol	Date	Examiner

US CLASSIFICATION SEARCHED

Class	Subclass	Date	Examiner
600	300, 301, 309, 310, 322, 323, 324, 326, 330, 336, 473, 476, 500, 501, 502, 508, 509,518	10/24/2013	CCL
600	300, 301, 309, 310, 322, 323, 324, 326, 330, 336, 473, 476, 500, 501, 502, 508, 509,518	03/12/2014	CCL
600	300, 301, 309, 310, 322, 323, 324, 326, 330, 336, 473, 476, 500, 501, 502, 508, 509,518	09/16/2014	CCL
600	300, 301, 309, 310, 322, 323, 324, 326, 330, 336, 473, 476, 500, 501, 502, 508, 509,518	02/24/2015	CCL
600	300, 301, 309, 310, 322, 323, 324, 326, 330, 336, 473, 476, 500, 501, 502, 508, 509,518	8/11/2015	CCL
600	300, 301, 309, 310, 322, 323, 324, 326, 330, 336, 473, 476, 500, 501, 502, 508, 509,518	11/18/2015	CCL
600	300, 301, 309, 310, 322, 323, 324, 326, 330, 336, 473, 476, 500, 501, 502, 508, 509,518	04/20/2016	CCL
600	300, 301, 309, 310, 322, 323, 324, 326, 330, 336, 473, 476, 500, 501, 502, 508, 509,518	9/13/2016	CCL

SEARCH NOTES

/CHU CHUAN (JJ) LIU/ Examiner.Art Unit 3777	

Search Notes	Date	Examiner
Inventor Name Search (PALM and EAST)	10/23/2013	CCL
EAST Search (TEXT, USPGPUB, USPAT) See Search History	10/24/2013	CCL
Google NPL Search	10/24/2013	CCL
Updated EAST Search (TEXT, USPGPUB, USPAT) See Search History	03/12/2014	CCL
Google NPL Search	03/12/2014	CCL
Updated EAST Search (TEXT, USPGPUB, USPAT) See Search History	09/16/2014	CCL
Updated EAST Search (TEXT, USPGPUB, USPAT, CPC) See Search History	02/24/2015	CCL
Google NPL Search	02/24/2015	CCL
Updated EAST Search (TEXT, USPGPUB, USPAT, CPC) See Search History	8/11/2015	CCL
NPL Search	8/11/2015	CCL
Updated EAST Search (TEXT, USPGPUB, USPAT, CPC) See Search History	11/18/2015	CCL
Google NPL Search	11/18/2015	CCL
Updated EAST Search (TEXT, USPGPUB, USPAT, CPC) See Search History	04/20/2016	CCL
Google NPL Search	04/20/2016	CCL
Updated EAST Search (TEXT, USPGPUB, USPAT, CPC) See Search History	9/13/2016	CCL
Google NPL Search	9/13/2016	CCL
Updated EAST Search (TEXT, USPGPUB, USPAT, CPC) See Search History	2/28/2017	CCL
Google NPL Search	2/28/2017	CCL
Allowance consultation with Eric Winakur	2/28/2017	CCL

INTERFERENCE SEARCH			
US Class/ CPC Symbol	**US Subclass / CPC Group**	**Date**	**Examiner**
A61B5	0002,0059,0205,02405,1455,14551,14552	2/28/2017	CCL

/CHU CHUAN (JJ) LIU/ Examiner.Art Unit 3777	

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BIB DATA SHEET

CONFIRMATION NO. 9133

SERIAL NUMBER	FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
13/354,941	01/20/2012 RULE	600	3735	30210-201

APPLICANTS

INVENTORS

Ki H. Chon, Worcester, MA;
Jinseok Lee, Worcester, MA;
Nandakumar Selvaraj, Worcester, MA;

**** CONTINUING DATA ***************************

This appln claims benefit of 61/434,862 01/21/2011
and claims benefit of 61/512,199 07/27/2011
and claims benefit of 61/434,856 01/21/2011
and claims benefit of 61/566,329 12/02/2011

**** FOREIGN APPLICATIONS ***************************

**** IF REQUIRED, FOREIGN FILING LICENSE GRANTED **** ** SMALL ENTITY **
02/09/2012

Foreign Priority claimed	35 USC 119(a-d) conditions met	Verified and Acknowledged	Met after Allowance	STATE OR COUNTRY	SHEETS DRAWINGS	TOTAL CLAIMS	INDEPENDENT CLAIMS
☐ Yes ☑ No	☐ Yes ☑ No	/CHU CHUAN LIU/ Examiner's Signature	☐ Initials	MA	10	53	3

ADDRESS

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125 SUMMER STREET
BOSTON, MA 02110
UNITED STATES

TITLE

PHYSIOLOGICAL PARAMETER MONITORING WITH A MOBILE COMMUNICATION DEVICE

FILING FEE RECEIVED	FEES: Authority has been given in Paper	☐ All Fees
2215	No._____ to charge/credit DEPOSIT ACCOUNT	☐ 1.16 Fees (Filing)
	No._____ for following:	☐ 1.17 Fees (Processing Ext. of time)
		☐ 1.18 Fees (Issue)
		☐ Other _____
		☐ Credit

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13354941	CHON ET AL.
	Examiner	**Art Unit**
	CHU CHUAN (JJ) LIU	3735

CPC							
Symbol						**Type**	**Version**
A61B		5	/	02405		F	2013-01-01
A61B		5	/	02416		I	2013-01-01
A61B		5	/	0452		I	2013-01-01
A61B		5	/	0816		I	2013-01-01
A61B		5	/	14551		I	2013-01-01
A61B		5	/	7207		I	2013-01-01
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			/				
			/				
			/				
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			/				
			/				
			/				

CPC Combination Sets							
Symbol					**Type**	**Set**	**Ranking**	**Version**
			/					
			/					

/CHU CHUAN (JJ) LIU/ Examiner.Art Unit 3735	02/28/2017	**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	46	
/ERIC WINAKUR/ Primary Examiner.Art Unit 3735	03/06/2017	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	1

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13354941	CHON ET AL.
	Examiner	**Art Unit**
	CHU CHUAN (JJ) LIU	3735

US ORIGINAL CLASSIFICATION		INTERNATIONAL CLASSIFICATION										
CLASS	SUBCLASS	CLAIMED					NON-CLAIMED					
		A	6	1	B	5 / 00 (2006.01.01)						
CROSS REFERENCE(S)												
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)											

/CHU CHUAN (JJ) LIU/ Examiner.Art Unit 3735	02/28/2017	**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	46	
/ERIC WINAKUR/ Primary Examiner.Art Unit 3735	03/06/2017	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	1