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. |
|---|---|---|---|---|
| 15/895,353 | 02/13/2018 | Rohan BANERJEE | 13178.0283 | 1016 |

133992 7590 03/22/2021

Tata Consultancy Services/Finnegan
901 New York Ave., NW
Washington, DC 20001

| EXAMINER | |
|---|---|
| AGAHI, PUYA | |

| ART UNIT | PAPER NUMBER |
|---|---|
| 3791 | |

| NOTIFICATION DATE | DELIVERY MODE |
|---|---|
| 03/22/2021 | 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):

Regional-Desk@finnegan.com
TCS_USPTO@finnegan.com
cig.patents@tcs.com

| Office Action Summary | Application No. 15/895,353 | Applicant(s) BANERJEE et al. | |
|---|---|---|---|
| | Examiner PUYA AGAHI | Art Unit 3791 | AIA (FITF) Status Yes |

*-- 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 12/22/2020.

☐ 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) 1-3,5-8 and 12-17 is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6) ☐ Claim(s) _____ is/are allowed.

7) ☑ Claim(s) 1-3,5-8 and 12-17 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

**Note**: *The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.*

1. Applicant's arguments filed in the reply on December 22, 2020 were received and fully considered. Claims 1 and 14-17 were amended. Please see corresponding rejection headings and response to arguments section below for more detail.

### *Continued Examination Under 37 CFR 1.114*

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 December 22, 2020 has been entered.

### *Claim Rejections - 35 USC § 101*

3. 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.

4. Claims 1-3, 5-8, and 12-17 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter. The claim(s) as a whole, considering all claim elements both individually and in combination, do not amount to significantly more than an abstract idea. A streamlined analysis of claim 1 follows.

Regarding claim 1, the claim recites a non-invasive method for detection of coronary artery disease (CAD) in a person. Thus, the claim is directed to a process, which is one of the statutory categories of invention.

The claim is then analyzed to determine whether it is directed to any judicial exception. The following limitations set forth a judicial exception:

"A non-invasive method for detection of coronary artery disease (CAD) in a person, the method comprising a processor implemented steps of...

processing the plurality of physiological signals to remove a plurality of noises using a signal processing module;

extracting features from each processed physiological signal of the plurality of physiological signals using a feature extraction module, wherein the features comprises at least one of time domain features, frequency domain features, time-frequency domain features and statistical features, wherein the features are a set of combination of features corresponding heart beat morphology and heart rate variability (HRV), wherein the features corresponding to the heart beat morphology are extracted using a wide band PCG signal, and wherein the features corresponding to the HRV are extracted using a narrow band PPG signal and the ECG signal;

classifying the person for each of the features independently using a plurality of physiological signal classifiers as CAD or normal, wherein the classification is done using a supervised machine learning technique;

fusing an output of each of the physiological signal classifiers by a hyper-plane based fusion approach;

detecting a presence of coronary artery disease in the person using the fused output of the physiological signal classifiers based on a predefined criteria; and

performing a validation analysis and a performance analysis on at least one feature for at least one of sensitivity and specificity."

These limitations describe a mathematical calculation. Furthermore, the limitations also amount to a mental process as the skilled artisan is capable of analyzing plurality of physiological signals and making a mental assessment thereafter.

Next, the claim as a whole is analyzed to determine whether any element, or combination of elements, integrates the identified judicial exception into a practical application.

For this part of the 101 analysis, the following additional limitations are considered:

"...capturing a plurality of physiological signals from the person using a plurality of physiological sensors, wherein the plurality of physiological signals includes at least one of phonocardiogram (PCG) signal, photoplethysmogram (PPG) signal, and electrocardiogram (ECG) signal."

These additional limitations do not integrate the judicial exception into a practical application. Rather, the additional limitations are each recited at a high level of generality such that it amounts to insignificant pre-solution, e.g., mere data gathering steps necessary to perform the mathematical calculation and/or mental process. Furthermore, it is well established that the mere physical or tangible nature of additional elements such as the obtaining and measuring steps do not automatically confer eligibility on a claim directed to an abstract idea (see, e.g., *Alice Corp. v. CLS Bank Int'l, 134 S.Ct. 2347, 2358-59 (2014)*).

**Independent claims 16 and 17 recited mirrored limitations in apparatus and non-transitory form and are also not patent eligible for substantially similar reasons.**

Dependent claims 2, 3, 5-8, and 12-15 also fail to add something more to the abstract independent claims as they merely further limit the abstract idea.

**Therefore, claims 1-3, 5-8, and 12-17 are not patent eligible under 35 USC 101.**

## *Response to Arguments*

5. Applicant's arguments filed with respect to the 35 USC 112A rejections raised in the previous office action were persuasive. These rejections are withdrawn.

Applicant's arguments filed with respect to the 35 USC 101 rejections raised in the previous office action have been fully considered, but they are not persuasive. Examiner maintains that the claimed invention recites a judicial exception that is not integrated into a practical application. Applicant argues that the claimed invention, when considered as a whole, amounts to an improvement to the relevant technology. Examiner respectfully disagrees and maintains that the purported improvement appears to lie within the judicial exception itself, i.e. increased accuracy in detecting presence of coronary artery disease. Again, this does not equate to integration into a practical application as the Court has held "the judicial exception alone cannot provide the improvement." See the discussion of *Diamond v. Diehr*, 450 U.S. 175, 187 and 191-92, 209 USPQ 1, 10 (1981). Therefore, the 35 USC 101 rejection is maintained. Please see corresponding rejection heading above for more detailed analysis.

## *Conclusion*

6. No claim is allowed.

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to PUYA AGAHI whose telephone number is (571)270-1906. The examiner can normally be reached on M-F 8 AM - 5 PM.

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, Jason M Sims can be reached on 5712727540. 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 https://ppair-my.uspto.gov/pair/PrivatePair. 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.

/PUYA AGAHI/
Primary Examiner, Art Unit 3791

## REMARKS

### Claim Status, Amendments and Support

Applicant respectfully requests reconsideration and allowance of all the claims of the application. The status of the claims is as follows:

- Claims **1-3, 5-8 and 12-17** were pending at the time of the Office Action.
- Applicant amends claims **1, 16 and 17**.
- Applicant presents claims **1-3, 5-8 and 12-17** for further examination.

Support for the amendments may be found at least in paragraphs [0036] – [0038], [0042] - [0044] of the as-filed specification and in the originally filed claims. Hence, the amendments submitted herein do not introduce new matter to the claims.

### Claim Rejections - 35 USC § 101

Claims 1 -3, 5-8, and 12-17 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter. The claim(s) as a whole, considering all claim elements both individually and in combination, do not amount to significantly more than an abstract idea.

More particularly the Office Action contends that: limitations describe a mathematical calculation. Furthermore, the limitations also amount to a mental process as the skilled artisan is capable of analyzing plurality of physiological signals and making a mental assessment thereafter. Next, the claim as a whole is analyzed to determine whether any element, or combination of elements, integrates the identified judicial exception into a practical application.

Applicant respectfully disagrees with the Examiner's contentions.

In response, Applicant has amended claim 1 to clarify the significantly more features of the presently claimed subject matter.

Amended claim 1 recites *inter alia*:

> "...capturing a plurality of physiological signals from the person using a plurality of physiological sensors, wherein the plurality of physiological signals includes at least one of phonocardiogram (PCG) signal, photoplethysmogram (PPG) signal, and electrocardiogram (ECG) signal;
>
> **processing the plurality of physiological signals to remove a plurality of noises** using a signal processing module;

**extracting features from each processed physiological signal** of the plurality of physiological signals using a feature extraction module, wherein the features comprises at least one of time domain features, frequency domain features, time-frequency domain features and statistical features, wherein the features corresponding to heart beat morphology are extracted using a **wide band PCG signal**, and wherein the features corresponding to heart rate variability (HRV) are extracted using **a narrow band PPG signal and the ECG signal**;

**forming composite feature sets from a combination of extracted features corresponding to the heart beat morphology and the HRV**;

**classifying the person for each of the composite feature sets independently using a plurality of physiological signal classifiers**, as CAD or normal, wherein the classification is done using a supervised machine learning technique;

**fusing an output of each of the physiological signal classifiers by a hyper-plane based fusion approach, to produce a fused output**; and

**detecting a presence of coronary artery disease in the person by choosing a particular physiological signal classifier** to detect CAD, and wherein the particular physiological signal classifier is chosen **based on the fused output**."

{**Emphasis Added**}

- Firstly, Applicant asserts that the amended claim includes several limitations that are based upon mathematical relationships, formulas, or calculations. **However, these mathematical relationships, formulas, or calculations are not explicitly recited in the claim. Therefore, the claim does not recite a mathematical concept**. Moreover, the claims do not recite a mental process because the steps, as claimed, are **not practically performed in the human mind**.
- Additionally, **the amended claim recites the combination of additional elements of**: (1) extracting features corresponding to heart beat morphology using a **wide band PCG signal**, and features corresponding to heart rate variability (HRV) are extracted using a **narrow band PPG signal and the ECG signal** (2) **forming composite feature sets** from a combination of extracted features corresponding to the heart beat morphology and the HRV, (3) classifying the person for each of the composite feature sets independently using a plurality of physiological signal classifier (4) **fusing an output of each of the physiological signal classifiers by a hyper-plane based fusion approach** and (5) detecting a presence CAD in the person by **choosing a particular physiological signal classifier based on the fused output**;.... **which although analyzed individually may be viewed as mere pre-or post-solution activity, the claim as a whole is directed to solve a technical problem related to accurate segregation of diastolic heart sound from a single physiological signal, which is extremely vulnerable to ambient noise (or uncontrolled environment), to enable detecting a presence of CAD in the subject with a higher sensitivity and specificity**.

- The additional elements **recite a specific manner of forming composite feature sets to generate outputs for various classifiers**, **fusing output of classifiers for choose a particular signal classifier**, **which avoids effects of ambient noise (or uncontrolled environment) in the physiological signal**. Thereby enabling higher test sensitivity (i.e, ability of a test to correctly identify those with the disease = true positive rate), and specificity (i.e., ability of the test to correctly identify those without the disease = true negative rate).

In this regard, Applicant highlights that, in the present application, the signal processing module 108 is configured to remove a plurality of noises from the captured PCG signal and the PPG signal. The captured PCG signal is extremely vulnerable to ambient noise in audible range. Even in a constrained quiet environment, the frictional noise generated at the contact region of human body and stethoscope corrupts the signal heavily. Segregation of fundamental heart sounds from a noisy PCG is a tricky task. A logistic regression based HSMM is applied for segregating heart sounds on one very clean signal and one partially noisy signal from the input data. Thus, instead of segregating the fundamental heart sounds, **a window-based approach was used**. In view of this amended claim recites forming **composite feature sets from a combination of extracted features corresponding to the heart beat morphology and the HRV. The features corresponding to the heart beat morphology and heart valve functioning are extracted using wide band PCG signal. While the features corresponding to the detailed heart rate variability are extracted using narrow band PPG signal and ECG signal**. The list of various features is provided in table I and table II of paragraph [0030] – [032] of the present application. Subsequently, the classification module 112 is configured to classify the person from each of the features independently using physiological signal classifiers. In the present example the physiological signal classifiers comprise a PPG classifier and a PCG classifier.

More importantly, the amended claim discloses **fusing an output of each of the physiological signal classifiers by a hyper-plane based fusion approach**. in the present application, the fusion module 114 is configured to **fuse the output of the PPG classifier and the PCG classifier**. The SVM separates two classes in a multidimensional feature space by fitting an optimal separating hyper-plane to the training samples. The objective function of SVM aims to maximize the margin between the hyper-plane and the closest training samples (support vectors). For a given sample, higher the distance to the hyper-plane, the more reliable the output class label is. **This fundamental concept of SVM is used in the present disclosure for fusing the outcomes of two independent classifiers**. The detection module 116 configured to detect the person if he is a CAD or non-CAD person. For the person if there is a classification mismatch between PCG and PPG based classifiers, **the classifier producing higher absolute distance**

**of the test data-point form its separating hyper-plane is considered as the reliable source for the final decision making**.

**For the person if there is a classification mismatch between PCG and PPG based classifiers, the classifier producing higher absolute distance of the test data-point form its separating hyper-plane is considered as the reliable source for the final decision making**.

In Prior art models, as shown in Fig 4, the diastolic portion of PCG using an autoregressive (AR) model for identifying CAD, whereas prior art is a PPG based approach that considers relative crest time as the discriminative feature. It can be observed that our proposed PCG and PPG features outperform prior art. However, the sensitivity scores obtained by either of them is largely unsatisfactory (0:6). A simple feature level fusion was also performed, where all 16 features (5 PCG features+11 PPG features) are combined to form a composite feature set for classification. It is observed that in spite of an improvement in sensitivity (0:8), the specificity (0:7) falls, resulting in a similar overall accuracy score to the earlier methodologies. Subsequently, a simple majority voting based fusion was applied at decision level as a benchmark approach. Here a subject is declared as CAD, if either of the classifiers marks him/her as CAD. Although a very high sensitivity (0:9) is achieved in this approach, the specificity drops significantly (0:67), resulting in a minimum improvement in overall accuracy (0:79).

However, **a significant improvement in both sensitivity (0:8) and specificity (0:93) can be simultaneously achieved by incorporating the proposed hyper-plane based fusion approach, resulting in the maximum accuracy (Acc=0:87) among all**. As shown in FIG. 5A, out of 10 CAD subjects, there is a mismatch between PPG and PCG classifiers in 6 cases. **In 5 out of 6 such cases (except Subject 10), the proposed fusion technique yields the correct decision**. However, in non CAD subjects, 5 out of 15 cases (Subject 3, 6, 9, 12 and 13 of FIG. 5B) had this mismatch of decisions and **the proposed fusion technique was able to correctly resolve 4 out of those 5 conflicts**. A closer inspection further revealed that one of the two borderline CAD patients having 30% blockage (Subject 5 of FIG. 5A) was missed by both PPG and PCG classifiers. A possible reason is that PPG and PCG features of those subjects are similar to a normal person rather than a severe CAD patient, hence they are very difficult to identify even by the doctors. The only false detected non-CAD subject (Subject 6 of FIG. 5B) was a patient being treated for asthma related issues {See paragraphs [0038] to [0044] of the present application}.

Therefore, based on the above clarification, Applicant strongly believes that the **claim as a whole integrates the identified judicial exception (i.e., detecting a presence of coronary artery disease**

**in the person) into a practical application (i.e., accurate segregation of diastolic heart sound from a single physiological signal, vulnerable to ambient noise).** Thus, the claim is eligible because it is not directed to the recited judicial exception (abstract idea) under Step 2A – Prong 2 of the revised guidance for assessing the Patent Subject Matter Eligibility.

In view of the above, Applicant respectfully requests that the 35 U.S.C. §101 rejection of claim 1 be withdrawn. Independent claims 16 and 17 recite similar limitations as allowable claim 1. Hence withdrawal of the rejections of claim 16 and 17 is respectfully submitted. In light of the above assertions, Applicant submits that dependent claims that depend from independent claim 1 are also allowable for at least the same reasons. Accordingly, Applicant respectfully requests withdrawal of the 35 U.S.C. §101 rejection of the claims.

## RESERVATION OF RIGHTS

In the interest of clarity and brevity, every assertion made in the Office Action may not have been addressed. Silence regarding any such assertion does not constitute any admission or acquiescence. All rights not exercised in connection with this response, such as the right to challenge or rebut any tacit or explicit characterization of any reference or of any of the present claims, the right to challenge or rebut any asserted factual or legal basis of any of the rejections, the right to swear behind any cited reference such as provided under 37 C.F.R. § 1.131 or otherwise, or the right to assert co-ownership of any cited reference, are reserved. It is not admitted that any of the cited references or any other references of record are relevant to the present claims, or that they constitute prior art. To the extent that any rejection or assertion is based upon the Patent Office's personal knowledge, rather than any objective evidence of record as manifested by a cited prior art reference, timely objection to such reliance on Official Notice is made, and all rights to request that the Patent Office provide a reference or affidavit in support of such assertion, as required by MPEP § 2144.03, are reserved. All rights to pursue any cancelled claims in a subsequent patent application claiming the benefit of priority of the present patent application, and to request rejoinder of any withdrawn claim, as required by MPEP § 821.04, are likewise reserved.

## CONCLUSION

For at least the foregoing reasons, all of the pending claims are in condition for allowance. Applicant respectfully requests reconsideration and the prompt issuance of the application. Should the Examiner find the application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the telephone number listed below to discuss any other changes deemed necessary.

The Commissioner is hereby authorized to charge any additional fees which may be required by this paper, or to credit any overpayment to Deposit Account 06-0916. Prompt and favorable examination are requested.

Respectfully submitted,

FINNEGAN, HENDERSON, FARABOW,
GARRETT & DUNNER, L.L.P.

Dated: May 25, 2021

By: /Henry J. Shikani/
Henry J. Shikani
Registration No. 74,972
(202) 408-4330

## IN THE CLAIMS

The following listing of claims will replace all prior versions and listings of claims in the application. No new matter is introduced as a result of the following claim amendments.

**Listing of Claims:**

1. (**Currently Amended**) A non-invasive method for detection of coronary artery disease (CAD) in a person, the method comprising a processor implemented steps of:

capturing a plurality of physiological signals from the person using a plurality of physiological sensors, wherein the plurality of physiological signals includes at least one of phonocardiogram (PCG) signal, photoplethysmogram (PPG) signal, and electrocardiogram (ECG) signal;

processing the plurality of physiological signals to remove a plurality of noises using a signal processing module;

extracting features from each processed physiological signal of the plurality of physiological signals using a feature extraction module, wherein the features comprises at least one of time domain features, frequency domain features, time-frequency domain features and statistical features, ~~wherein the features are a set of combination of features corresponding heart beat morphology and heart rate variability (HRV),~~ wherein the features corresponding to ~~the~~ heart beat morphology are extracted using a wide band PCG signal, and wherein the features corresponding to ~~the HRV~~ heart rate variability (HRV) are extracted using a narrow band PPG signal and the ECG signal;

forming composite feature sets from a combination of extracted features corresponding to the heart beat morphology and the HRV;

classifying the person for each of the composite feature sets ~~features~~ independently using a plurality of physiological signal classifiers, as CAD or normal, wherein the classification is done using a supervised machine learning technique;

fusing an output of each of the physiological signal classifiers by a hyper-plane based fusion approach, to produce a fused output; and

detecting a presence of coronary artery disease in the person ~~using the fused output of the physiological signal classifiers based on a predefined criteria~~ by choosing a particular physiological signal classifier to detect CAD, and wherein the particular physiological signal classifier is chosen based on the fused output; ~~and~~

~~performing a validation analysis and a performance analysis on at least one feature for at least one of sensitivity and specificity~~.

2. (**Previously Presented**) The method of claim 1, wherein the predefined criteria comprises choosing classifier if there is a classification mismatch between the output of each of the physiological signal classifiers.
3. (**Previously Presented**) The method of claim 2, wherein the classifier is chosen based on an outcome of the classifier which has a highest accuracy out of the each of the physiological signal classifiers.
4. (**Cancelled**)
5. (**Original**) The method of claim 1, wherein the physiological signal classifiers include a PCG classifier, a PPG classifier and an ECG classifier.
6. (**Previously Presented**) The method of claim 4, wherein the PPG signal is extracted from the person's peripheral body parts.
7. (**Original**) The method as claimed in claim 6, wherein the person's peripheral body parts are at least one of fingertip, ear, toe or forehead.
8. (**Previously Presented**) The method of claim 4, wherein the ECG signal is captured from a portable single lead ECG machine and PCG is captured using a digital stethoscope.
9. (**Cancelled**)
10. (**Cancelled**)
11. (**Cancelled**)
12. (**Previously Presented**) The method as claimed in claim 1, wherein the classification of CAD patients and non-CAD patients is performed by using machine learning methods.
13. (**Original**) The method of claim 1, wherein the method is a sensor agnostic.
14. (**Previously Presented**) The method of claim 1, further comprising using a low pass filter for filtering the PCG signal with frequency above 500 Hz.
15. (**Previously Presented**) The method of claim 1, further comprising using a band pass filter for filtering the PPG signal with frequency between 0.5 Hz and 10 Hz.
16. (**Currently Amended**) A non-invasive system for detection of coronary artery disease (CAD) in a person, the system comprises:

    a plurality of physiological sensors for capturing a plurality of physiological signals from the person, wherein the plurality of physiological signals includes at least one of phonocardiogram (PCG) signal, photoplethysmogram (PPG) signal, and electrocardiogram (ECG) signal;

a memory; and

a processor in communication with the memory, the processor further comprises:

a signal processing module processing the plurality of physiological signals to remove a plurality of noises;

a feature extraction module for:

extracting features from each processed physiological signal of the plurality of physiological signals, wherein the features comprises at least one of time domain features, frequency domain features, time-frequency domain features and statistical features, ~~wherein the features are a set of combination of features corresponding heart beat morphology and heart rate variability (HRV),~~ wherein the features corresponding to ~~the~~ heart beat morphology are extracted using a wide band PCG signal, and wherein the features corresponding to ~~the HRV~~ heart rate variability (HRV) are extracted using a narrow band PPG signal and the ECG signal; and

forming composite feature sets from a combination of extracted features corresponding to the heart beat morphology and the HRV;

a classification module for classifying the person for each of the composite feature sets ~~feature~~s independently, as CAD or normal, using a plurality of physiological signal classifiers, wherein the classification is done using a supervised machine learning technique;

a fusion module for fusing an output of each of the physiological signal classifiers by a hyper-plane based fusion approach, to produce a fused output; and

a detection module for detecting a presence of the coronary artery disease in the person using ~~the physiological signal classifiers based on a predefined criteria, and performing a validation analysis and a performance analysis on at least one feature for at least one of sensitivity and specificity~~ by choosing a particular physiological signal classifier to detect CAD, and wherein the particular physiological signal classifier is chosen based on the fused output.

17. (**Currently Amended**) One or more non-transitory machine readable information storage mediums comprising one or more instructions which when executed by one or more hardware processors perform actions comprising:

capturing a plurality of physiological signals from the person using a plurality of physiological sensors, wherein the plurality of physiological signals includes at least one of phonocardiogram (PCG) signal, photoplethysmogram (PPG) signal, and electrocardiogram (ECG) signal;

processing the plurality of physiological signals to remove a plurality of noises using a signal processing module;

extracting features from each processed physiological signal of the plurality of physiological signals using a feature extraction module, wherein the features comprises at least one of time domain features, frequency domain features, time-frequency domain features and statistical features, ~~wherein the features are a set of combination of features corresponding heart beat morphology and heart rate variability (HRV),~~ wherein the features corresponding to ~~the~~ heart beat morphology are extracted using a wide band PCG signal, and wherein the features corresponding to ~~the HRV~~ heart rate variability (HRV) are extracted using a narrow band PPG signal and the ECG signal;

forming composite feature sets from a combination of extracted features corresponding to the heart beat morphology and the HRV;

classifying the person for each of the composite feature sets ~~features~~ independently using a plurality of physiological signal classifiers, as CAD or normal, wherein the classification is done using a supervised machine learning technique;

fusing an output of each of the physiological signal classifiers by a hyper-plane based fusion approach, to produce a fused output; and

detecting a presence of coronary artery disease in the person ~~using the fused output of the physiological signal classifiers based on a predefined criteria~~ by choosing a particular physiological signal classifier to detect CAD, and wherein the particular physiological signal classifier is chosen based on the fused output; ~~and~~

~~performing a validation analysis and a performance analysis on at least one feature for at least one of sensitivity and specificity~~.