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Table with 5 columns: APPLICATION NO., FILING DATE, FIRST NAMED INVENTOR, ATTORNEY DOCKET NO., CONFIRMATION NO. Includes details for application 16/289,614 filed 02/28/2019 by Albert James Thomas BUCHARD, attorney MCDERMOTT, WILL & EMERY LLP, examiner BARR, MARY EVANGELINE, art unit 3626, and notification date 10/20/2020.

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):

mweipdocket@mwe.com

# Office Action Summary

Application No.

16/289,614

Applicant(s)

BUCHARD et al.

Examiner

Evangeline Barr

Art Unit

3626

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 09/22/2020.

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) 1-5 and 7-11 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) 1-5 and 7-11 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](http://www.uspto.gov/patents/init_events/pph/index.jsp) or send an inquiry to [PPHfeedback@uspto.gov](mailto: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)

3)  Interview Summary (PTO-413)

Paper No(s)/Mail Date \_\_\_\_\_

2)  Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b)

4)  Other: \_\_\_\_\_

Paper No(s)/Mail Date \_\_\_\_\_

***Notice of Pre-AIA or AIA Status***

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

**DETAILED ACTION**

***Status of the Application***

2. **Claims 1-5 and 7-11** are currently pending in this case and have been examined and addressed below. This communication is a Final Rejection in response to the Amendment to the Claims and Remarks filed on 09/22/2020.

- **Claims 1 and 10** are currently amended.
- **Claim 6** is cancelled and not considered at this time.
- **Claims 2-5, 7-9 and 11** are as previously presented.

***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 1-5 and 7-11** are rejected under 35 U.S.C. 101 because the claimed invention is directed to an abstract idea without significantly more. The claims recite generating questions for a user to obtain information for providing a medical diagnosis.

Independent claim 1 falls within the statutory category of a process. Independent claim 10 falls within the statutory category of a system or apparatus. Independent claim 11 falls within the statutory category of an article of manufacture as the claim recites a non-transitory carrier medium carrying computer readable instructions. Claims 1, 10 and 11 are directed to

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certain methods of organizing human activity including managing personal behavior or relationships or interactions between people.

As per Claims 1, 10 and 11, the limitation of receiving input from a user comprising at least one symptom, as drafted, under its broadest reasonable interpretation, covers managing personal behaviors or interactions between people but for the recitation of generic computer components. That is, other than reciting “the processor being adapted to” and “non-transitory carrier medium carrying computer readable instructions being adapted to”, nothing in the claim elements precludes the step from being a function which is an interaction between people. For example, receiving an input from a user in the context of this claim encompasses a user interacting with a person or machine to give the input. Similarly, the limitation of providing the at least one symptom as an input to a medical model, as drafted, under its broadest reasonable interpretation, covers a method of organizing human activity including the user interacting with a person or machine to provide the symptom to a model which includes rules or instructions that are followed such as probability distributions, relationships between symptoms and diseases, and an inference engine performing Bayesian inference. These rules and instructions are followed using the input provided from the user. Generating a question for the user to obtain further information and outputting the question to the user is also a method of organizing human activity which includes managing personal behavior and interactions where the generation and outputting of a question is the interaction with the user. The generating of a question is executed through following rules or instructions such as ranking the questions by measuring the expected information gain from a question and penalizing that amount by the cost incurred by moving the question, also normalizing the weight for the expected information

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gain. The retrieving of the nodes including diseases, risk factors, and symptoms for calculating the cost of moving a question and outputting the question to a user is also a certain method of organizing human activity because retrieving information and outputting the resulting question to a person includes interactions between people and/or between a person and a computer. If a claim limitation, under its broadest reasonable interpretation, covers managing personal behavior or relationships or interactions between people including teaching and following rules or instructions, but for the recitation of generic computer components, then it falls within the “Certain Methods of Organizing Human Behavior” grouping of abstract ideas. Accordingly, the claim recites an abstract idea.

This judicial exception is not integrated into a practical application because the additional elements and combination of additional elements do not impose meaningful limits on the judicial exception. In particular, the claims recite the additional elements – a processor and memory as well as a non-transitory carrier medium carrying computer readable instructions to perform the steps of the claims. The processor and memory in these steps are recited at a high-level of generality (i.e., as a generic computing system comprising a processor which is coupled to a mass storage unit (specification [0085])), and the non-transitory carrier medium is also recited at a high level of generality (i.e., computer program storage medium such as an optical disk, specification [0088]), such that they amount to no more than mere instructions to apply the exception using a generic computer component. The claims also include a user device receiving an input from a user and the user device outputting said question as well as storing the nodes including diseases, risk factors, and symptoms in a memory. The receiving of information by a user device, storing of data in a memory, and the

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outputting of information to a user device amounts to mere instructions to apply the exception.

As per MPEP 2106.05(f)(2), use of a computer or other machinery in its ordinary capacity for tasks such as receiving, storing, or transmitting data amounts to mere instructions to apply the exception. The outputting of the question to a user is a limitation that amounts to necessary data gathering and outputting, as in MPEP 2106.05(g), in which the result of the analysis which is the determined question is output to the user amounting to insignificant extra-solution activity. The claims also include applying the input to a medical model, where the medical model comprises a probabilistic graphical model which is a mathematical algorithm of a probability distribution and relationships between symptoms and diseases as well as an inference engine performing Bayesian inference. The mathematical algorithm of the claims is recited at a high level of generality (probability distribution, Bayesian inference) such that it amounts to no more than mere instructions to apply an exception. As per MPEP 2106.05(f), the courts have found additional elements which do no more than merely invoke computers or machinery as a tool to perform an existing problem such as a commonplace business method or mathematical algorithm to be mere instructions to apply an exception (*Alice Corp. Pty. Ltd. V. CLS Bank Int'l*, 134 S. Ct. 2347, 1357, 110 USPQ2d 1976, 1983 (2014); *Gottschalk v. Benson*, 409 U.S. 63, 64, 175 USPQ 673, 674 (1972); *Versata Dev. Group, Inc. v. SAP Am., Inc.*, 793 F.3d 1306, 1334, 115 USPQ2d 1681, 1701 (Fed. Cir. 2015)). Accordingly, this additional element does not integrate the abstract idea into a practical application because it does not impose any meaningful limits on practicing the abstract idea. The claim is directed to an abstract idea.

The claims do not include additional elements that are sufficient to amount to significantly more than the judicial exception. As discussed above with respect to integration of

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the abstract idea into a practical application, the additional elements of a processor and memory as well as a non-transitory carrier medium carrying computer readable instructions to perform the steps of the claims amounts to no more than mere instructions to apply the exception using a generic computer component. The receiving of input from a user device, storing data offline in a memory, and user device outputting information are also shown to be mere instructions to apply the exception. The inputting of data into a medical model where the model includes probability distributions, relationships between symptoms and diseases, and an inference engine to perform Bayesian inference also amounts to no more than mere instructions to apply an exception because it is a mathematical algorithm being applied to a general purpose computer to determine a result. Mere instructions to apply an exception using a generic computer component cannot provide an inventive concept. As described above, the step of outputting a question to the user, which is insignificant extra-solution activity, amounts to well-understood, routine and conventional computer activity because it is claimed at a high level of generality and includes receiving or transmitting data, which has been found to be well-understood, routine and conventional computer functions by the Court ( MPEP 2106.05(d)(II)(i) Receiving or transmitting data over a network, *e.g.*, using the Internet to gather data, *Symantec*, 838 F.3d at 1321, 120 USPQ2d at 1362 (utilizing an intermediary computer to forward information); *TLI Communications LLC v. AV Auto. LLC*, 823 F.3d 607, 610, 118 USPQ2d 1744, 1745 (Fed. Cir. 2016) (using a telephone for image transmission); *OIP Techs., Inc., v. Amazon.com, Inc.*, 788 F.3d 1359, 1363, 115 USPQ2d 1090, 1093 (Fed. Cir. 2015) (sending messages over a network); *buySAFE, Inc. v. Google, Inc.*, 765 F.3d 1350, 1355, 112 USPQ2d 1093, 1096 (Fed. Cir. 2014) (computer receives and sends information over a network); but see

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*DDR Holdings, LLC v. Hotels.com, L.P.*, 773 F.3d 1245, 1258, 113 USPQ2d 1097, 1106 (Fed. Cir. 2014) ("Unlike the claims in *Ultramercial*, the claims at issue here specify *how* interactions with the Internet are manipulated to yield a desired result--a result that overrides the routine and conventional sequence of events ordinarily triggered by the click of a hyperlink." (emphasis added)). Looking at the limitations as an ordered combination adds nothing that is not already present when looking at the elements taken individually. There is no indication that the combination of elements improves the functioning of the computer or improves another technology. The claims do not amount to significantly more than the underlying abstract idea. The claims are not patent eligible.

**Dependent claims 2-5 and 7-9** add additional limitations which only serve to further limit or specify the limitations of the independent claims, and hence are nonetheless directed towards fundamentally the same abstract idea as independent claims 1, 10 and 11.

The dependent claims do not include additional elements that have not been previously addressed in the independent claims and thus do not provide an inventive concept by integrating the exception into a practical application or reciting significantly more than the abstract idea. Therefore, when taken individually or as an ordered combination, Claims 1-5 and 7-11 are nonetheless rejected under 35 U.S.C. 101 as being directed to non-statutory subject matter.

### ***Response to Arguments***

5. Applicant's arguments, see Pages 6-8, "Claim Rejections - 35 U.S.C. 101", filed 09/22/2020 with respect to claims 1-5 and 7-11 have been fully considered but they are not persuasive.

Applicant argues that the present claims are not directed to an abstract idea because the claims as a whole integrate the judicial exception into a practical application. Specifically, Applicant argues that the claims implement medical diagnosis into computer-related technology for a practical application of diagnosing a patient utilizing a probabilistic graphical model comprising nodes relating to diseases, risk factors, and symptoms. Applicant asserts that this provides a specific improvement over prior information medical diagnosis methods which results in an improved process for diagnosing patients through an automated natural flow of questioning. Examiner respectfully disagrees that this provides an improvement to a technology or technical field. The concept of providing a medical diagnosis using a determined flow of questioning is the abstract idea itself, which as in the rejection above, is directed to certain methods of organizing human activity. Determining a line of questions to ask a patient to determine a diagnosis is a fundamental activity in medical care and has been a long carried out practice by medical care providers in diagnosing and treating patients. The automation of the abstract idea by applying to computer components and mathematical algorithms amounts to mere instructions to apply the exception, as per MPEP 2106.05(f). The improvement to the abstract idea of generating questions and presenting to the patient, no matter how innovative, is not enough for eligibility. No matter how much of an advance in the medical diagnosis field the claims recite, the advance lies entirely in the realm of abstract ideas, with no plausibly alleged innovation in the nonabstract application realm. An advance of that nature is ineligible for patenting. Applicant also argues that the claims recite storing embedded nodes offline in memory and retrieving the information for calculating the cost to move a question in semantic space as an implementation which provides technical advantages such as allowing easy fast

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calculation and retrieval of questions which increase the speed, reliability and resource utilization. Examiner respectfully disagrees that this is a technical solution to a technical problem, but rather amounts to mere instructions to apply the exception. As per MPEP 2106.05(f)(2), claiming the improved speed or efficiency inherent with applying the abstract idea on a computer does not integrate the abstract idea into a practical application or provide significantly more. The storing of information in a memory and retrieving that data for use in the abstract idea is using computer components in their ordinary capacity for tasks such as receiving, storing and transmitting data, and thus does not integrate the abstract idea into a practical application. Therefore, the claims are directed to an abstract idea and the rejection is maintained.

#### ***Conclusion***

6. **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.

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7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Evangeline Barr whose telephone number is (571)272-0369.

The examiner can normally be reached on Monday to Friday 8:00 am to 4:00 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, Fonya Long can be reached on 571-270-5096. 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.

/EVANGELINE BARR/  
Primary Examiner, Art Unit 3626

**REMARKS**

This application has been carefully reviewed in light of the Office Action dated October 20, 2020. Claims 1–5 and 7–11 are currently pending in the application, with Claims 1 and 10 being the independent claims. Claims 1 and 10 have been amended. Support for the claim amendments can be found, for example, in paragraphs [0058], [0061], [0067], and [0070] of the originally filed specification. New claims 12 and 13 have been added. Claim 7 has been canceled without prejudice or disclaimer of the subject matter. No new matter is believed to be added herein. Reconsideration and further examination are respectfully requested.

***After Final Consideration Pilot Program 2.0 Request***

Pursuant to the After Final Consideration Pilot Program 2.0 (AFCP 2.0), Applicant respectfully requests participation in AFCP 2.0, and requests to have this response and amendment considered thereunder. Submitted herewith is a corresponding form PTO/SB/434.

***Interview Summary***

Applicant would initially like to thank Examiner Barr for the thoughtful courtesies extended to the Applicant's counsel, Teddie Hsu (USPTO Reg. No. 67,780), on March 17, 2021. During the telephonic interview, Examiner Barr stated that the above-identified amendments to the independent claims would require further review and consideration.

***Claim Rejections – 35 U.S.C. § 101***

Claims 1-5 and 7-11 are rejected under 35 U.S.C. 101 because the claimed invention is directed to an abstract idea without significantly more. The claims recite generating questions for a user to obtain information for providing a medical diagnosis. These rejections are respectfully traversed, and reconsideration and withdrawal of these rejections are respectfully requested.

Applicant respectfully submits that the claims as a whole, when the elements are considered both individually and as a combination, integrate a judicial exception into a practical application. For example, amended independent claim 1 recites:

A computer-implemented method for providing a computer implemented medical diagnosis, the computer being configured to generate questions to ask to

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a user when performing the diagnosis, the computer comprising a memory, the method comprising:

receiving at the computer from a user device, an input from a user comprising at least one symptom of the user;

providing the at least one symptom as an input to a medical model, the medical model being stored in the memory, the medical model comprising:

a probabilistic graphical model (PGM) comprising probability distributions and relationships between evidence and diseases, wherein evidence comprises symptoms and risk factors, the PGM further comprising evidence nodes relating to risk factors and symptoms and disease nodes; wherein the at least one symptom is provided to the PGM by activating an evidence node in the PGM corresponding to the symptom,

performing Bayesian inference utilizing an inference engine on said PGM to calculate the expected information gain of activating each node of a set of further evidence nodes;

retrieving from memory embedded evidence nodes of the PGM, wherein the embedded evidence nodes correspond to evidence nodes of the PGM that are embedded in a semantic space;

calculating a cost, for each of the embedded evidence nodes of the set of further evidence nodes, of moving in the semantic space from an embedded state vector in semantic space to an embedded evidence node, wherein the embedded state vector is determined from previous question asked by the computer to the user;

ranking said set of further evidence nodes using, for each node, said calculated expected information gain penalized by the calculated cost of moving in the semantic space from the embedded state vector;

using said ranked further evidence nodes to select the next question to be provided by the computer to the user; and

outputting said question to the user through the user device.

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“A claim that integrates a judicial exception into a practical application will apply, rely on, or use the judicial exception in a manner that imposes a meaningful limit on the judicial exception, such that the claim is more than a drafting effort designed to monopolize the judicial exception. When the exception is so integrated, then the claim is not directed to a judicial exception ... and is eligible.” 2019 Revised Patent Subject Matter Eligibility Guidance (January 7, 2019). Applicant respectfully submits that at least the foregoing features recited in the independent claims when considered individually and in combination, implement medical diagnosis into computer-related technology for a practical application of diagnosing a patient utilizing a probabilistic graphical model comprising nodes relating to diseases, risk factors and symptoms. The claimed features provide a specific improvement over prior information medical diagnosis methods, resulting in an improved process for diagnosing patients through an automated natural flow of questioning.

Independent claim 1 has been amended and re-arranged for clarification. The claim now recites the “activation of an evidence node.” The basis for this amendment is to be found, for example, in paragraph [0070] of the originally filed specification.

Independent claim 1 claim now discusses evidence nodes which can be symptoms or risk factors. The term “evidence” is now used in the claim since the claim now recites more explicitly how the cost is determined. This is discussed in the description in relation to evidence nodes.

Independent claim 1 also now specifies using the PGM to calculate the expected information gain by activating each node of a set of further evidence nodes. This is described, for example, in paragraph [0058] of the originally filed specification.

Independent claim 1 has also been amended to refer to an “embedded state vector” in the semantic space that is determined from previous questions asked to the use by the computer. The basis for this amendment is to be found, for example, in paragraphs [0061] and [0067] of the originally filed specification.

Independent claim 10 has been amended similarly to independent claim 1.

The amended independent claims explicitly recite the steps performed by the computer. The applicant respectfully submits that these steps could not be performed by a human.

Specifically, the amended independent claims refer to activating a node in a PGM and performing inference on the PGM. As explained in, for example, paragraph [0031] of the

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originally filed specification, performing inference requires calculations on >100s of billions of combinations of symptoms, diseases, and risk factors. This could not be performed by human. The step of determining the set of evidence nodes and calculating the VOI for each evidence nodes is described, for example, in paragraph [0058] of the originally filed specification, which is clearly far too computationally heavy to be performed by the human brain.

The other claims currently under consideration in the application are dependent from their respective independent claims discussed above and therefore are believed to be allowable for at least similar reasons to at least some of the explanations described above. Because each dependent claim is deemed to define an additional aspect of the invention, the individual consideration of each on its own merits is respectfully requested.

Therefore, Applicant respectfully requests that the Examiner withdraw the rejection of Claims 1–5 and 7–11 under 35 U.S.C. § 101.

**CONCLUSION**

Applicant respectfully submits that the entire application is in condition for allowance, and such action is respectfully requested at the Examiner's earliest convenience. Should the Examiner have any questions, please call the undersigned at the phone number listed below so that any such questions may be promptly resolved.

Any remarks in support of patentability of one claim should not be imputed to any other claim, even if similar terminology is used. Any language or remarks referring to only a portion of a claim should not necessarily be understood to base patentability on solely that portion; rather, patentability rests on each claim taken as a whole.

Applicant respectfully submits that to the extent any disclaimers or statements were made previously during prosecution with respect to the scope of the claimed invention, such disclaimers and statements are hereby rescinded.

Applicant respectfully reserves the right to traverse any of the rejections, assertions and submissions made in connection with the application, even if not discussed herein, including the right to challenge later whether any of the cited references is prior art. The absence of a reply to a specific rejection, issue, or comment does not signify agreement with or concession of that rejection, issue, or comment. In addition, because any arguments made may not be exhaustive, there may be other reasons that have not been expressed for patentability of any or all claims.

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When amendments are made to any claims, no acquiescence or estoppel is implied thereby; such amendments are made only to expedite prosecution of the present application and are without prejudice to the presentation or assertion, in the future, of claims directed to subject matter that is same as or similar to that previously presented. Nothing in this paper should be construed as an intent to concede, or actual concession of, any issue with regard to any claim, or to any cited art, except as specifically stated in this paper, and the amendment or cancellation of any claim does not necessarily signify concession of unpatentability of the claim prior to its amendment or cancellation.

To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 50-0417 and please credit any excess fees to such deposit account.

Respectfully submitted,

McDERMOTT WILL & EMERY LLP

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**Date: 22 March 2021**

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AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions and listings of claims in the application:

LISTING OF CLAIMS:

1. (Currently Amended) A computer-implemented method for providing a computer implemented medical diagnosis, the computer being configured to generate questions to ask to a user when performing the diagnosis, the computer comprising a memory, the method comprising:

receiving at the computer from a user device, an input from a user comprising at least one symptom of the user;

providing the at least one symptom as an input to a medical model, the medical model being stored in the memory, the medical model comprising:

a probabilistic graphical model (PGM) comprising probability distributions and relationships between evidence symptoms and diseases, wherein evidence comprises symptoms and risk factors, the ~~probabilistic graphical model~~ PGM further comprising evidence nodes relating to diseases, risk factors and symptoms and disease nodes;, wherein the at least one symptom is provided to the PGM by activating an evidence node in the PGM corresponding to the symptom,[[;]]

~~performing an inference engine configured to perform~~ Bayesian inference utilizing an inference engine on said ~~probabilistic graphical model~~ PGM to calculate the expected information gain of activating each node of a set of further evidence nodes;[[,]]

retrieving from memory embedded evidence nodes of the PGM, wherein the embedded evidence nodes correspond to evidence nodes of the PGM that are embedded in a semantic space;

calculating a cost, for each of the embedded evidence nodes of the set of further evidence nodes, of moving in the semantic space from an embedded state vector in semantic space to an embedded evidence node, wherein the embedded state vector is determined from previous question asked by the computer to the user;

ranking said set of further evidence nodes using, for each node, said calculated expected information gain penalized by the calculated cost of moving in the semantic space from the embedded state vector;

using said ranked further evidence nodes to select the next question to be provided by the computer to the user; and

~~generating a question for the user to obtain further information concerning the user to allow a diagnosis, and outputting said question to the user,~~

~~wherein generating a question for the user comprises:~~

~~ranking said questions by determining a utility of the possible questions, the utility being a measure of an expected information gain determined from the inference engine penalised by a cost incurred by moving from a previous question in semantic space to the question, the expected information gain weighted by a current marginal posterior of each disease being present and normalized between 0 and 1, wherein the nodes of the graphical model are embedded in the semantic space, and the embedded nodes are stored offline in a memory and retrieved for~~

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~~calculating the cost incurred by moving from a previous question in semantic space to the question; and~~

outputting said question to the user through the user device.

2. (Original) A method according to claim 1, wherein the semantic space is represented by at least one semantic simplex defining an embedding space.
3. (Previously Presented) A method according to claim 2, wherein vertices of the simplex represents a location in said embedding space of independent semantic properties and wherein a dot product of two elements at distinct vertices is null.
4. (Original) A method according to claim 2, wherein the embedding spaces are selected from at least one of Pathogenesis and body systems.
5. (Previously Presented) A method according to claim 2, wherein said nodes are embedded in said at least one semantic simplex.
6. (Canceled)
7. (Canceled)
8. (Original) A method according to claim 2, wherein the cost is calculated by assuming that the simplex defines a fixed energy landscape.
9. (Original) A method according to claim 2, wherein the cost is calculated by assuming that the simplex defines a dynamic energy landscape.

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10. (Currently Amended) A system for providing a computer implemented medical diagnosis, the system being configured to generate questions to ask a user when performing diagnosis, the system comprising a processor and a memory:

the processor being adapted to:

receive an input from a user comprising at least one symptom of the user;

provide the at least one symptom as an input to a medical model, the medical model being stored in the memory, the medical model comprising:

a probabilistic graphical model (PGM) comprising probability distributions and relationships between ~~symptoms~~ evidence and diseases, wherein evidence comprises symptoms and risk factors, the ~~probabilistic graphical model PGM~~ PGM further comprising evidence nodes relating to diseases, risk factors and symptoms and disease nodes, wherein the at least one symptom is provided to the PGM by activating an evidence node in the PGM corresponding to the symptom;

~~an inference engine configured to perform Bayesian inference on said probabilistic graphical model PGM to calculate the expected information gain of activating each node of a set of further evidence nodes~~,

retrieve from memory embedded evidence nodes of the PGM, wherein the embedded evidence nodes correspond to evidence nodes of the PGM that are embedded in a semantic space;

calculate a cost, for each of the embedded evidence nodes of the set of further evidence nodes, of moving in the semantic space from an embedded state vector in semantic space to an embedded evidence node, wherein the embedded state vector is determined from previous question asked by the computer to the user;

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rank said set of further evidence nodes using, for each node, said calculated expected information gain penalized by the calculated cost of moving in the semantic space from the embedded state vector;

use said ranked further evidence nodes to select the next question to be provided by the computer to the user; and

~~generate a question for the user to obtain further information concerning the user to allow a diagnosis, and outputting said question to the user,~~

~~wherein generating a question for the user comprises:~~

~~ranking said questions by determining the utility of the possible questions, the utility being a measure of an expected information gain determined from the inference engine penalised by the cost incurred by moving from a previous question in semantic space to the question, the expected information gain weighted by a current marginal posterior of each disease being present and normalized between 0 and 1, wherein the nodes of the graphical model are embedded in the semantic space, and the embedded nodes are stored offline in a memory and retrieved for calculating the cost incurred by moving from a previous question in semantic space to the question; and~~

~~output[[ting]] said question to the user through the user device.~~

11. (Original) A non-transitory carrier medium carrying computer readable instructions being adapted to cause a computer to run the method recited in claim 1.

12. (New) A method according to claim 5, wherein there are a plurality of semantic simplexes, and wherein:

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the PGM nodes are embedded in each simplex;

an embedded state vector is provided for each simplex;

calculating a cost of moving in the semantic space from an embedded state vector in semantic space to each node in the set of embedded evidence nodes is performed for each simplex; and

the evidence nodes are ranked, using, for each node, said calculated expected information gain penalized by the calculated cost in each simplex of moving in the semantic space from the embedded state vector.

13. (New) A method according to claim 1, wherein the embedded state is determined from the average embedding of the evidence requested in  $n$  previous questions, where  $n$  is an integer.