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(54) Title: SYSTEMS AND METHODS FOR PREDICTING MENTAL HEALTH CONDITIONS BASED ON PROCESSING OF CONVERSATIONAL SPEECH/TEXT AND LANGUAGE

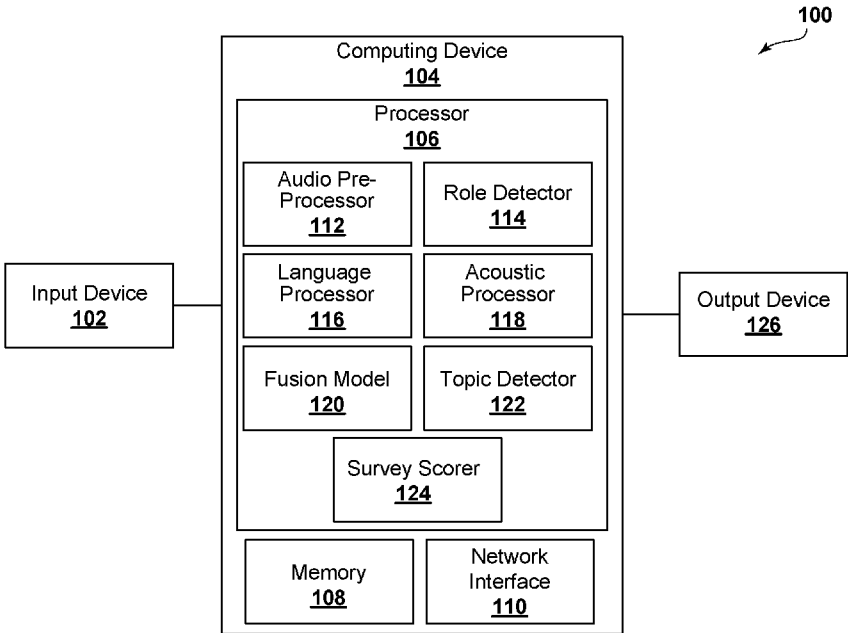


FIG. 1

(57) Abstract: Described herein are systems and methods for identifying the severity of a mental health condition or symptoms of same by listening to a human-to-human conversation by receiving conversation data, processing the conversation data to generate a language model output and/or an acoustic model output using one or more language models and/or acoustic models. Further described herein are systems and methods for automatically tracking and providing analytics on self-report questionnaires administered during the conversation.

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

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 24/33710

A. CLASSIFICATION OF SUBJECT MATTER

IPC - INV. G06F 40/00, G10L 25/00 (2024.01)

ADD. A61B 5/00 (2024.01)

CPC - INV. G06F 40/00, G10L 25/00

ADD. A61B 5/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

See Search History document

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

See Search History document

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

See Search History document

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 10,614,810 B1 (Verbit Software Ltd.) 07 April 2020 (07.04.2020) entire document, especially abstract and col 35, ln 1-22	1-14, 44-57
Y	US 2022/0328064 A1 (Ellipsis Health Inc.) 13 October 2022 (13.10.2022) entire document, especially abstract and para [0013]	1-14, 44-57
Y	US 2021/0201144 A1 (Conversica Inc.) 01 July 2021 (01.07.2021) entire document, especially abstract and para [0084]	1-14, 44-57
Y	US 2020/0005796 A1 (Verint Systems Ltd) 02 January 2020 (02.01.2020) entire document, especially abstract and para [0048]-[0050]	6, 49
Y	US 2022/0295191 A1 (Oticon A/S) 15 September 2022 (15.09.2022) entire document, especially abstract and para [0177]-[0180]	6, 49
Y	US 2015/0227941 A1 (Tuchman et al.) 13 August 2015 (13.08.2015) entire document, especially abstract and para [0030]-[0031]	8, 51
Y	US 2022/0115020 A1 (SoundHound Inc.) 14 April 2022 (14.04.2022) entire document, especially abstract and para [0103]-[0104]	11, 54

☐ Further documents are listed in the continuation of Box C.☐ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"D" document cited by the applicant in the international application

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

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Date of mailing of the international search report

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Name and mailing address of the ISA/US

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 24/33710

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:
This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1.

Group I: Claims 1-14, 44-57, directed to identifying roles of speakers in a conversation.

Group II: Claims 15-29, 58-71, directed to identifying topics in a conversation.

Group III: Claims 30-43, 72-86, directed to scoring surveys based on a conversation.

Group IV: Claims 87-90, directed to training a baseline for a language model, an acoustic model, and a fusion model.

--See extra sheet--

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:
1-14, 44-57

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

Continuation of Box No. III, Observations where unity of invention is lacking:

Group V: Claims 91-96, directed to predicting a severity of symptom of a behavioral or mental health condition of a subject

The groups of inventions listed above do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons:

Special Technical Features:

The special technical feature of Group I is identifying roles of speakers in a conversation, processing the conversation data to generate a language model output and/or an acoustic model output, apply weights to the language model output and/or the acoustic model output, wherein the weights are based on the role of the speaker during each time segment, not required by Group II-V.

The special technical feature of Group II is identifying topics in a conversation, processing the conversation data to generate a language model output, apply weights to an output, wherein the weights are based on the topics during each time segment, not required by Group I, III-V.

The special technical feature of Group III is identifying a query based on conversation data from an agent and response to the query from a patient, mapping the query onto a predefined query and the response to the query to a predefined response to the predefined query, not required by Group I-II, IV-V.

The special technical feature of Group IV is training a baseline for one or more of a language model, an acoustic model, and a fusion model to detect behavioural or mental health condition, updating the model based on accuracy of predicting a behavioural or mental health condition, not required by Group I-III, V.

The special technical feature of Group V is predicting a severity of symptom of a behavioral or mental health condition of a subject based on in-context learning and conversation data, not required by Group I-IV.

Common Technical Features:

Groups I and II share at least one input device for receiving conversation data from at least one user; at least one output device for outputting an electronic report; at least one computing device in communication with the at least one input device and the at least one output device, the at least one computing device configured to: receive the conversation data from the at least one input device; process the conversation data to generate a language model output, apply weights to the language model output, wherein the weights are optionally temporally-based, generate an electronic report; and transmit the electronic report to the output device

These shared technical features fail to provide a contribution over prior art, for example US 2021/0201144 A1 to Conversica Inc. (hereinafter 'Conversica'). Conversica discloses at least one input device for receiving conversation data from at least one user (para [0008] "a system and method for generating custom client intents in an AI driven conversation system are provided. In such systems and methods data for the client is received and a series of standard intent categories responsive to the client data are auto generated. A custom question is then received from the client, and intent categories are generated using at least one AI classification models, wherein the classifying calculates a percentage confidence of a match between the custom question and the intent categories. The classification results are then displayed along with the percentage confidence to the client. Feedback from the client to either merge the custom question with one of the standard intent categories or generate a new intent category is then received."); at least one output device for outputting an electronic report (para [0008]); at least one computing device in communication with the at least one input device and the at least one output device, the at least one computing device configured to: receive the conversation data from the at least one input device (para [0008]); process the conversation data to generate a language model output (para [0084] "The exchange lifecycle modifier 417 tracks the exchange maturity and augments the model weights accordingly, while the role awareness modifier 416 tracks the contact's role and likewise alters model weights to ensure the actions taken in response to the prior response insights are appropriate and best tailored to the assistant type, stage of the conversation, and the person the conversation is engaged with to achieve the goal(s) of the conversation. The final output of the output modifier 415 is the assistant output 418 which includes the weightings for the various models and/or features that can be incorporated into the action model."; para [0143]-[0144] "Here role awareness is initially applied (at 1710), which weights different templates and/or action models based upon the role of the contact. For example, a contact at a base level position within a procurement division would be treated significantly differently than an Executive Vice President within the same organization. Salutations, message tone, and objective would vary based upon the contact's position/role....The message templates and phrase selections would likewise be modified based upon conversation lifecycle (at 1720). For example, a message that is early within the conversation exchange will likely be more formal than after the system has developed a "rapport" with the contact. Next, the acceptable message templates are selected from a database of all templates available to the specific assistant the contact is conversing with (at 1730). Finally, from among the available templates, the specific template to apply is selected to transition the conversation from the present state, to a desired next state (at 1740). This selection process includes applying a model to the current state and the chance of shifting to a desired subsequent state, given the lifecycle stage and role awareness modifications. Rules linking the intents, entities, and exchange state may be leveraged for template selection."; apply weights to the language model output (para [0084]; para [0143]-[0144]), wherein the weights are optionally temporally-based, generate an electronic report (para [0008]); and transmit the electronic report to the output device (para [0008]).

Groups I-III share receiving conversation data from at least one input device; processing the conversation data to generate a language model output

These shared technical features fail to provide a contribution over prior art, for example Conversica. Conversica discloses receiving conversation data from at least one input device (para [0008]; para [0084]; para [0143]-[0144]); processing the conversation data to generate a language model output (para [0008]; para [0084]; para [0143]-[0144]).

--See extra sheet--

Box No. III Observations where unity of invention is lacking (contd.):

Groups I-IV share a language model output

These shared technical features fail to provide a contribution over prior art, for example Conversica. Conversica discloses a language model output (para [0008]; para [0084]; para [0143]-[0144]).

Groups IV-V share predicting at least one symptom of a behavioral or mental health condition of a subject

These shared technical features fail to provide a contribution over prior art, for example US 2022/0328064 A1 to Ellipsis Health Inc. (hereinafter 'Ellipsis'). Ellipsis discloses predicting at least one symptom of a behavioral or mental health condition of a subject (para [0005]) "The present disclosure also provides systems and methods for predicting, using natural language processing ("NLP") models, whether a subject has a behavioral or mental health condition. The NLP models described herein may have an encoder, a language model, and one or more classifiers. The encoder can receive a transcribed speech sample from a subject and generate an encoded speech sample (e.g., a real-valued vector). The language model and the classifier can process the encoded speech sample to generate a prediction that indicates whether the subject has the behavioral or mental health condition. The language model may first be trained on encoded-based representations that are not necessarily related to the behavioral or mental health condition. For example, the language model may be trained on a corpus of Wikipedia articles. The language model may then be fine-tuned on encoded text related to the behavioral or mental health condition. Thereafter, the one or more classifiers may be trained to predict whether the subject has the behavioral or mental health condition. The training data for the classifier may include a plurality of transcribed and encoded speech samples from a plurality of subjects. Each speech sample may be associated with a label that indicates whether the subject that provided the speech sample has the behavioral or mental health condition.")

Accordingly, the inventions listed as Groups above lack unity of invention under PCT Rule 13 because they do not share a same or corresponding special technical feature providing contribution over prior art.