(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
14 February 2019 (14.02.2019)

WIPO | PCT

(10) International Publication Number
WO 2019/032847 A1

(51) International Patent Classification:
G06F 19/00 (2018.01)

(21) International Application Number:
PCT/US2018/046041

(22) International Filing Date:
09 August 2018 (09.08.2018)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
62/543,762 10 August 2017 (10.08.2017) US
62/638,809 05 March 2018 (05.03.2018) US

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(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, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, 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, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM,

(54) Title: AUTOMATED CLINICAL DOCUMENTATION SYSTEM AND METHOD

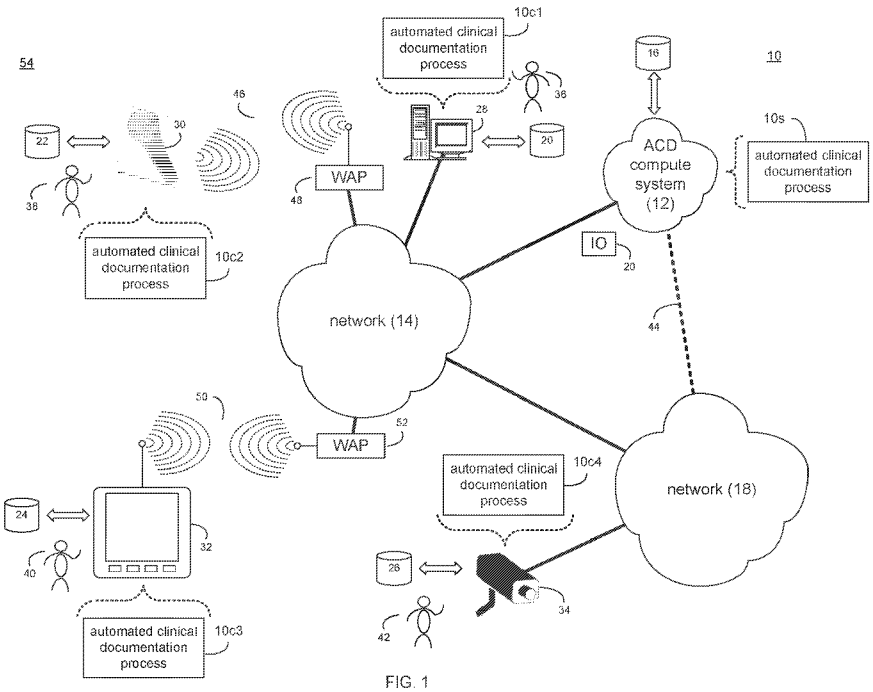

FIG. 1

(57) Abstract: A method, computer program product, and computing system for reactive encounter scanning is executed on a computing device and includes obtaining encounter information of a patient encounter. A request is received from a user concerning a specific medical condition. In response to receiving the request, the encounter information is processed to determine if the encounter information is indicative of the specific medical condition and to generate a result set. The result set is provided to the user.

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TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

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

Automated Clinical Documentation System and Method

Related Application(s)

[001] This application claims the benefit of the following U.S. Provisional Application Nos.: 62/543,762, filed on 10 August 2017; and 62/638,809, filed on 05 March 2018; their entire contents of which are incorporated herein by reference.

Technical Field

[002] This disclosure relates to documentation systems and methods and, more particularly, to automated clinical documentation systems and methods.

Background

[003] As is known in the art, clinical documentation is the creation of medical records and documentation that details the medical history of medical patients. As would be expected, traditional clinical documentation includes various types of data, examples of which may include but are not limited to paper-based documents and transcripts, as well as various images and diagrams.

[004] As the world moved from paper-based content to digital content, clinical documentation also moved in that direction, where medical records and documentation were gradually transitioned from stacks of paper geographically-dispersed across multiple locations / institutions to consolidated and readily accessible digital content.

Summary of Disclosure

Invention #19

[005] In one implementation, a computer-implemented method for reactive encounter scanning is executed on a computing device and includes obtaining encounter information of a patient encounter. A request is received from a user concerning a specific medical condition. In response to receiving the request, the encounter information is processed to

determine if the encounter information is indicative of the specific medical condition and to generate a result set. The result set is provided to the user.

[006] One or more of the following features may be included. Receiving a request from a user may include one or more of: receiving a verbal request from the user concerning the specific medical condition; and receiving a text-based request from the user concerning the specific medical condition. Processing the encounter information may include identifying one or more portions of the encounter information that concern the specific medical condition, thus defining one or more condition-related encounter potions. Processing the encounter information may further include filtering the encounter information to highlight the one or more condition-related encounter portions. Providing the result set to the user may include rendering a visual representation of the result set for the user. Providing the result set to the user may include rendering an audible representation of the result set for the user. Obtaining encounter information may include one or more of: utilizing a virtual assistant to prompt the patient to provide at least a portion of the encounter information during a pre-visit portion of the patient encounter; and utilizing a virtual assistant to prompt the patient to provide at least a portion of the encounter information during a post-visit portion of the patient encounter.

[007] In another implementation, a computer program product resides on a computer readable medium and has a plurality of instructions stored on it. When executed by a processor, the instructions cause the processor to perform operations including obtaining encounter information of a patient encounter. A request is received from a user concerning a specific medical condition. In response to receiving the request, the encounter information is processed to determine if the encounter information is indicative of the specific medical condition and to generate a result set. The result set is provided to the user.

[008] One or more of the following features may be included. Receiving a request from a user may include one or more of: receiving a verbal request from the user concerning

the specific medical condition; and receiving a text-based request from the user concerning the specific medical condition. Processing the encounter information may include identifying one or more portions of the encounter information that concern the specific medical condition, thus defining one or more condition-related encounter potions. Processing the encounter information may further include filtering the encounter information to highlight the one or more condition-related encounter portions. Providing the result set to the user may include rendering a visual representation of the result set for the user. Providing the result set to the user may include rendering an audible representation of the result set for the user. Obtaining encounter information may include one or more of: utilizing a virtual assistant to prompt the patient to provide at least a portion of the encounter information during a pre-visit portion of the patient encounter; and utilizing a virtual assistant to prompt the patient to provide at least a portion of the encounter information during a post-visit portion of the patient encounter.

[009] In another implementation, a computing system includes a processor and memory is configured to perform operations including obtaining encounter information of a patient encounter. A request is received from a user concerning a specific medical condition. In response to receiving the request, the encounter information is processed to determine if the encounter information is indicative of the specific medical condition and to generate a result set. The result set is provided to the user.

[0010] One or more of the following features may be included. Receiving a request from a user may include one or more of: receiving a verbal request from the user concerning the specific medical condition; and receiving a text-based request from the user concerning the specific medical condition. Processing the encounter information may include identifying one or more portions of the encounter information that concern the specific medical condition, thus defining one or more condition-related encounter potions. Processing the encounter information may further include filtering the encounter information to highlight the one or more condition-related encounter portions. Providing

the result set to the user may include rendering a visual representation of the result set for the user. Providing the result set to the user may include rendering an audible representation of the result set for the user. Obtaining encounter information may include one or more of: utilizing a virtual assistant to prompt the patient to provide at least a portion of the encounter information during a pre-visit portion of the patient encounter; and utilizing a virtual assistant to prompt the patient to provide at least a portion of the encounter information during a post-visit portion of the patient encounter.

[0011] The details of one or more implementations are set forth in the accompanying drawings and the description below. Other features and advantages will become apparent from the description, the drawings, and the claims.

Brief Description of the Drawings

[0012] FIG. 1 is a diagrammatic view of an automated clinical documentation compute system and an automated clinical documentation process coupled to a distributed computing network;

[0013] FIG. 2 is a diagrammatic view of a modular ACD system incorporating the automated clinical documentation compute system of FIG. 1;

[0014] FIG. 3 is a diagrammatic view of a mixed-media ACD device included within the modular ACD system of FIG. 2;

[0015] FIG. 4 is a flow chart of one implementation of the automated clinical documentation process of FIG. 1;

[0016] FIG. 5 is a flow chart of another implementation of the automated clinical documentation process of FIG. 1;

[0017] FIG. 6 is a flow chart of another implementation of the automated clinical documentation process of FIG. 1;

[0018] FIG. 7 is a flow chart of another implementation of the automated clinical documentation process of FIG. 1;

[0019] FIG. 8 is a flow chart of another implementation of the automated clinical documentation process of FIG. 1;

[0020] FIG. 9 is a flow chart of another implementation of the automated clinical documentation process of FIG. 1;

[0021] FIG. 10 is a flow chart of another implementation of the automated clinical documentation process of FIG. 1;

[0022] FIG. 11 is a flow chart of another implementation of the automated clinical documentation process of FIG. 1;

[0023] FIG. 12 is a flow chart of another implementation of the automated clinical documentation process of FIG. 1;

[0024] FIGS. 13A-13E are diagrammatic views of the encounter transcript and semantic frames as generated by the automated clinical documentation process of FIG. 1;

[0025] FIGS. 14A-14B are diagrammatic views of a medical record as populated by the automated clinical documentation process of FIG. 1;

[0026] FIG. 15 is a flow chart of another implementation of the automated clinical documentation process of FIG. 1;

[0027] FIG. 16 is a flow chart of another implementation of the automated clinical documentation process of FIG. 1;

[0028] FIG. 17 is a flow chart of another implementation of the automated clinical documentation process of FIG. 1;

[0029] FIG. 18 is a flow chart of another implementation of the automated clinical documentation process of FIG. 1;

[0030] FIG. 19 is a flow chart of another implementation of the automated clinical documentation process of FIG. 1;

[0031] FIG. 20 is a diagrammatic view of an ACD media player for use with the automated clinical documentation process of FIG. 1;

[0032] FIG. 21 is a flow chart of another implementation of the automated clinical

documentation process of FIG. 1;

[0033] FIG. 22 is a flow chart of another implementation of the automated clinical documentation process of FIG. 1;

[0034] FIG. 23 is a flow chart of another implementation of the automated clinical documentation process of FIG. 1; and

[0035] FIG. 24 is a flow chart of another implementation of the automated clinical documentation process of FIG. 1.

[0036] Like reference symbols in the various drawings indicate like elements.

Detailed Description of the Preferred Embodiments

System Overview:

[0037] Referring to FIG. 1, there is shown automated clinical documentation process 10. As will be discussed below in greater detail, automated clinical documentation process 10 may be configured to automate the collection and processing of clinical encounter information to generate / store / distribute medical records.

[0038] Automated clinical documentation process 10 may be implemented as a server-side process, a client-side process, or a hybrid server-side / client-side process. For example, automated clinical documentation process 10 may be implemented as a purely server-side process via automated clinical documentation process 10s. Alternatively, automated clinical documentation process 10 may be implemented as a purely client-side process via one or more of automated clinical documentation process 10c1, automated clinical documentation process 10c2, automated clinical documentation process 10c3, and automated clinical documentation process 10c4. Alternatively still, automated clinical documentation process 10 may be implemented as a hybrid server-side / client-side process via automated clinical documentation process 10s in combination with one or more of automated clinical documentation process 10c1, automated clinical documentation process 10c2, automated clinical documentation process 10c3, and automated clinical

documentation process 10c4.

[0039] Accordingly, automated clinical documentation process 10 as used in this disclosure may include any combination of automated clinical documentation process 10s, automated clinical documentation process 10c1, automated clinical documentation process 10c2, automated clinical documentation process 10c3, and automated clinical documentation process 10c4.

[0040] Automated clinical documentation process 10s may be a server application and may reside on and may be executed by automated clinical documentation (ACD) compute system 12, which may be connected to network 14 (e.g., the Internet or a local area network). ACD compute system 12 may include various components, examples of which may include but are not limited to: a personal computer, a server computer, a series of server computers, a mini computer, a mainframe computer, one or more Network Attached Storage (NAS) systems, one or more Storage Area Network (SAN) systems, one or more Platform as a Service (PaaS) systems, one or more Infrastructure as a Service (IaaS) systems, one or more Software as a Service (SaaS) systems, a cloud-based computational system, and a cloud-based storage platform.

[0041] As is known in the art, a SAN may include one or more of a personal computer, a server computer, a series of server computers, a mini computer, a mainframe computer, a RAID device and a NAS system. The various components of ACD compute system 12 may execute one or more operating systems, examples of which may include but are not limited to: Microsoft Windows Server tm; Redhat Linux tm, Unix, or a custom operating system, for example.

[0042] The instruction sets and subroutines of automated clinical documentation process 10s, which may be stored on storage device 16 coupled to ACD compute system 12, may be executed by one or more processors (not shown) and one or more memory architectures (not shown) included within ACD compute system 12. Examples of storage device 16 may include but are not limited to: a hard disk drive; a RAID device; a random

access memory (RAM); a read-only memory (ROM); and all forms of flash memory storage devices.

[0043] Network 14 may be connected to one or more secondary networks (e.g., network 18), examples of which may include but are not limited to: a local area network; a wide area network; or an intranet, for example.

[0044] Various IO requests (e.g. IO request 20) may be sent from automated clinical documentation process 10s, automated clinical documentation process 10c1, automated clinical documentation process 10c2, automated clinical documentation process 10c3 and/or automated clinical documentation process 10c4 to ACD compute system 12. Examples of IO request 20 may include but are not limited to data write requests (i.e. a request that content be written to ACD compute system 12) and data read requests (i.e. a request that content be read from ACD compute system 12).

[0045] The instruction sets and subroutines of automated clinical documentation process 10c1, automated clinical documentation process 10c2, automated clinical documentation process 10c3 and/or automated clinical documentation process 10c4, which may be stored on storage devices 20, 22, 24, 26 (respectively) coupled to ACD client electronic devices 28, 30, 32, 34 (respectively), may be executed by one or more processors (not shown) and one or more memory architectures (not shown) incorporated into ACD client electronic devices 28, 30, 32, 34 (respectively). Storage devices 20, 22, 24, 26 may include but are not limited to: hard disk drives; optical drives; RAID devices; random access memories (RAM); read-only memories (ROM), and all forms of flash memory storage devices. Examples of ACD client electronic devices 28, 30, 32, 34 may include, but are not limited to, personal computing device 28 (e.g., a smart phone, a personal digital assistant, a laptop computer, a notebook computer, and a desktop computer), audio input device 30 (e.g., a handheld microphone, a lapel microphone, an embedded microphone (such as those embedded within eyeglasses, smart phones, tablet computers and/or watches) and an audio recording device), display device 32 (e.g., a tablet computer, a

computer monitor, and a smart television), machine vision input device 34 (e.g., an RGB imaging system, an infrared imaging system, an ultraviolet imaging system, a laser imaging system, a SONAR imaging system, a RADAR imaging system, and a thermal imaging system), a hybrid device (e.g., a single device that includes the functionality of one or more of the above-references devices; not shown), an audio rendering device (e.g., a speaker system, a headphone system, or an earbud system; not shown), various medical devices (e.g., medical imaging equipment, heart monitoring machines, body weight scales, body temperature thermometers, and blood pressure machines; not shown), and a dedicated network device (not shown).

[0046] Users 36, 38, 40, 42 may access ACD compute system 12 directly through network 14 or through secondary network 18. Further, ACD compute system 12 may be connected to network 14 through secondary network 18, as illustrated with link line 44.

[0047] The various ACD client electronic devices (e.g., ACD client electronic devices 28, 30, 32, 34) may be directly or indirectly coupled to network 14 (or network 18). For example, personal computing device 28 is shown directly coupled to network 14 via a hardwired network connection. Further, machine vision input device 34 is shown directly coupled to network 18 via a hardwired network connection. Audio input device 30 is shown wirelessly coupled to network 14 via wireless communication channel 46 established between audio input device 30 and wireless access point (i.e., WAP) 48, which is shown directly coupled to network 14. WAP 48 may be, for example, an IEEE 802.11a, 802.11b, 802.11g, 802.11n, Wi-Fi, and/or Bluetooth device that is capable of establishing wireless communication channel 46 between audio input device 30 and WAP 48. Display device 32 is shown wirelessly coupled to network 14 via wireless communication channel 50 established between display device 32 and WAP 52, which is shown directly coupled to network 14.

[0048] The various ACD client electronic devices (e.g., ACD client electronic devices 28, 30, 32, 34) may each execute an operating system, examples of which may include but

are not limited to Microsoft Windows tm, Apple Macintosh tm, Redhat Linux tm, or a custom operating system, wherein the combination of the various ACD client electronic devices (e.g., ACD client electronic devices 28, 30, 32, 34) and ACD compute system 12 may form modular ACD system 54.

The Automated Clinical Documentation System:

Invention #6

[0049] Referring also to FIG. 2, there is shown a simplified exemplary embodiment of modular ACD system 54 that is configured to automate clinical documentation. Modular ACD system 54 may include: machine vision system 100 configured to obtain machine vision encounter information 102 concerning a patient encounter; audio recording system 104 configured to obtain audio encounter information 106 concerning the patient encounter; and a compute system (e.g., ACD compute system 12) configured to receive machine vision encounter information 102 and audio encounter information 106 from machine vision system 100 and audio recording system 104 (respectively). Modular ACD system 54 may also include: display rendering system 108 configured to render visual information 110; and audio rendering system 112 configured to render audio information 114, wherein ACD compute system 12 may be configured to provide visual information 110 and audio information 114 to display rendering system 108 and audio rendering system 112 (respectively).

[0050] Example of machine vision system 100 may include but are not limited to: one or more ACD client electronic devices (e.g., ACD client electronic device 34, examples of which may include but are not limited to an RGB imaging system, an infrared imaging system, a ultraviolet imaging system, a laser imaging system, a SONAR imaging system, a RADAR imaging system, and a thermal imaging system). Examples of audio recording system 104 may include but are not limited to: one or more ACD client electronic devices (e.g., ACD client electronic device 30, examples of which may include but are not limited to a handheld microphone, a lapel microphone, an embedded microphone (such as those

embedded within eyeglasses, smart phones, tablet computers and/or watches) and an audio recording device). Examples of display rendering system 108 may include but are not limited to: one or more ACD client electronic devices (e.g., ACD client electronic device 32, examples of which may include but are not limited to a tablet computer, a computer monitor, and a smart television). Examples of audio rendering system 112 may include but are not limited to: one or more ACD client electronic devices (e.g., audio rendering device 116, examples of which may include but are not limited to a speaker system, a headphone system, and an earbud system).

[0051] As will be discussed below in greater detail, ACD compute system 12 may be configured to access one or more datasources 118 (e.g., plurality of individual datasources 120, 122, 124, 126, 128), examples of which may include but are not limited to one or more of a user profile datasource, a voice print datasource, a voice characteristics datasource (e.g., for adapting the automated speech recognition models), a face print datasource, a humanoid shape datasource, an utterance identifier datasource, a wearable token identifier datasource, an interaction identifier datasource, a medical conditions symptoms datasource, a prescriptions compatibility datasource, a medical insurance coverage datasource, and a home healthcare datasource. While in this particular example, five different examples of datasources 118, are shown, this is for illustrative purposes only and is not intended to be a limitation of this disclosure, as other configurations are possible and are considered to be within the scope of this disclosure.

[0052] As will be discussed below in greater detail, modular ACD system 54 may be configured to monitor a monitored space (e.g., monitored space 130) in a clinical environment, wherein examples of this clinical environment may include but are not limited to: a doctor's office, a medical facility, a medical practice, a medical lab, an urgent care facility, a medical clinic, an emergency room, an operating room, a hospital, a long term care facility, a rehabilitation facility, a nursing home, and a hospice facility. Accordingly, an example of the above-referenced patient encounter may include but is not

limited to a patient visiting one or more of the above-described clinical environments (e.g., a doctor's office, a medical facility, a medical practice, a medical lab, an urgent care facility, a medical clinic, an emergency room, an operating room, a hospital, a long term care facility, a rehabilitation facility, a nursing home, and a hospice facility).

[0053] Machine vision system 100 may include a plurality of discrete machine vision systems when the above-described clinical environment is larger or a higher level of resolution is desired. As discussed above, examples of machine vision system 100 may include but are not limited to: one or more ACD client electronic devices (e.g., ACD client electronic device 34, examples of which may include but are not limited to an RGB imaging system, an infrared imaging system, an ultraviolet imaging system, a laser imaging system, a SONAR imaging system, a RADAR imaging system, and a thermal imaging system). Accordingly, machine vision system 100 may include one or more of each of an RGB imaging system, an infrared imaging systems, an ultraviolet imaging systems, a laser imaging system, a SONAR imaging system, a RADAR imaging system, and a thermal imaging system.

[0054] Audio recording system 104 may include a plurality of discrete audio recording systems when the above-described clinical environment is larger or a higher level of resolution is desired. As discussed above, examples of audio recording system 104 may include but are not limited to: one or more ACD client electronic devices (e.g., ACD client electronic device 30, examples of which may include but are not limited to a handheld microphone, a lapel microphone, an embedded microphone (such as those embedded within eyeglasses, smart phones, tablet computers and/or watches) and an audio recording device). Accordingly, audio recording system 104 may include one or more of each of a handheld microphone, a lapel microphone, an embedded microphone (such as those embedded within eyeglasses, smart phones, tablet computers and/or watches) and an audio recording device.

[0055] Display rendering system 108 may include a plurality of discrete display

rendering systems when the above-described clinical environment is larger or a higher level of resolution is desired. As discussed above, examples of display rendering system 108 may include but are not limited to: one or more ACD client electronic devices (e.g., ACD client electronic device 32, examples of which may include but are not limited to a tablet computer, a computer monitor, and a smart television). Accordingly, display rendering system 108 may include one or more of each of a tablet computer, a computer monitor, and a smart television.

[0056] Audio rendering system 112 may include a plurality of discrete audio rendering systems when the above-described clinical environment is larger or a higher level of resolution is desired. As discussed above, examples of audio rendering system 112 may include but are not limited to: one or more ACD client electronic devices (e.g., audio rendering device 116, examples of which may include but are not limited to a speaker system, a headphone system, or an earbud system). Accordingly, audio rendering system 112 may include one or more of each of a speaker system, a headphone system, or an earbud system.

[0057] ACD compute system 12 may include a plurality of discrete compute systems. As discussed above, ACD compute system 12 may include various components, examples of which may include but are not limited to: a personal computer, a server computer, a series of server computers, a mini computer, a mainframe computer, one or more Network Attached Storage (NAS) systems, one or more Storage Area Network (SAN) systems, one or more Platform as a Service (PaaS) systems, one or more Infrastructure as a Service (IaaS) systems, one or more Software as a Service (SaaS) systems, a cloud-based computational system, and a cloud-based storage platform. Accordingly, ACD compute system 12 may include one or more of each of a personal computer, a server computer, a series of server computers, a mini computer, a mainframe computer, one or more Network Attached Storage (NAS) systems, one or more Storage Area Network (SAN) systems, one or more Platform as a Service (PaaS) systems, one or more Infrastructure as a Service

(IaaS) systems, one or more Software as a Service (SaaS) systems, a cloud-based computational system, and a cloud-based storage platform.

[0058] Referring also to FIG. 3, audio recording system 104 may include directional microphone array 200 having a plurality of discrete microphone assemblies. For example, audio recording system 104 may include a plurality of discrete audio acquisition devices (e.g., audio acquisition devices 202, 204, 206, 208, 210, 212, 214, 216, 218) that may form microphone array 200. As will be discussed below in greater detail, modular ACD system 54 may be configured to form one or more audio recording beams (e.g., audio recording beams 220, 222, 224) via the discrete audio acquisition devices (e.g., audio acquisition devices 202, 204, 206, 208, 210, 212, 214, 216, 218) included within audio recording system 104.

[0059] For example, modular ACD system 54 may be further configured to steer the one or more audio recording beams (e.g., audio recording beams 220, 222, 224) toward one or more encounter participants (e.g., encounter participants 226, 228, 230) of the above-described patient encounter. Examples of the encounter participants (e.g., encounter participants 226, 228, 230) may include but are not limited to: medical professionals (e.g., doctors, nurses, physician's assistants, lab technicians, physical therapists, scribes (e.g., a transcriptionist) and/or staff members involved in the patient encounter), patients (e.g., people that are visiting the above-described clinical environments for the patient encounter), and third parties (e.g., friends of the patient, relatives of the patient and/or acquaintances of the patient that are involved in the patient encounter).

[0060] Accordingly, modular ACD system 54 and/or audio recording system 104 may be configured to utilize one or more of the discrete audio acquisition devices (e.g., audio acquisition devices 202, 204, 206, 208, 210, 212, 214, 216, 218) to form an audio recording beam. For example, modular ACD system 54 and/or audio recording system 104 may be configured to utilize audio acquisition device 210 to form audio recording beam 220, thus enabling the capturing of audio (e.g., speech) produced by encounter participant 226 (as

audio acquisition device 210 is pointed to (i.e., directed toward) encounter participant 226). Additionally, modular ACD system 54 and/or audio recording system 104 may be configured to utilize audio acquisition devices 204, 206 to form audio recording beam 222, thus enabling the capturing of audio (e.g., speech) produced by encounter participant 228 (as audio acquisition devices 204, 206 are pointed to (i.e., directed toward) encounter participant 228). Additionally, modular ACD system 54 and/or audio recording system 104 may be configured to utilize audio acquisition devices 212, 214 to form audio recording beam 224, thus enabling the capturing of audio (e.g., speech) produced by encounter participant 230 (as audio acquisition devices 212, 214 are pointed to (i.e., directed toward) encounter participant 230). Further, modular ACD system 54 and/or audio recording system 104 may be configured to utilize null-steering precoding to cancel interference between speakers and/or noise.

[0061] As is known in the art, null-steering precoding is a method of spatial signal processing by which a multiple antenna transmitter may null multiuser interference signals in wireless communications, wherein null-steering precoding may mitigate the impact off background noise and unknown user interference.

[0062] In particular, null-steering precoding may be a method of beamforming for narrowband signals that may compensate for delays of receiving signals from a specific source at different elements of an antenna array. In general and to improve performance of the antenna array, in incoming signals may be summed and averaged, wherein certain signals may be weighted and compensation may be made for signal delays.

[0063] Machine vision system 100 and audio recording system 104 may be stand-alone devices (as shown in FIG. 2). Additionally / alternatively, machine vision system 100 and audio recording system 104 may be combined into one package to form mixed-media ACD device 232. For example, mixed-media ACD device 232 may be configured to be mounted to a structure (e.g., a wall, a ceiling, a beam, a column) within the above-described clinical environments (e.g., a doctor's office, a medical facility, a medical practice, a medical lab,

an urgent care facility, a medical clinic, an emergency room, an operating room, a hospital, a long term care facility, a rehabilitation facility, a nursing home, and a hospice facility), thus allowing for easy installation of the same. Further, modular ACD system 54 may be configured to include a plurality of mixed-media ACD devices (e.g., mixed-media ACD device 232) when the above-described clinical environment is larger or a higher level of resolution is desired.

The Mixed-Media Automated Clinical Documentation Device:

Invention #11

[0064] Modular ACD system 54 may be further configured to steer the one or more audio recording beams (e.g., audio recording beams 220, 222, 224) toward one or more encounter participants (e.g., encounter participants 226, 228, 230) of the patient encounter based, at least in part, upon machine vision encounter information 102. As discussed above, mixed-media ACD device 232 (and machine vision system 100 / audio recording system 104 included therein) may be configured to monitor one or more encounter participants (e.g., encounter participants 226, 228, 230) of a patient encounter.

[0065] Specifically and as will be discussed below in greater detail, machine vision system 100 (either as a stand-alone system or as a component of mixed-media ACD device 232) may be configured to detect humanoid shapes within the above-described clinical environments (e.g., a doctor's office, a medical facility, a medical practice, a medical lab, an urgent care facility, a medical clinic, an emergency room, an operating room, a hospital, a long term care facility, a rehabilitation facility, a nursing home, and a hospice facility). And when these humanoid shapes are detected by machine vision system 100, modular ACD system 54 and/or audio recording system 104 may be configured to utilize one or more of the discrete audio acquisition devices (e.g., audio acquisition devices 202, 204, 206, 208, 210, 212, 214, 216, 218) to form an audio recording beam (e.g., audio recording beams 220, 222, 224) that is directed toward each of the detected humanoid shapes (e.g., encounter participants 226, 228, 230).

[0066] As discussed above, ACD compute system 12 may be configured to receive machine vision encounter information 102 and audio encounter information 106 from machine vision system 100 and audio recording system 104 (respectively); and may be configured to provide visual information 110 and audio information 114 to display rendering system 108 and audio rendering system 112 (respectively). Depending upon the manner in which modular ACD system 54 (and/or mixed-media ACD device 232) is configured, ACD compute system 12 may be included within mixed-media ACD device 232 or external to mixed-media ACD device 232.

The Automated Clinical Documentation Process:

[0067] As discussed above, ACD compute system 12 may execute all or a portion of automated clinical documentation process 10, wherein the instruction sets and subroutines of automated clinical documentation process 10 (which may be stored on one or more of e.g., storage devices 16, 20, 22, 24, 26) may be executed by ACD compute system 12 and/or one or more of ACD client electronic devices 28, 30, 32, 34.

Invention #1

[0068] As discussed above, automated clinical documentation process 10 may be configured to automate the collection and processing of clinical encounter information to generate / store / distribute medical records. Accordingly and referring also to FIG. 4, automated clinical documentation process 10 may be configured to obtain 300 encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) of a patient encounter (e.g., a visit to a doctor's office). Automated clinical documentation process 10 may further be configured to process 302 the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) to generate an encounter transcript (e.g., encounter transcript 234), wherein automated clinical documentation process 10 may then process 304 at least a portion of the encounter transcript (e.g., encounter transcript 234) to populate at least a portion of a medical record (e.g., medical record 236) associated with the patient encounter

(e.g., the visit to the doctor's office). Encounter transcript 234 and/or medical record 236 may be reviewed by a medical professional involved with the patient encounter (e.g., a visit to a doctor's office) to determine the accuracy of the same and/or make corrections to the same.

[0069] For example, a scribe involved with (or assigned to) the patient encounter (e.g., a visit to a doctor's office) may review encounter transcript 234 and/or medical record 236 to confirm that the same was accurate and/or make corrections to the same. In the event that corrections are made to encounter transcript 234 and/or medical record 236, automated clinical documentation process 10 may utilize these corrections for training / tuning purposes (e.g., to adjust the various profiles associated the participants of the patient encounter) to enhance the future accuracy / efficiency / performance of automated clinical documentation process 10.

[0070] Alternatively / additionally, a doctor involved with the patient encounter (e.g., a visit to a doctor's office) may review encounter transcript 234 and/or medical record 236 to confirm that the same was accurate and/or make corrections to the same. In the event that corrections are made to encounter transcript 234 and/or medical record 236, automated clinical documentation process 10 may utilize these corrections for training / tuning purposes (e.g., to adjust the various profiles associated the participants of the patient encounter) to enhance the future accuracy / efficiency / performance of automated clinical documentation process 10.

[0071] For example, assume that a patient (e.g., encounter participant 228) visits a clinical environment (e.g., a doctor's office) because they do not feel well. They have a headache, fever, chills, a cough, and some difficulty breathing. In this particular example, a monitored space (e.g., monitored space 130) within the clinical environment (e.g., the doctor's office) may be outfitted with machine vision system 100 configured to obtain machine vision encounter information 102 concerning the patient encounter (e.g., encounter participant 228 visiting the doctor's office) and audio recording system 104

configured to obtain audio encounter information 106 concerning the patient encounter (e.g., encounter participant 228 visiting the doctor's office) via one or more audio sensors (e.g., audio acquisition devices 202, 204, 206, 208, 210, 212, 214, 216, 218).

[0072] As discussed above, machine vision system 100 may include a plurality of discrete machine vision systems if the monitored space (e.g., monitored space 130) within the clinical environment (e.g., the doctor's office) is larger or a higher level of resolution is desired, wherein examples of machine vision system 100 may include but are not limited to: an RGB imaging system, an infrared imaging system, an ultraviolet imaging system, a laser imaging system, a SONAR imaging system, a RADAR imaging system, and a thermal imaging system. Accordingly and in certain instances / embodiments, machine vision system 100 may include one or more of each of an RGB imaging system, an infrared imaging system, an ultraviolet imaging system, a laser imaging system, a SONAR imaging system, a RADAR imaging system, and a thermal imaging system positioned throughout monitored space 130, wherein each of these systems may be configured to provide data (e.g., machine vision encounter information 102) to ACD compute system 12 and/or modular ACD system 54.

[0073] As also discussed above, audio recording system 104 may include a plurality of discrete audio recording systems if the monitored space (e.g., monitored space 130) within the clinical environment (e.g., the doctor's office) is larger or a higher level of resolution is desired, wherein examples of audio recording system 104 may include but are not limited to: a handheld microphone, a lapel microphone, an embedded microphone (such as those embedded within eyeglasses, smart phones, tablet computers and/or watches) and an audio recording device. Accordingly and in certain instances / embodiments, audio recording system 104 may include one or more of each of a handheld microphone, a lapel microphone, an embedded microphone (such as those embedded within eyeglasses, smart phones, tablet computers and/or watches) and an audio recording device positioned throughout monitored space 130, wherein each of these microphones / devices may be

configured to provide data (e.g., audio encounter information 106) to ACD compute system 12 and/or modular ACD system 54.

[0074] Since machine vision system 100 and audio recording system 104 may be positioned throughout monitored space 130, all of the interactions between medical professionals (e.g., encounter participant 226), patients (e.g., encounter participant 228) and third parties (e.g., encounter participant 230) that occur during the patient encounter (e.g., encounter participant 228 visiting the doctor's office) within the monitored space (e.g., monitored space 130) of the clinical environment (e.g., the doctor's office) may be monitored / recorded / processed. Accordingly, a patient "check-in" area within monitored space 130 may be monitored to obtain encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) during this pre-visit portion of the patient encounter (e.g., encounter participant 228 visiting the doctor's office). Further, various rooms within monitored space 130 may be monitored to obtain encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) during these various portions of the patient encounter (e.g., while meeting with the doctor, while vital signs and statistics are obtained, and while imaging is performed). Further, a patient "check-out" area within monitored space 130 may be monitored to obtain encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) during this post-visit portion of the patient encounter (e.g., encounter participant 228 visiting the doctor's office). Additionally and via machine vision encounter information 102, visual speech recognition (via visual lip reading functionality) may be utilized by automated clinical documentation process 10 to further effectuate the gathering of audio encounter information 106.

[0075] Accordingly and when obtaining 300 encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106), automated clinical documentation process 10 may: obtain 306 encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) from a medical

professional (e.g., encounter participant 226); obtain 308 encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) from a patient (e.g., encounter participant 228); and/or obtain 310 encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) from a third party (e.g., encounter participant 230). Further and when obtaining 300 encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106), automated clinical documentation process 10 may obtain 300 the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) from previous (related or unrelated) patient encounters. For example, if the current patient encounter is actually the third visit that the patient is making concerning e.g., shortness of breath, the encounter information from the previous two visits (i.e., the previous two patient encounters) may be highly-related and may be obtained 300 by automated clinical documentation process 10.

[0076] As will be discussed below in greater detail, when automated clinical documentation process 10 obtains 300 the encounter information, automated clinical documentation process 10 may utilize 312 a virtual assistant (e.g., virtual assistant 238) to prompt the patient (e.g., encounter participant 228) to provide at least a portion of the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) during a pre-visit portion (e.g., a patient intake portion) of the patient encounter (e.g., encounter participant 228 visiting the doctor's office).

[0077] Further and as will be discussed below in greater detail, when automated clinical documentation process 10 obtains 300 encounter information, automated clinical documentation process 10 may utilize 314 a virtual assistant (e.g., virtual assistant 238) to prompt the patient (e.g., encounter participant 228) to provide at least a portion of the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) during a post-visit portion (e.g., a patient follow-up portion) of the patient encounter (e.g., encounter participant 228 visiting the doctor's office).

Invention #2

[0078] As discussed above, when automated clinical documentation process 10 obtains 300 encounter information, automated clinical documentation process 10 may utilize 312 a virtual assistant (e.g., virtual assistant 238) to prompt the patient (e.g., encounter participant 228) to provide at least a portion of the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) during a pre-visit portion (e.g., a patient intake portion) of the patient encounter (e.g., encounter participant 228 visiting the doctor's office).

[0079] As will be discussed below in greater detail, virtual assistant 238 may be configured to aid medical professionals (e.g., doctors, nurses, physician's assistants, lab technicians, physical therapists, scribes (e.g., a transcriptionist) and/or staff members involved in the patient encounter) with the gathering of encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) during various portions of the patient encounter (e.g., encounter participant 228 visiting the doctor's office).

[0080] Accordingly and referring also to FIG. 5, automated clinical documentation process 10 may be configured to prompt 350 a patient (e.g., encounter participant 228) to provide encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) via a virtual assistant (e.g., virtual assistant 238) during a pre-visit portion of a patient encounter (e.g., encounter participant 228 visiting the doctor's office).

[0081] For example and upon arriving for the patient encounter (e.g., encounter participant 228 visiting the doctor's office), the patient (e.g., encounter participant 228) may be directed to a "check-in" area within the monitored space (e.g., monitored space 130) of the clinical environment. An example of this "check-in" area may include a booth into which the patient (e.g., encounter participant 228) enters. Upon entering this "check-in" area, the pre-visit portion (e.g., the patient intake portion) of the patient encounter (e.g.,

encounter participant 228 visiting the doctor's office) may begin.

[0082] When prompting 350 the patient (e.g., encounter participant 228) to provide encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) via the virtual assistant (e.g., virtual assistant 238), automated clinical documentation process 10 may audibly prompt 352 the patient (e.g., encounter participant 228) to provide encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) via the virtual assistant (e.g., virtual assistant 238). For example, virtual assistant 238 may provide (via audio rendering device 116) a cordial greeting to the patient (e.g., encounter participant 228) and ask them if they are checking in for a visit. If the patient (e.g., encounter participant 228) responds affirmatively, virtual assistant 238 may audibly prompt 352 the patient (e.g., encounter participant 228) to provide encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106), examples of which may include but are not limited to: patient background information; patient current-prescription information; patient insurance information; and patient symptom information.

[0083] Therefore, virtual assistant 238 may ask the patient (e.g., encounter participant 228) to provide various pieces of identifying information, examples of which may include but are not limited to: patient name, patient social security number, and patient date of birth, Depending upon the manner in which automated clinical documentation process 10 is configured, machine vision encounter information 102 may be utilized to further enhance / expedite the check-in process. For example and via machine vision encounter information 102, facial recognition functionality may be utilized to positively identify the patient (e.g., encounter participant 228). Additionally and via machine vision encounter information 102, visual speech recognition (via visual lip reading functionality) may be utilized by automated clinical documentation process 10 to further effectuate the gathering of audio encounter information 106. Virtual assistant 238 may ask the patient (e.g., encounter participant 228) to provide additional pieces of information, examples of which may

include but are not limited to patient current-prescription information; patient insurance information; and patient symptom information.

[0084] While the pre-visit portion of the patient encounter (e.g., encounter participant 228 visiting the doctor's office) is described above as being the point of the patient encounter (e.g., encounter participant 228 visiting the doctor's office) where the patient (e.g., encounter participant 228) is entering the monitored space (e.g., monitored space 130) in a clinical environment, this is for illustrative purposes only and is not intended to be a limitation of this disclosure, as other configurations are possible and are considered to be within the scope of this disclosure. For example, this pre-visit portion of the patient encounter (e.g., encounter participant 228 visiting the doctor's office) may include: automated wellness phone calls, automated wellness text messages, and automated wellness video conferences initiated by virtual assistant 238 and directed toward the patient (e.g., encounter participant 228) or a third party; and/or phone calls, text messages, and video conferences initiated by the patient (e.g., encounter participant 228) or a third party and automatically processed by virtual assistant 238.

[0085] During this pre-visit portion (e.g., the patient intake portion) of the patient encounter (e.g., encounter participant 228 visiting the doctor's office), automated clinical documentation process 10 may obtain 354 encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) from the patient (e.g., encounter participant 228) in response to the prompting by the virtual assistant (e.g., virtual assistant 238). When obtaining 354 the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) from the patient (e.g., encounter participant 228), automated clinical documentation process 10 may audibly obtain 356 the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) from the patient (e.g., encounter participant 228), thus allowing encounter participant 228 to simply verbalize their answers, wherein this information (e.g., audio encounter information 106) may be received via audio input device

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[0086] Automated clinical documentation process 10 may then process 302 the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) to generate an encounter transcript (e.g., encounter transcript 234), wherein at least a portion of the encounter transcript (e.g., encounter transcript 234) may be processed 304 to populate at least a portion of a medical record (e.g., medical record 236) associated with the patient encounter (e.g., a visit to a doctor's office).

Invention #3

[0087] As discussed above, when automated clinical documentation process 10 obtains 300 encounter information, automated clinical documentation process 10 may utilize 314 a virtual assistant (e.g., virtual assistant 238) to prompt the patient (e.g., encounter participant 228) to provide at least a portion of the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) during a post-visit portion (e.g., a patient follow-up portion) of the patient encounter (e.g., encounter participant 228 visiting the doctor's office.

[0088] As discussed above and as will be discussed below in greater detail, virtual assistant 238 may be configured to aid medical professionals (e.g., doctors, nurses, physician's assistants, lab technicians, physical therapists, scribes (e.g., a transcriptionist) and/or staff members involved in the patient encounter) with the gathering of encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) during various portions of the patient encounter (e.g., encounter participant 228 visiting the doctor's office).

[0089] Accordingly and referring also to FIG. 6, automated clinical documentation process 10 may be configured to prompt 400 a patient (e.g., encounter participant 228) to provide encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) via a virtual assistant (e.g., virtual assistant 238) during a post-visit portion of a patient encounter (e.g., encounter participant 228 visiting the

doctor's office).

[0090] For example and upon completing the patient encounter (e.g., encounter participant 228 visiting the doctor's office), the patient (e.g., encounter participant 228) may be directed to a "check-out" area within the monitored space (e.g., monitored space 130) of the clinical environment. An example of this "check-out" area may include a booth into which the patient (e.g., encounter participant 228) enters. Upon entering this "check-out" area, the post-visit portion (e.g., the patient follow-up portion) of the patient encounter (e.g., encounter participant 228 visiting the doctor's office) may begin.

[0091] When prompting 400 the patient (e.g., encounter participant 228) to provide encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) via the virtual assistant (e.g., virtual assistant 238), automated clinical documentation process 10 may audibly prompt 402 the patient (e.g., encounter participant 228) to provide encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) via the virtual assistant (e.g., virtual assistant 238). For example, virtual assistant 238 may provide (via audio rendering device 116) a cordial greeting to the patient (e.g., encounter participant 228) and ask them if they are checking out. If the patient (e.g., encounter participant 228) responds affirmatively, virtual assistant 238 may audibly prompt 402 the patient (e.g., encounter participant 228) to provide encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106), examples of which may include but are not limited to: patient status information; patient medication information; and patient follow-up information.

[0092] Therefore, virtual assistant 238 may ask the patient (e.g., encounter participant 228) to provide various pieces of identifying information, examples of which may include but are not limited to: patient status information; patient medication information; and patient follow-up information, Depending upon the manner in which automated clinical documentation process 10 is configured, machine vision encounter information 102 may

be utilized to further enhance / expedite the check-out process. For example and via machine vision encounter information 102, facial recognition functionality may be utilized to positively identify the patient (e.g., encounter participant 228). Additionally and via machine vision encounter information 102, visual speech recognition (via visual lip reading functionality) may be utilized by automated clinical documentation process 10 to further effectuate the gathering of audio encounter information 106.

[0093] While the post-visit portion of the patient encounter (e.g., encounter participant 228 visiting the doctor's office) is described above as being the point of the patient encounter (e.g., encounter participant 228 visiting the doctor's office) where the patient (e.g., encounter participant 228) is leaving the monitored space (e.g., monitored space 130) in a clinical environment, this is for illustrative purposes only and is not intended to be a limitation of this disclosure, as other configurations are possible and are considered to be within the scope of this disclosure. For example, this post-visit portion of the patient encounter (e.g., encounter participant 228 visiting the doctor's office) may include: automated wellness phone calls, automated wellness text messages, and automated wellness video conferences initiated by virtual assistant 238 and directed toward the patient (e.g., encounter participant 228) or a third party; and/or phone calls, text messages, and video conferences initiated by the patient (e.g., encounter participant 228) or a third party and automatically processed by virtual assistant 238.

[0094] During this post-visit portion (e.g., the patient follow-up portion) of the patient encounter (e.g., encounter participant 228 visiting the doctor's office), automated clinical documentation process 10 may obtain 404 encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) from the patient (e.g., encounter participant 228) in response to the prompting by the virtual assistant (e.g., virtual assistant 238). When obtaining 404 encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) from the patient (e.g., encounter participant 228), automated clinical documentation process 10 may audibly obtain 406

encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) from the patient (e.g., encounter participant 228), thus allowing encounter participant 228 to simply verbalize their answers, wherein this information (e.g., audio encounter information 106) may be received via audio input device 30.

[0095] Automated clinical documentation process 10 may then process 302 the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) to generate an encounter transcript (e.g., encounter transcript 234), wherein at least a portion of the encounter transcript (e.g., encounter transcript 234) may be processed 304 to populate at least a portion of a medical record (e.g., medical record 236) associated with the patient encounter (e.g., a visit to a doctor's office).

Invention #4

[0096] Automated clinical documentation process 10 may be configured to monitor the interaction between the patient (e.g., encounter participant 228) and the medical professionals (e.g., a doctor, a nurse, a physician's assistant, a lab technician, a physical therapist and/or a staff member involved in the patient encounter) during the patient encounter (e.g., encounter participant 228 visiting the doctor's office) to determine if any potential medical situations are missed.

[0097] Accordingly and referring also to FIG. 7, automated clinical documentation process 10 may obtain 300 encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) of a patient encounter (e.g., a visit to a doctor's office).

[0098] As discussed above, since machine vision system 100 and audio recording system 104 may be positioned throughout monitored space 130, all of the interactions between medical professionals (e.g., encounter participant 226), patients (e.g., encounter participant 228) and third parties (e.g., encounter participant 230) that occur during the patient encounter (e.g., encounter participant 228 visiting the doctor's office) within the monitored space (e.g., monitored space 130) of the clinical environment (e.g., the doctor's

office) may be monitored / recorded / processed. Accordingly, a patient "check-in" area within monitored space 130 may be monitored to obtain encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) during this pre-visit portion of the patient encounter (e.g., encounter participant 228 visiting the doctor's office). Additionally and as discussed above, this pre-visit encounter information may be obtained via e.g., virtual assistant 238 before the patient (e.g., encounter participant 228) has entered monitored space 130. Further, various rooms within monitored space 130 may be monitored to obtain encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) during these various portions of the patient encounter (e.g., while meeting with the doctor, while vital signs and statistics are obtained, and while imaging is performed). Further, a patient "check-out" area within monitored space 130 may be monitored to obtain encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) during this post-visit portion of the patient encounter (e.g., encounter participant 228 visiting the doctor's office). Additionally and as discussed above, this post-visit encounter information may be obtained via e.g., virtual assistant 238 after the patient (e.g., encounter participant 228) has left monitored space 130. Further and via machine vision encounter information 102, visual speech recognition (via visual lip reading functionality) may be utilized by automated clinical documentation process 10 to further effectuate the gathering of audio encounter information 106.

[0099] Accordingly, a complete recording of the patient encounter (e.g., encounter participant 228 visiting the doctor's office) may be generated, wherein this encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) may be processed 302 to generate an encounter transcript (e.g., encounter transcript 234) and at least a portion of this encounter transcript (e.g., encounter transcript 234) may be processed 304 to populate at least a portion of a medical record (e.g., medical record 236) associated with the patient encounter (e.g., the visit to the doctor's office).

[00100] Automated clinical documentation process 10 may process 450 the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) to determine if the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) is indicative of a potential medical situation, wherein examples of these potential medical situations may include but are not limited to one or more of: a potential medical condition; a potential medication issue; a potential home healthcare issue; and a potential follow-up issue.

[00101] As discussed above, ACD compute system 12 may be configured to access one or more datasources (e.g., datasources 118), wherein examples of datasources 118 may include a medical conditions symptoms datasource (e.g., that defines the symptoms for various diseases and medical conditions), a prescriptions compatibility datasource (e.g., that defines groups of prescriptions that are substitutable for (or compatible with) each other), a medical insurance coverage datasource (e.g., that defines what prescriptions are covered by various medical insurance providers), and a home healthcare datasource (e.g., that defines best practices concerning when home healthcare is advisable). Accordingly, automated clinical documentation process 10 may process 450 the data included within the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) to compare this data to data defined within the datasources (e.g., datasources 118) to determine if the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) is indicative of a potential medical situation.

[00102] For example, assume that the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) indicates that the patient (e.g., encounter participant 228) mentioned during the patient encounter (e.g., encounter participant 228 visiting the doctor's office) that their wound was healing slowly. Can that be indicative of high blood sugar? Further suppose that the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106)

indicates that the patient (e.g., encounter participant 228) is quite elderly, lives alone and now needs to take injectable medication every day for the next week. Should home health care be arranged to medicate this patient? Additionally, suppose the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) indicates that the doctor (e.g., encounter participant 226) prescribed medication X. Does the patient's medical insurance cover Medication X (or do they only cover Medication Y)?

[00103] If a potential medical situation is identified, automated clinical documentation process 10 may initiate 452 an inquiry concerning the potential medical situation. When initiating 452 an inquiry concerning the potential medical situation, automated clinical documentation process 10 may provide 454 a notification (e.g., as visual information 110 and/or audio information 114) to a medical professional (e.g., a doctor, a nurse, a physician's assistant, a lab technician, a physical therapist and/or a staff member involved in the patient encounter) concerning the potential medical situation. Example of such an inquiry may be asking one or more questions, such as "Does this patient have diabetes?", "Should we arrange home healthcare for this patient?" of "Would you like to substitute Medication Y for Medication X?"

[00104] When providing 454 a notification (e.g., as visual information 110 and/or audio information 114) to a medical professional (e.g., a doctor, a nurse, a physician's assistant, a lab technician, a physical therapist and/or a staff member involved in the patient encounter) concerning the potential medical situation, automated clinical documentation process 10 may provide 456 a private text-based notification (e.g., as visual information 110) to the medical professional (e.g., a doctor, a nurse, a physician's assistant, a lab technician, a physical therapist and/or a staff member involved in the patient encounter) concerning the potential medical situation. This private text-based notification (e.g., as visual information 110) may be provided to the medical professional on e.g., a private display device, examples of which may include but are not limited to a smart phone, a table computer, a notebook computer, or a desktop computer.

[00105] When providing 454 a notification (e.g., as visual information 110 and/or audio information 114) to a medical professional (e.g., a doctor, a nurse, a physician's assistant, a lab technician, a physical therapist and/or a staff member involved in the patient encounter) concerning the potential medical situation, automated clinical documentation process 10 may provide 458 a private audio-based notification (e.g., as audio information 114) to the medical professional (e.g., a doctor, a nurse, a physician's assistant, a lab technician, a physical therapist and/or a staff member involved in the patient encounter) concerning the potential medical situation. This private audio-based notification (e.g., as audio information 114) may be provided to the medical professional on e.g., a private audio device, examples of which may include but are not limited to a smart phone, or an earbud.

[00106] Alternatively, when initiating 452 an inquiry concerning the potential medical situation, automated clinical documentation process 10 may inquire 460 about the potential medical situation via a virtual assistant (e.g., virtual assistant 238), wherein inquiring 460 about the potential medical situation via a virtual assistant (e.g., virtual assistant 238) may include verbally inquiring 462 about the potential medical situation via a virtual assistant (e.g., virtual assistant 238). For example and in such a configuration, when initiating 452 the inquiry, automated clinical documentation process 10 may inquire 460 about the potential medical situation by having virtual assistant 238 verbally (and publically) inquire 462 by asking one or more questions, such as "Does this patient have diabetes?", "Should we arrange home healthcare for this patient?" of "Would you like to substitute Medication Y for Medication X?"

Invention #5

[00107] Automated clinical documentation process 10 may be configured to simultaneously render content to multiple output devices at varying levels of detail, as it may be desirable to not broadcast certain "sensitive" content within the examination room.

[00108] Accordingly and referring also to FIG. 8, automated clinical documentation process 10 may obtain 300 encounter information (e.g., machine vision encounter

information 102 and/or audio encounter information 106) of a patient encounter (e.g., a visit to a doctor's office). Assume that during the course of the patient encounter (e.g., a visit to a doctor's office), a medical professional (e.g., a doctor, a nurse, a physician's assistant, a lab technician, a physical therapist and/or a staff member involved in the patient encounter) wishes to render a piece of content for viewing. For example and as discussed above, during the various portions of the patient encounter (e.g., a visit to a doctor's office), various procedures may occur, an example of which includes but is not limited to an imaging procedure. Accordingly, assume that the medical professional would like to display one or more images for viewing within the monitored space (e.g., monitored space 130). Accordingly, automated clinical documentation process 10 may be configured to receive 500 a request to render clinical content (e.g., an x-ray image) during a patient encounter (e.g., a visit to a doctor's office). This rendering request may be in the form of a verbal request (e.g., audio encounter information 106) that is spoken by e.g., a medical professional or a computer-based request that is initiated by the medical processional via ACD client electronic devices 28, 32.

[00109] Upon receiving 500 such a request, automated clinical documentation process 10 may determine 502 if the clinical content (e.g., the x-ray image) includes sensitive content. Examples of such sensitive content may include but are not limited to one or more of: sensitive image-based content; sensitive text-based content; sensitive prognosis-based content; sensitive diagnosis-based content; and sensitive complication-based content.

[00110] If the clinical content includes sensitive content, automated clinical documentation process 10 may render 504: a complete version of the clinical content (e.g., an x-ray image) on a first device (wherein the complete version of the clinical content includes the sensitive content) and a limited version of the clinical content (e.g., an x-ray image) on a second device (wherein the limited version of the clinical content excludes the sensitive content).

[00111] For this example, the first device may be a private device available only to one or more medical professionals of the patient encounter (e.g., a visit to a doctor's office). Examples of such private devices may include but are not limited to a visual private device and an audible private device. For this example, the second device may be a public device available to all encounter participants of the patient encounter (e.g., a visit to a doctor's office). Examples of such public devices may include but are not limited to a visual public device.

[00112] For example, assume that upon receiving 500 a request to render the clinical content (e.g., the x-ray image), automated clinical documentation process 10 determines 502 that the clinical content (e.g., the x-ray image) does include sensitive content (e.g., a strange mass). Accordingly, automated clinical documentation process 10 may render 504 a complete version of the x-ray image (that includes annotations highlighting the strange mass) on a first device e.g., a private tablet computer only accessible to the medical professional (e.g., a doctor, a nurse, a physician's assistant, a lab technician, a physical therapist and/or a staff member involved in the patient encounter). Further, automated clinical documentation process 10 may render 504 a limited version of the x-ray image (that excludes annotations highlighting the strange mass) on a second device (e.g., a wall-mounted television within monitored space 130).

[00113] As another example, automated clinical documentation process 10 may render 504 a complete version of the patient's symptoms on a second device (e.g., a wall-mounted television within monitored space 130), wherein some of these symptoms may be indicative of diabetes. Accordingly, automated clinical documentation process 10 may render 504 a private message (e.g., as a text-based message or an audio-based message) on a first device (e.g., a private tablet computer accessible to the doctor or a private earbud worn by the doctor) indicating that some of these symptoms may be indicative of diabetes and, therefore, the doctor may wish to order an A1C test.

Invention #7

[00114] Automated clinical documentation process 10 may be configured to process the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) to generate encounter transcript 234 that may be automatically formatted and punctuated.

[00115] Accordingly and referring also to FIG. 9, automated clinical documentation process 10 may be configured to obtain 300 encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) of a patient encounter (e.g., a visit to a doctor's office).

[00116] When obtaining 300 encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106), automated clinical documentation process 10 may obtain 306 the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) from a medical professional; obtain 308 the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) from a patient; and/or obtain 310 the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) from a third party. Further and when obtaining 300 encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106), automated clinical documentation process 10 may obtain 300 the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) from previous (related or unrelated) patient encounters. For example, if the current patient encounter is actually the third visit that the patient is making concerning e.g., shortness of breath, the encounter information from the previous two visits (i.e., the previous two patient encounters) may be highly-related and may be obtained 300 by automated clinical documentation process 10.

[00117] As discussed above, virtual assistant 238 may be configured to aid medical professionals (e.g., doctors, nurses, physician's assistants, lab technicians, physical therapists, scribes (e.g., a transcriptionist) and/or staff members involved in the patient

encounter) with the gathering of encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) during various portions of the patient encounter (e.g., encounter participant 228 visiting the doctor's office).

[00118] Accordingly and when obtaining 300 encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106), automated clinical documentation process 10 may utilize 312 a virtual assistant (e.g., virtual assistant 238) to prompt the patient to provide at least a portion of the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) during a pre-visit portion of the patient encounter (e.g., a visit to a doctor's office).

[00119] Further and when obtaining 300 encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106), automated clinical documentation process 10 may utilize 314 a virtual assistant (e.g., virtual assistant 238) to prompt the patient to provide at least a portion of the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) during a post-visit portion of the patient encounter (e.g., a visit to a doctor's office).

[00120] Automated clinical documentation process 10 may process 550 the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) to: associate a first portion of the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) with a first encounter participant, and associate at least a second portion of the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) with at least a second encounter participant.

[00121] As discussed above, modular ACD system 54 may be configured to form one or more audio recording beams (e.g., audio recording beams 220, 222, 224) via the discrete audio acquisition devices (e.g., discrete audio acquisition devices 202, 204, 206, 208, 210, 212, 214, 216, 218) included within audio recording system 104, wherein modular ACD system 54 may be further configured to steer the one or more audio recording

beams (e.g., audio recording beams 220, 222, 224) toward one or more encounter participants (e.g., encounter participants 226, 228, 230) of the above-described patient encounter.

[00122] Accordingly and continuing with the above-stated example, modular ACD system 54 may steer audio recording beam 220 toward encounter participant 226, may steer audio recording beam 222 toward encounter participant 228, and may steer audio recording beam 224 toward encounter participant 230. Accordingly and due to the directionality of audio recording beams 220, 222, 224, audio encounter information 106 may include three components, namely audio encounter information 106A (which is obtained via audio recording beam 220), audio encounter information 106B (which is obtained via audio recording beam 222) and audio encounter information 106C (which is obtained via audio recording beam 220).

[00123] Further and as discussed above, ACD compute system 12 may be configured to access one or more datasources 118 (e.g., plurality of individual datasources 120, 122, 124, 126, 128), examples of which may include but are not limited to one or more of a user profile datasource, a voice print datasource, a voice characteristics datasource (e.g., for adapting the automated speech recognition models), a face print datasource, a humanoid shape datasource, an utterance identifier datasource, a wearable token identifier datasource, an interaction identifier datasource, a medical conditions symptoms datasource, a prescriptions compatibility datasource, a medical insurance coverage datasource, and a home healthcare datasource.

[00124] Accordingly, automated clinical documentation process 10 may process 550 the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) to: associate a first portion (e.g., encounter information 106A) of the encounter information (e.g., audio encounter information 106) with a first encounter participant (e.g., encounter participant 226), and associate at least a second portion (e.g., encounter information 106B, 106C) of the encounter information (e.g., audio encounter

information 106) with at least a second encounter participant (e.g., encounter participants 228, 230; respectively).

[00125] Further and when processing 550 the encounter information (e.g., audio encounter information 106A, 106B, 106C), automated clinical documentation process 10 may compare each of audio encounter information 106A, 106B, 106C to the voice prints defined within the above-referenced voice print datasource so that the identity of encounter participants 226, 228, 230 (respectively) may be determined. Accordingly, if the voice print datasource includes a voice print that corresponds to one or more of the voice of encounter participant 226 (as heard within audio encounter information 106A), the voice of encounter participant 228 (as heard within audio encounter information 106B) or the voice of encounter participant 230 (as heard within audio encounter information 106C), the identity of one or more of encounter participants 226, 228, 230 may be defined. And in the event that a voice heard within one or more of audio encounter information 106A, audio encounter information 106B or audio encounter information 106C is unidentifiable, that one or more particular encounter participant may be defined as "Unknown Participant".

[00126] Once the voices of encounter participants 226, 228, 230 are processed 550, automated clinical documentation process 10 may generate 302 an encounter transcript (e.g., encounter transcript 234) based, at least in part, upon the first portion of the encounter information (e.g., audio encounter information 106A) and the at least a second portion of the encounter information (e.g., audio encounter information 106B. 106C).

Invention #8

[00127] Automated clinical documentation process 10 may be configured to automatically define roles for the encounter participants (e.g., encounter participants 226, 228, 230) in the patient encounter (e.g., a visit to a doctor's office).

[00128] Accordingly and referring also to FIG. 10, automated clinical documentation process 10 may be configured to obtain 300 encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) of a

patient encounter (e.g., a visit to a doctor's office).

[00129] Automated clinical documentation process 10 may then process 600 the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) to associate a first portion of the encounter information with a first encounter participant (e.g., encounter participant 226) and assign 602 a first role to the first encounter participant (e.g., encounter participant 226).

[00130] When processing 600 the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) to associate the first portion of the encounter information with the first encounter participant (e.g., encounter participant 226), automated clinical documentation process 10 may process 604 the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) to associate a first portion of the audio encounter information (e.g., audio encounter information 106A) with the first encounter participant (e.g., encounter participant 226).

[00131] Specifically and when processing 604 the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) to associate the first portion of the audio encounter information (e.g., audio encounter information 106A) with the first encounter participant (e.g., encounter participant 226), automated clinical documentation process 10 may compare 606 one or more voice prints (defined within voice print datasource) to one or more voices defined within the first portion of the audio encounter information (e.g., audio encounter information 106A) ; and may compare 608 one or more utterance identifiers (defined within utterance datasource) to one or more utterances defined within the first portion of the audio encounter information (e.g., audio encounter information 106A); wherein comparisons 606, 608 may allow automated clinical documentation process 10 to assign 602 a first role to the first encounter participant (e.g., encounter participant 226). For example, if the identity of encounter participant 226 can be defined via voice prints, a role for encounter participant

226 may be assigned 602 if that identity defined is associated with a role (e.g., the identity defined for encounter participant 226 is Doctor Susan Jones). Further, if an utterance made by encounter participant 226 is "I am Doctor Susan Jones", this utterance may allow a role for encounter participant 226 to be assigned 602.

[00132] When processing 600 the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) to associate the first portion of the encounter information with the first encounter participant (e.g., encounter participant 226), automated clinical documentation process 10 may process 610 the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) to associate a first portion of the machine vision encounter information (e.g., machine vision encounter information 102A) with the first encounter participant (e.g., encounter participant 226).

[00133] Specifically and when processing 610 the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) to associate the first portion of the machine vision encounter information (e.g., machine vision encounter information 102A) with the first encounter participant (e.g., encounter participant 226), automated clinical documentation process 10 may compare 612 one or more face prints (defined within face print datasource) to one or more faces defined within the first portion of the machine vision encounter information (e.g., machine vision encounter information 102A); compare 614 one or more wearable token identifiers (defined within wearable token identifier datasource) to one or more wearable tokens defined within the first portion of the machine vision encounter information (e.g., machine vision encounter information 102A); and compare 616 one or more interaction identifiers (defined within interaction identifier datasource) to one or more humanoid interactions defined within the first portion of the machine vision encounter information (e.g., machine vision encounter information 102A); wherein comparisons 612, 614, 616 may allow automated clinical documentation process 10 to assign 602 a first role to the first encounter

participant (e.g., encounter participant 226). For example, if the identity of encounter participant 226 can be defined via face prints, a role for encounter participant 226 may be assigned 602 if that identity defined is associated with a role (e.g., the identity defined for encounter participant 226 is Doctor Susan Jones). Further, if a wearable token worn by encounter participant 226 can be identified as a wearable token assigned to Doctor Susan Jones, a role for encounter participant 226 may be assigned 602. Additionally, if an interaction made by encounter participant 226 corresponds to the type of interaction that is made by a doctor, the existence of this interaction may allow a role for encounter participant 226 to be assigned 602.

[00134] Examples of such wearable tokens may include but are not limited to wearable devices that may be worn by the medical professionals when they are within monitored space 130 (or after they leave monitored space 130). For example, these wearable tokens may be worn by medical professionals when e.g., they are moving between monitored rooms within monitored space 130, travelling to and/or from monitored space 130, and/or outside of monitored space 130 (e.g., at home).

[00135] Additionally, automated clinical documentation process 10 may process 618 the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) to associate at least a second portion of the encounter information with at least a second encounter participant; and may assign 620 at least a second role to the at least a second encounter participant.

[00136] Specifically, automated clinical documentation process 10 may process 618 the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) to associate at least a second portion of the encounter information with at least a second encounter participant. For example, automated clinical documentation process 10 may process 618 the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) to associate audio encounter information 106B and machine vision encounter information 102B with

encounter participant 228 and may associate audio encounter information 106C and machine vision encounter information 102C with encounter participant 230.

[00137] Further, automated clinical documentation process 10 may assign 620 at least a second role to the at least a second encounter participant. For example, automated clinical documentation process 10 may assign 620 a role to encounter participants 228, 230.

Invention #9

[00138] Automated clinical documentation process 10 may be configured to monitor multiple encounter participants (e.g., encounter participants 226, 228, 230) within a patient encounter (e.g., a visit to a doctor's office), wherein some of these encounter participants may be identifiable via a unique voice print / profile, while others may be unidentifiable due to a lack of a unique voice print / profile.

[00139] Accordingly and referring also to FIG. 11, automated clinical documentation process 10 may be configured to obtain 300 encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) of a patient encounter (e.g., a visit to a doctor's office).

[00140] Automated clinical documentation process 10 may process 650 the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) to: associate 652 at least a first portion of the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) with at least one known encounter participant, and associate 654 at least a second portion of the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) with at least one unknown encounter participant.

[00141] As discussed above, modular ACD system 54 may be configured to form one or more audio recording beams (e.g., audio recording beams 220, 222, 224) via the discrete audio acquisition devices (e.g., discrete audio acquisition devices 202, 204, 206,

208, 210, 212, 214, 216, 218) included within audio recording system 104, wherein modular ACD system 54 may be further configured to steer the one or more audio recording beams (e.g., audio recording beams 220, 222, 224) toward one or more encounter participants (e.g., encounter participants 226, 228, 230) of the above-described patient encounter.

[00142] Accordingly and continuing with the above-stated example, modular ACD system 54 may steer audio recording beam 220 toward encounter participant 226, may steer audio recording beam 222 toward encounter participant 228, and may steer audio recording beam 224 toward encounter participant 230. Accordingly and due to the directionality of audio recording beams 220, 222, 224, audio encounter information 106 may include three components, namely audio encounter information 106A (which is obtained via audio recording beam 220), audio encounter information 106B (which is obtained via audio recording beam 222) and audio encounter information 106C (which is obtained via audio recording beam 220).

[00143] Further and as discussed above, ACD compute system 12 may be configured to access one or more datasources 118 (e.g., plurality of individual datasources 120, 122, 124, 126, 128), examples of which may include but are not limited to one or more of a user profile datasource, a voice print datasource, a voice characteristics datasource (e.g., for adapting the automated speech recognition models), a face print datasource, a humanoid shape datasource, an utterance identifier datasource, a wearable token identifier datasource, an interaction identifier datasource, a medical conditions symptoms datasource, a prescriptions compatibility datasource, a medical insurance coverage datasource, and a home healthcare datasource.

[00144] When associating 652 at least a first portion of the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) with at least one known encounter participant, automated clinical documentation process 10 may compare 656 the data included within the user profile (defined within the user

profile datasource) to the at least a first portion of the audio encounter information. The data included within the user profile may include voice-related data (e.g., a voice print that is defined locally within the user profile or remotely within the voice print datasource), language use patterns, user accent identifiers, user-defined macros, and user-defined shortcuts, for example.

[00145] Specifically and when attempting to associate 652 at least a first portion of the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) with at least one known encounter participant, automated clinical documentation process 10 may compare 656 one or more voice prints (defined within the voice print datasource) to one or more voices defined within the first portion of the audio encounter information (e.g., audio encounter information 106A); may compare 656 one or more voice prints (defined within the voice print datasource) to one or more voices defined within the second portion of the audio encounter information (e.g., audio encounter information 106B); and may compare 656 one or more voice prints (defined within the voice print datasource) to one or more voices defined within the third portion of the audio encounter information (e.g., audio encounter information 106C).

[00146] As discussed above and for this example, assume: that encounter participant 226 is a medical professional that has a voice print / profile; that encounter participant 228 is a long-term patient that has a voice print / profile; and that encounter participant 230 is a third party (the acquaintance of encounter participant 228) and, therefore, does not have a voice print / profile. Accordingly and for this example: assume that automated clinical documentation process 10 will be successful and identify encounter participant 226 when comparing 656 audio encounter information 106A to the various voice prints / profiles included within voice print datasource; assume that automated clinical documentation process 10 will be successful and identify encounter participant 228 when comparing 656 audio encounter information 106B to the various voice prints / profiles included within voice print datasource; and assume that automated clinical documentation process 10 will

be unsuccessful and not identify encounter participant 230 when comparing 656 audio encounter information 106C to the various voice prints / profiles included within voice print datasource.

[00147] Accordingly and when processing 650 the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106), automated clinical documentation process 10 may associate 652 audio encounter information 106A with the voice print / profile of Doctor Susan Jones and may identify encounter participant 226 as "Doctor Susan Jones". Automated clinical documentation process 10 may further associate 654 audio encounter information 106B with the voice print / profile of Patient Paul Smith and may identify encounter participant 228 as "Patient Paul Smith". Further, automated clinical documentation process 10 may not be able to associate 654 audio encounter information 106C with any voice prints / profiles and may identify encounter participant 230 as "Unknown Participant".

[00148] Automated clinical documentation process 10 may generate 658 an encounter transcript (e.g., encounter transcript 234) based, at least in part, upon the at least a first portion of the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) and the at least a second portion of the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106). Accordingly, automated clinical documentation process 10 may generate 658 an encounter transcript (e.g., encounter transcript 234) that identifies the verbal comments and utterances made by "Doctor Susan Jones", "Patient Paul Smith" and "Unknown Participant".

Invention #10

[00149] Automated clinical documentation process 10 may be configured to use semantic frames as an intermediary step between encounter transcript 234 and medical record 236, wherein these semantic frames may define an abstract meaning of a portion of encounter transcript and this abstract meaning may be used when populating medical

record 236.

[00150] Accordingly and referring also to FIG. 12, automated clinical documentation process 10 may be configured to obtain 300 encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) of a patient encounter (e.g., a visit to a doctor's office).

[00151] As discussed above, since machine vision system 100 and audio recording system 104 may be positioned throughout monitored space 130, all of the interactions between medical professionals (e.g., encounter participant 226), patients (e.g., encounter participant 228) and third parties (e.g., encounter participant 230) that occur during the patient encounter (e.g., encounter participant 228 visiting the doctor's office) within the monitored space (e.g., monitored space 130) of the clinical environment (e.g., the doctor's office) may be monitored / recorded / processed. Accordingly, a patient "check-in" area within monitored space 130 may be monitored to obtain encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) during this pre-visit portion of the patient encounter (e.g., encounter participant 228 visiting the doctor's office). Additionally and as discussed above, this pre-visit encounter information may be obtained via e.g., virtual assistant 238 before the patient (e.g., encounter participant 228) has entered monitored space 130. Further, various rooms within monitored space 130 may be monitored to obtain encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) during these various portions of the patient encounter (e.g., while meeting with the doctor, while vital signs and statistics are obtained, and while imaging is performed). Further, a patient "check-out" area within monitored space 130 may be monitored to obtain encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) during this post-visit portion of the patient encounter (e.g., encounter participant 228 visiting the doctor's office). Additionally and as discussed above, this post-visit encounter information may be obtained via e.g., virtual assistant 238 after the patient (e.g., encounter participant 228) has

left monitored space 130. Further and via machine vision encounter information 102, visual speech recognition (via visual lip reading functionality) may be utilized by automated clinical documentation process 10 to further effectuate the gathering of audio encounter information 106.

[00152] Accordingly, a complete recording of the patient encounter (e.g., encounter participant 228 visiting the doctor's office) may be generated, wherein this encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) may be processed 302 to generate an encounter transcript (e.g., encounter transcript 234).

[00153] As is known in the art, a semantic frame (e.g., semantic frame 240) may be a collection of facts that specify "characteristic features, attributes, and functions of a denotatum, and its characteristic interactions with things necessarily or typically associated with it." Accordingly, a semantic frame (e.g., semantic frame 240) may be defined as a coherent structure of related concepts that are related such that without knowledge of all of the related concepts, one does not have complete knowledge of any of the related concepts. Further, a semantic frame (e.g., semantic frame 240) may be based on recurring experiences, wherein e.g., a commercial transaction semantic frame may be based upon recurring experiences in the commercial transactions space. Accordingly, a semantic frame (e.g., semantic frame 240) may define an abstract meaning of a portion of an encounter transcript.

[00154] Accordingly, automated clinical documentation process 10 may generate 700 at least one semantic frame (e.g., semantic frame 240) based, at least in part, upon at least one portion of encounter transcript 234, wherein the at least one semantic frame (e.g., semantic frame 240) may define an abstract meaning for the at least one portion of encounter transcript 234.

[00155] Referring also to FIGS. 13A-13E, there are shown various illustrative examples concerning the manner in which automated clinical documentation process 10

may generate 700 at least one semantic frame (e.g., semantic frame 240) based, at least in part, upon at least one portion of encounter transcript 234, Specifically and as shown in these figures, various discrete portions of encounter transcript 234 may be mapped onto the various semantic frames.

[00156] Automated clinical documentation process 10 may then process 702 the at least one semantic frame (e.g., semantic frame 240) to populate at least a portion of a medical record (e.g., medical record 236) associated with the patient encounter (e.g., a visit to a doctor's office).

[00157] Referring also to FIGS. 14A-14B, there are shown various illustrative examples concerning the manner in which automated clinical documentation process 10 may process 702 the at least one semantic frame (e.g., semantic frame 240) to populate at least a portion of a medical record (e.g., medical record 236). Specifically and as shown in these figures, various discrete pieces of data defined within the various semantic frames (e.g., semantic frame 240) may be used to populate medical record 236.

[00158] As discussed above, virtual assistant 238 may be configured to aid medical professionals (e.g., doctors, nurses, physician's assistants, lab technicians, physical therapists, scribes (e.g., a transcriptionist) and/or staff members involved in the patient encounter) with the gathering of encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) during various portions of the patient encounter (e.g., encounter participant 228 visiting the doctor's office).

[00159] Accordingly and when obtaining 300 encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106), automated clinical documentation process 10 may utilize 312 a virtual assistant (e.g., virtual assistant 238) to prompt the patient to provide at least a portion of the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) during a pre-visit portion of the patient encounter (e.g., a visit to a doctor's office).

[00160] Further and when obtaining 300 encounter information (e.g., machine

vision encounter information 102 and/or audio encounter information 106), automated clinical documentation process 10 may utilize 314 a virtual assistant (e.g., virtual assistant 238) to prompt the patient to provide at least a portion of the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) during a post-visit portion of the patient encounter (e.g., a visit to a doctor's office).

Invention #12

[00161] Automated clinical documentation process 10 may be configured to track the movement and/or interaction of humanoid shapes within the monitored space (e.g., monitored space 130) during the patient encounter (e.g., a visit to a doctor's office) so that e.g., the automated clinical documentation process 10 knows when encounter participants (e.g., one or more of encounter participants 226, 228, 230) enter, exit or cross paths within monitored space 130.

[00162] Accordingly and referring also to FIG. 15, automated clinical documentation process 10 may process 750 the machine vision encounter information (e.g., machine vision encounter information 102) to identify one or more humanoid shapes. As discussed above, examples of machine vision system 100 generally (and ACD client electronic device 34 specifically) may include but are not limited to one or more of an RGB imaging system, an infrared imaging system, an ultraviolet imaging system, a laser imaging system, a SONAR imaging system, a RADAR imaging system, and a thermal imaging system).

[00163] When ACD client electronic device 34 includes a visible light imaging system (e.g., an RGB imaging system), ACD client electronic device 34 may be configured to monitor various objects within monitored space 130 by recording motion video in the visible light spectrum of these various objects. When ACD client electronic device 34 includes an invisible light imaging systems (e.g., a laser imaging system, an infrared imaging system and/or an ultraviolet imaging system), ACD client electronic device 34 may be configured to monitor various objects within monitored space 130 by recording

motion video in the invisible light spectrum of these various objects. When ACD client electronic device 34 includes an X-ray imaging system, ACD client electronic device 34 may be configured to monitor various objects within monitored space 130 by recording energy in the X-ray spectrum of these various objects. When ACD client electronic device 34 includes a SONAR imaging system, ACD client electronic device 34 may be configured to monitor various objects within monitored space 130 by transmitting soundwaves that may be reflected off of these various objects. When ACD client electronic device 34 includes a RADAR imaging system, ACD client electronic device 34 may be configured to monitor various objects within monitored space 130 by transmitting radio waves that may be reflected off of these various objects. When ACD client electronic device 34 includes a thermal imaging system, ACD client electronic device 34 may be configured to monitor various objects within monitored space 130 by tracking the thermal energy of these various objects.

[00164] As discussed above, ACD compute system 12 may be configured to access one or more datasources 118 (e.g., plurality of individual datasources 120, 122, 124, 126, 128), wherein examples of which may include but are not limited to one or more of a user profile datasource, a voice print datasource, a voice characteristics datasource (e.g., for adapting the automated speech recognition models), a face print datasource, a humanoid shape datasource, a humanoid shape datasource, an utterance identifier datasource, a wearable token identifier datasource, an interaction identifier datasource, a medical conditions symptoms datasource, a prescriptions compatibility datasource, a medical insurance coverage datasource, and a home healthcare datasource.

[00165] Accordingly and when processing 750 the machine vision encounter information (e.g., machine vision encounter information 102) to identify one or more humanoid shapes, automated clinical documentation process 10 may be configured to compare the humanoid shapes defined within one or more datasources 118 to potential humanoid shapes within the machine vision encounter information (e.g., machine vision

encounter information 102).

[00166] When processing 750 the machine vision encounter information (e.g., machine vision encounter information 102) to identify one or more humanoid shapes, automated clinical documentation process 10 may track 752 the movement of the one or more humanoid shapes within the monitored space (e.g., monitored space 130). For example and when tracking 752 the movement of the one or more humanoid shapes within monitored space 130, automated clinical documentation process 10 may add 754 a new humanoid shape to the one or more humanoid shapes when the new humanoid shape enters the monitored space (e.g., monitored space 130) and/or may remove 756 an existing humanoid shape from the one or more humanoid shapes when the existing humanoid shape leaves the monitored space (e.g., monitored space 130).

[00167] For example, assume that a lab technician (e.g., encounter participant 242) temporarily enters monitored space 130 to chat with encounter participant 230. Accordingly, automated clinical documentation process 10 may add 754 encounter participant 242 to the one or more humanoid shapes being tracked 752 when the new humanoid shape (i.e., encounter participant 242) enters monitored space 130. Further, assume that the lab technician (e.g., encounter participant 242) leaves monitored space 130 after chatting with encounter participant 230. Therefore, automated clinical documentation process 10 may remove 756 encounter participant 242 from the one or more humanoid shapes being tracked 752 when the humanoid shape (i.e., encounter participant 242) leaves monitored space 130.

[00168] Also and when tracking 752 the movement of the one or more humanoid shapes within monitored space 130, automated clinical documentation process 10 may monitor the trajectories of the various humanoid shapes within monitored space 130. Accordingly, assume that when leaving monitored space 130, encounter participant 242 walks in front of (or behind) encounter participant 226. As automated clinical documentation process 10 is monitoring the trajectories of (in this example) encounter

participant 242 (who is e.g., moving from left to right) and encounter participant 226 (who is e.g., stationary), when encounter participant 242 passes in front of (or behind) encounter participant 226, the identities of these two humanoid shapes may not be confused by automated clinical documentation process 10.

[00169] Automated clinical documentation process 10 may be configured to obtain 300 the encounter information of the patient encounter (e.g., a visit to a doctor's office), which may include machine vision encounter information 102 (in the manner described above) and/or audio encounter information 106.

[00170] Automated clinical documentation process 10 may steer 758 one or more audio recording beams (e.g., audio recording beams 220, 222, 224) toward the one or more humanoid shapes (e.g., encounter participants 226, 228, 230) to capture audio encounter information (e.g., audio encounter information 106), wherein audio encounter information 106 may be included within the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106).

[00171] Specifically, automated clinical documentation process 10 (via modular ACD system 54 and/or audio recording system 104) may utilize one or more of the discrete audio acquisition devices (e.g., audio acquisition devices 202, 204, 206, 208, 210, 212, 214, 216, 218) to form an audio recording beam. For example, automated clinical documentation process 10 may utilize audio acquisition device 210 to form audio recording beam 220, thus enabling the capturing of audio (e.g., speech) produced by encounter participant 226 (as audio acquisition device 210 is pointed to (i.e., directed toward) encounter participant 226). Additionally, automated clinical documentation process 10 may utilize audio acquisition devices 204, 206 to form audio recording beam 222, thus enabling the capturing of audio (e.g., speech) produced by encounter participant 228 (as audio acquisition devices 204, 206 are pointed to (i.e., directed toward) encounter participant 228). Additionally, automated clinical documentation process 10 may utilize audio acquisition devices 212, 214 to form audio recording beam 224, thus enabling the

capturing of audio (e.g., speech) produced by encounter participant 230 (as audio acquisition devices 212, 214 are pointed to (i.e., directed toward) encounter participant 230).

[00172] Once obtained, automated clinical documentation process 10 may process 302 the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) to generate encounter transcript 234 and may process 304 at least a portion of encounter transcript 234 to populate at least a portion of a medical record (e.g., medical record 236) associated with the patient encounter (e.g., a visit to a doctor's office).

Invention #13

[00173] Automated clinical documentation process 10 may be configured to filter out audio that does not belong within audio recording beams (e.g., audio recording beams 220, 222, 224) using e.g., echo cancellation and/or blind source processing.

[00174] Accordingly and referring also to FIG. 16, automated clinical documentation process 10 may be configured to obtain 300 encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) of a patient encounter (e.g., a visit to a doctor's office), wherein the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) includes first audio encounter information obtained from a first encounter participant and at least a second audio encounter information obtained from at least a second encounter participant.

[00175] When obtaining 300 encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) of a patient encounter (e.g., a visit to a doctor's office), automated clinical documentation process 10 may steer 800 a first audio recording beam toward the first encounter participant; and may steer 802 at least a second audio recording beam toward the at least a second encounter participant.

[00176] Specifically, automated clinical documentation process 10 (via modular

ACD system 54 and/or audio recording system 104) may utilize one or more of the discrete audio acquisition devices (e.g., audio acquisition devices 202, 204, 206, 208, 210, 212, 214, 216, 218) to form an audio recording beam. For example, automated clinical documentation process 10 may utilize audio acquisition device 210 to form audio recording beam 220, thus enabling the capturing of audio (e.g., speech) produced by encounter participant 226 (as audio acquisition device 210 is pointed to (i.e., directed toward) encounter participant 226). Additionally, automated clinical documentation process 10 may utilize audio acquisition devices 204, 206 to form audio recording beam 222, thus enabling the capturing of audio (e.g., speech) produced by encounter participant 228 (as audio acquisition devices 204, 206 are pointed to (i.e., directed toward) encounter participant 228). Additionally, automated clinical documentation process 10 may utilize audio acquisition devices 212, 214 to form audio recording beam 224, thus enabling the capturing of audio (e.g., speech) produced by encounter participant 230 (as audio acquisition devices 212, 214 are pointed to (i.e., directed toward) encounter participant 230).

[00177] As there is a comparatively narrow angle of separation between audio recording beam 220 and audio recording beam 224, automated clinical documentation process 10 may process 804 the first audio encounter information (e.g., audio encounter information 106A from encounter participant 226) and the at least a second audio encounter information (e.g., audio encounter information 106C from encounter participant 230) to eliminate audio interference between the first audio encounter information (e.g., audio encounter information 106A) and the at least a second audio encounter information (e.g., audio encounter information 106C).

[00178] One example of such audio interference between the first audio encounter information (e.g., audio encounter information 106A) and the at least a second audio encounter information (e.g., audio encounter information 106C) may include but is not limited to crosstalk between the first audio encounter information (e.g., audio encounter

information 106A) and the at least a second audio encounter information (e.g., audio encounter information 106C). As is known in the art, crosstalk may occur when two or more people are speaking simultaneously when e.g., speakers are interrupting each other or during what may be referred to as "active listening" (i.e., basically indicating attention and comprehension with a lot of utterances of e.g., "yes", "got it" and "hmm". Other common sounds (e.g., heavy breathing and deep breathing) by the patient may also impact automated clinical documentation process 10 and may need to be filtered out.

[00179] When processing 804 the first audio encounter information (e.g., audio encounter information 106A) and the at least a second audio encounter information (e.g., audio encounter information 106C) to eliminate audio interference, automated clinical documentation process 10 may execute 806 an echo cancellation process on the first audio encounter information (e.g., audio encounter information 106A) and the at least a second audio encounter information (e.g., audio encounter information 106C).

[00180] As is known in the art, echo cancellation is a method for improving signal quality by removing echo after it is already present. This method may be called acoustic echo suppression (AES) and acoustic echo cancellation (AEC), and more rarely line echo cancellation (LEC). In some cases, these terms are more precise, as there are various types and causes of echo with unique characteristics, including acoustic echo (sounds from a loudspeaker being reflected and recorded by a microphone, which can vary substantially over time) and line echo (electrical impulses caused by e.g., coupling between the sending and receiving wires, impedance mismatches, electrical reflections, etc., which varies much less than acoustic echo). Accordingly and in this configurations, such echo cancellation methodologies may be utilized to e.g., eliminate the echo of a second speaker that appears in the audio recording beam steered at a closely-positioned first speaker; while also eliminating the echo of the first speaker that appears in the audio recording beam steered at the closely-positioned second speaker.

[00181] When processing 804 the first audio encounter information (e.g., audio

encounter information 106A) and the at least a second audio encounter information (e.g., audio encounter information 106C) to eliminate audio interference, automated clinical documentation process 10 may execute 808 a blind source separation process on the first audio encounter information (e.g., audio encounter information 106A) and the at least a second audio encounter information (e.g., audio encounter information 106C).

[00182] As is known in the art, blind source separation is the separation of a set of source signals from a set of mixed signals, without the aid of information (or with very little information) about the source signals or the mixing process. This problem is in general highly underdetermined but useful solutions can be derived under a surprising variety of conditions. Much of the early literature in this field focuses on the separation of temporal signals such as audio. However, blind source separation is now routinely performed on multidimensional data, such as images and tensors that may involve no time dimension whatsoever. Since the chief difficulty of the problem is its underdetermination, methods for blind source separation generally seek to narrow the set of possible solutions in a way that is unlikely to exclude the desired solution. In one approach, exemplified by principal and independent component analysis, one seeks source signals that are minimally correlated or maximally independent in a probabilistic or information-theoretic sense. A second approach, exemplified by nonnegative matrix factorization, is to impose structural constraints on the source signals. These structural constraints may be derived from a generative model of the signal, but are more commonly heuristics justified by good empirical performance. A common theme in the second approach is to impose some kind of low-complexity constraint on the signal, such as sparsity in some basis for the signal space. This approach can be particularly effective if one requires not the whole signal, but merely its most salient features.

[00183] As discussed above, modular ACD system 54 and/or audio recording system 104 may be configured to utilize null-steering precoding to cancel interference between speakers and/or noise.

[00184] Once processed 804, automated clinical documentation process 10 may process 302 the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) to generate encounter transcript 234 and may process 304 at least a portion of encounter transcript 234 to populate at least a portion of a medical record (e.g., medical record 236) associated with the patient encounter (e.g., a visit to a doctor's office).

Invention #14

[00185] Automated clinical documentation process 10 may be configured to include a virtual assistant (e.g., virtual assistant 238) that is modular in design. While this virtual assistant (e.g., virtual assistant 238) may include only one persona (e.g., Nuance's Florence) for interacting with users, this virtual assistant (e.g., virtual assistant 238) may include various functionality modules that may be configured to run in parallel with each other and be added to (or removed from) the virtual assistant (e.g., virtual assistant 238) as needed

[00186] Accordingly and referring also to FIG. 17, automated clinical documentation process 10 may be configured to obtain 850 encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) via a compartmentalized virtual assistant (e.g., virtual assistant 238) during a patient encounter (e.g., a visit to a doctor's office), wherein the compartmentalized virtual assistant (e.g., virtual assistant 238) may include a core functionality module (e.g., core functionality module 244). An example of core functionality module 244 may include but is not limited to a functionality module that verbally interacts with an encounter participant (e.g., encounter participant 228) of the patient encounter (e.g., a visit to a doctor's office).

[00187] As discussed above, virtual assistant 238 may be configured to aid medical professionals (e.g., doctors, nurses, physician's assistants, lab technicians, physical therapists, scribes (e.g., a transcriptionist) and/or staff members involved in the patient encounter) with the gathering of encounter information (e.g., machine vision encounter

information 102 and/or audio encounter information 106) during various portions of the patient encounter (e.g., encounter participant 228 visiting the doctor's office). For example and during a pre-visit portion of the patient encounter (e.g., a visit to a doctor's office), the patient may be directed to a patient "check-in" area within monitored space 130, wherein the compartmentalized virtual assistant (e.g., virtual assistant 238) may verbally interact with the encounter participant (e.g., encounter participant 228). Accordingly and within this "check-in" area, automated clinical documentation process 10 may audibly obtain 852 encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) via the compartmentalized virtual assistant (e.g., virtual assistant 238).

[00188] The compartmentalized virtual assistant (e.g., virtual assistant 238) may be configured to perform various different types of functionality during the patient encounter (e.g., a visit to a doctor's office). For example and during one portion of the patient encounter (e.g., a visit to a doctor's office), the compartmentalized virtual assistant (e.g., virtual assistant 238) may require functionality to interact with a medical insurance coverage datasource to determine whether a particular medication / medical procedure that was mentioned during a patient encounter (e.g., a visit to a doctor's office) is covered by the medical insurance plan of the patient. However, during other portions of the patient encounter (e.g., a visit to a doctor's office), such functionality may not be needed. Further and during other patient encounters, such functionality may not be needed at all.

[00189] Accordingly, automated clinical documentation process 10 may be configured to add 854 one or more additional functionalities to the compartmentalized virtual assistant (e.g., virtual assistant 238) on an as-needed basis. Accordingly and if during the patient encounter (e.g., a visit to a doctor's office), a certain functionality is needed, the appropriate functionality module (e.g., functionality module 246) may be added 854 by automated clinical documentation process 10. When adding 854 one or more additional functionalities to the compartmentalized virtual assistant (e.g., virtual assistant

238) on an as-needed basis, automated clinical documentation process 10 may load 856 one or more additional functionality modules (e.g., functionality module 246) for the compartmentalized virtual assistant (e.g., virtual assistant 238) when needed to effectuate the additional functionalities. Accordingly and by only loading 856 functionality modules (e.g., functionality module 246) on an as-needed basis, modular ACD system 54 will not be unduly loaded, thus efficiently utilizing the system resources (e.g., memory resources, compute resources, network resources, etc.) of modular ACD system 54.

[00190] Further, automated clinical documentation process 10 may be configured to remove 858 one or more existing functionalities from the compartmentalized virtual assistant (e.g., virtual assistant 238) on an as-needed basis. Accordingly and when, during the patient encounter (e.g., a visit to a doctor's office) a certain functionality is no longer needed, the appropriate functionality module (e.g., functionality module 248) may be removed 858 by automated clinical documentation process 10. When removing 858 one or more existing functionalities from the compartmentalized virtual assistant (e.g., virtual assistant 238) on an as-needed basis, automated clinical documentation process 10 may unload 860 one or more existing functionality modules (e.g., functionality module 248) of the compartmentalized virtual assistant (e.g., virtual assistant 238) when no longer needed to effectuate the existing functionalities. Accordingly and by unloading 860 functionality modules (e.g., functionality module 248) on an as-needed basis, modular ACD system 54 will not be unduly loaded, thus efficiently utilizing the system resources (e.g., memory resources, compute resources, network resources, etc.) of modular ACD system 54.

[00191] Once obtained 850, automated clinical documentation process 10 may process 302 the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) to generate encounter transcript 234 and may process 304 at least a portion of encounter transcript 234 to populate at least a portion of a medical record (e.g., medical record 236) associated with the patient encounter (e.g., a visit to a doctor's office).

Invention #15

[00192] Automated clinical documentation process 10 may be configured to allow for direct interaction of various functionality modules (e.g., functionality modules 244, 246, 248) of the compartmentalized virtual assistant (e.g., virtual assistant 238), thus not requiring hub & spoke interaction of these functionality modules.

[00193] Accordingly and referring also to FIG. 18, automated clinical documentation process 10 may be configured to obtain 850 encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) via the compartmentalized virtual assistant (e.g., virtual assistant 238) during a patient encounter (e.g., a visit to a doctor's office), wherein the compartmentalized virtual assistant (e.g., virtual assistant 238) may include a plurality of functionality modules (e.g., functionality modules 244, 246, 248).

[00194] As discussed above, virtual assistant 238 may be configured to aid medical professionals (e.g., doctors, nurses, physician's assistants, lab technicians, physical therapists, scribes (e.g., a transcriptionist) and/or staff members involved in the patient encounter) with the gathering of encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) during various portions of the patient encounter (e.g., encounter participant 228 visiting the doctor's office). For example and during a pre-visit portion of the patient encounter (e.g., a visit to a doctor's office), the patient may be directed to a patient "check-in" area within monitored space 130, wherein the compartmentalized virtual assistant (e.g., virtual assistant 238) may verbally interact with the encounter participant (e.g., encounter participant 228). Accordingly and within this "check-in" area, automated clinical documentation process 10 may audibly obtain 852 encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) via the compartmentalized virtual assistant (e.g., virtual assistant 238).

[00195] When obtaining 850 encounter information (e.g., machine vision encounter

information 102 and/or audio encounter information 106), automated clinical documentation process 10 may: obtain 306 encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) from a medical professional; obtain 308 encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) from a patient; and obtain 310 encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) from a third party. Further and when obtaining 300 encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106), automated clinical documentation process 10 may obtain 300 the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) from previous (related or unrelated) patient encounters. For example, if the current patient encounter is actually the third visit that the patient is making concerning e.g., shortness of breath, the encounter information from the previous two visits (i.e., the previous two patient encounters) may be highly-related and may be obtained 300 by automated clinical documentation process 10.

[00196] Once obtained 850, automated clinical documentation process 10 may process 302 the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) to generate encounter transcript 234 and may process 304 at least a portion of encounter transcript 234 to populate at least a portion of a medical record (e.g., medical record 236) associated with the patient encounter (e.g., a visit to a doctor's office).

[00197] As will be discussed below in greater detail, automated clinical documentation process 10 may process 900 at least a portion of the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) via a first functionality module (e.g., functionality module 246) of the plurality of functionality modules (e.g., functionality modules 244, 246, 248) to generate a first result (e.g., result set 250). Automated clinical documentation process 10 may provide 902 the

first result (e.g., result set 250) to a second functionality module (e.g., functionality module 244) of the plurality of functionality modules (e.g., functionality modules 244, 246, 248). Automated clinical documentation process 10 may then process 904 the first result (e.g., result set 250) via the second functionality module (e.g., functionality module 244) to generate a second result (e.g., result set 252), which may be provided to a third functionality module (e.g., functionality module 248) of the plurality of functionality modules (e.g., functionality modules 244, 246, 248) for processing.

[00198] As discussed above, automated clinical documentation process 10 may be configured to include a virtual assistant (e.g., virtual assistant 238) that is modular in design. So while this virtual assistant (e.g., virtual assistant 238) may include only one persona (e.g., Nuance's Florence) for interacting with users, this virtual assistant (e.g., virtual assistant 238) may include various functionality modules (e.g., functionality modules 244, 246, 248) that may be configured to run in parallel with each other and effectuate different functionalities.

[00199] Accordingly, assume for this example that encounter participant 226 is going to prescribe an RA medication to encounter participant 228. Accordingly, the first functionality module (e.g., functionality module 246) may be an insurance functionality module that is configured to process 900 this portion of the encounter information and interface with a medical insurance provider of encounter participant 228 to obtain a list of covered RA medications (e.g., first result 250). Functionality module 246 may then provide 902 first result 250 to the second functionality module (e.g., functionality module 244), which may be an adverse interaction functionality module that is configured to identify any potential adverse interactions between the current medications of encounter participant 228 and the approved RA medications defined within first result 250.

Invention #16

[00200] Automated clinical documentation process 10 may be configured to utilize machine vision (e.g., an RGB imaging system, an infrared imaging system, an ultraviolet

imaging system, a SONAR imaging system, a laser imaging system, a RADAR imaging system and/or a thermal imaging system) to record a visual representation (e.g., machine vision encounter information 102) of the patient encounter (in addition to recording an audio representation (e.g., audio encounter information 106) of the patient encounter), wherein automated clinical documentation process 10 may index / synchronize the visual representation (e.g., machine vision encounter information 102) and the audio representation (e.g., audio encounter information 106) of the patient encounter to produce an encounter recording.

[00201] Accordingly and referring also to FIG. 19, automated clinical documentation process 10 may be configured to obtain 300 encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) of a patient encounter (e.g., a visit to a doctor's office), wherein the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) includes machine vision encounter information and audio encounter information.

[00202] As discussed above, virtual assistant 238 may be configured to aid medical professionals (e.g., doctors, nurses, physician's assistants, lab technicians, physical therapists, scribes (e.g., a transcriptionist) and/or staff members involved in the patient encounter) with the gathering of encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) during various portions of the patient encounter (e.g., encounter participant 228 visiting the doctor's office).

[00203] Accordingly and when obtaining 300 encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106), automated clinical documentation process 10 may utilize 312 a virtual assistant (e.g., virtual assistant 238) to prompt the patient to provide at least a portion of the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) during a pre-visit portion of the patient encounter (e.g., a visit to a doctor's office).

[00204] Further and when obtaining 300 encounter information (e.g., machine

vision encounter information 102 and/or audio encounter information 106), automated clinical documentation process 10 may utilize 314 a virtual assistant (e.g., virtual assistant 238) to prompt the patient to provide at least a portion of the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) during a post-visit portion of the patient encounter (e.g., a visit to a doctor's office).

[00205] Referring also to FIG. 20, automated clinical documentation process 10 may temporarily-align 950 machine vision encounter information 102 and audio encounter information 106 to produce temporarily-aligned encounter recording 1000, which may be rendered 952 for the user of modular ACD system 54 via ACD media player 1002. Specifically and in one particular implementation of ACD media player 1002, visual representation 1004 of the encounter information may allow the user of modular ACD system 54 to select a particular portion of encounter recording 1000 for rendering, wherein automated clinical documentation process 10 may then render the appropriate portion of machine vision encounter information 102 and audio encounter information 106 in a temporarily aligned fashion.

Invention #17

[00206] Automated clinical documentation process 10 may be configured to identify (e.g., temporally & visually) the individual encounter participants (e.g., one or more of encounter participants 226, 228, 230) within an encounter recording of a patient encounter (e.g., a visit to a doctor's office).

[00207] Accordingly and referring also to FIG. 21, automated clinical documentation process 10 may be configured to obtain 300 encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) of a patient encounter (e.g., a visit to a doctor's office), wherein the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) includes machine vision encounter information and audio encounter information).

[00208] As discussed above, virtual assistant 238 may be configured to aid medical

professionals (e.g., doctors, nurses, physician's assistants, lab technicians, physical therapists, scribes (e.g., a transcriptionist) and/or staff members involved in the patient encounter) with the gathering of encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) during various portions of the patient encounter (e.g., encounter participant 228 visiting the doctor's office).

[00209] Accordingly and when obtaining 300 the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106), automated clinical documentation process 10 may utilize 312 a virtual assistant (e.g., virtual assistant 238) to prompt the patient to provide at least a portion of the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) during a pre-visit portion of the patient encounter (e.g., a visit to a doctor's office).

[00210] Further and when obtaining 300 encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106), automated clinical documentation process 10 may utilize 314 a virtual assistant (e.g., virtual assistant 238) to prompt the patient to provide at least a portion of the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) during a post-visit portion of the patient encounter (e.g., a visit to a doctor's office).

[00211] Automated clinical documentation process 10 may generate 1050 an encounter transcript based, at least in part, upon the first portion of the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) and the at least a second portion of the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106).

[00212] Automated clinical documentation process 10 may process 1052 the information (e.g., machine vision encounter information 102 and/or audio encounter information 106) information to: associate a first portion (e.g., machine vision encounter information 102A and/or audio encounter information 106A) of the encounter information

(e.g., machine vision encounter information 102 and/or audio encounter information 106) with a first encounter participant (e.g., encounter participant 226), and associate at least a second portion (e.g., machine vision encounter information 102B and/or audio encounter information 106B) of the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) with at least a second encounter participant (e.g., encounter participant 228). The association of these various encounter information portions with the various encounter participants may be accomplished in one or more of the methodologies described above (via the use of one or more of voice prints, face prints, wearable tokens, utterances, interactions, etc.).

[00213] Once the above-described associations are made, automated clinical documentation process 10 may render 1054 a visual representation (e.g., visual representation 1004) of the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106). As discussed above, visual representation 1004 of the encounter information may allow the user of modular ACD system 54 to select a particular portion of encounter recording 1000 for rendering.

[00214] Automated clinical documentation process 10 may render 1056 a first visual representation (e.g., first visual representation 1006) of the first portion (e.g., machine vision encounter information 102A and/or audio encounter information 106A) of the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) that is temporally-aligned with visual representation 1004 of the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106). Specifically, first visual representation 1006 may be visually indicative of the portions of the encounter information during which the first encounter participant (e.g., encounter participant 226) was speaking (as illustrated by darker grey portions versus lighter grey portions).

[00215] Further, automated clinical documentation process 10 may render 1058 at least a second visual representation (e.g., second visual representation 1008) of the at least

a second portion (e.g., machine vision encounter information 102B and/or audio encounter information 106B) of the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) that is temporally-aligned with visual representation 1004 of the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106). Specifically, second visual representation 1008 may be visually indicative of the portions of the encounter information during which the second encounter participant (e.g., encounter participant 228) was speaking (as illustrated by darker grey portions versus lighter grey portions).

[00216] Additionally, automated clinical documentation process 10 may be configured to allow the user of modular ACD system 54 to filter 1060 the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) based upon one or more of the first visual representation (e.g., first visual representation 1006) and the at least a second visual representation (e.g., second visual representation 1008). For example, the user of modular ACD system 54 may select (e.g., via clicking) the appropriate visual representation (or appropriate visual representations) and automated clinical documentation process 10 may filter 1060 encounter recording 1000 based upon the user selections.

Invention #18

[00217] Automated clinical documentation process 10 may be configured to identify (e.g., temporally & visually) the individual portions of an encounter recording of a patient encounter (e.g., a visit to a doctor's office).

[00218] Accordingly and referring also to FIG. 22, automated clinical documentation process 10 may be configured to obtain 300 encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) of a patient encounter (e.g., a visit to a doctor's office). When obtaining 300 encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106), automated clinical documentation process 10 may: obtain 306 encounter

information (e.g., machine vision encounter information 102 and/or audio encounter information 106) from a medical professional (e.g., encounter participant 226); obtain 308 encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) from a patient (e.g., encounter participant 228); and/or obtain 310 encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) from a third party (e.g., encounter participant 230). Further and when obtaining 300 encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106), automated clinical documentation process 10 may obtain 300 the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) from previous (related or unrelated) patient encounters. For example, if the current patient encounter is actually the third visit that the patient is making concerning e.g., shortness of breath, the encounter information from the previous two visits (i.e., the previous two patient encounters) may be highly-related and may be obtained 300 by automated clinical documentation process 10.

[00219] As discussed above, virtual assistant 238 may be configured to aid medical professionals (e.g., doctors, nurses, physician's assistants, lab technicians, physical therapists, scribes (e.g., a transcriptionist) and/or staff members involved in the patient encounter) with the gathering of encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) during various portions of the patient encounter (e.g., encounter participant 228 visiting the doctor's office).

[00220] Accordingly and when obtaining 300 encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106), automated clinical documentation process 10 may utilize 312 a virtual assistant (e.g., virtual assistant 238) to prompt the patient to provide at least a portion of the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) during a pre-visit portion of the patient encounter (e.g., a visit to a doctor's office).

[00221] Further and when obtaining 300 encounter information (e.g., machine

vision encounter information 102 and/or audio encounter information 106), automated clinical documentation process 10 may utilize 314 a virtual assistant (e.g., virtual assistant 238) to prompt the patient to provide at least a portion of the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) during a post-visit portion of the patient encounter (e.g., a visit to a doctor's office).

[00222] Automated clinical documentation process 10 may process 1100 the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) to: associate a first portion of the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) with a first patient encounter portion (e.g., a pre-visit portion), and associate at least a second portion of the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) with at least a second patient encounter portion (e.g., the visit portion). The association of these various encounter information portions with the various patient encounter portions may be accomplished in one or more of the methodologies described above (via the use of one or more of voice prints, face prints, wearable tokens, utterances, interactions, etc., as well as the specific locations within monitored space 130 in which the various portions of the encounter information were generated).

[00223] Once the above-described associations are made, automated clinical documentation process 10 may render 1102 a visual representation (e.g., visual representation 1004) of the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106). As discussed above, visual representation 1004 of the encounter information may allow the user of modular ACD system 54 to select a particular portion of encounter recording 1000 for rendering.

[00224] Automated clinical documentation process 10 may render 1104 a first visual representation (e.g., first visual representation 1010) of the first portion (e.g., a pre-visit portion) of the encounter information (e.g., machine vision encounter information 102

and/or audio encounter information 106) that is temporally-aligned with the visual representation 1004 of the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106). Specifically, first visual representation 1010 may be visually indicative of the pre-visit portion of the encounter information.

[00225] Automated clinical documentation process 10 may render 1106 at least a second visual representation (e.g., second visual representation 1012) of the at least a second portion (e.g., a visit portion) of the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) that is temporally-aligned with visual representation 1004 of the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106). Specifically, second visual representation 1012 may be visually indicative of the visit portion of the encounter information.

[00226] Additionally, automated clinical documentation process 10 may be configured to allow the user of modular ACD system 54 to filter 1108 the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) based upon one or more of the first visual representation (e.g., first visual representation 1010) and the at least a second visual representation (e.g., second visual representation 1012). For example, the user of modular ACD system 54 may select (e.g., via clicking) the appropriate visual representation (or appropriate visual representations) and automated clinical documentation process 10 may filter 1108 encounter recording 1000 based upon the user selections.

Invention #19

[00227] Automated clinical documentation process 10 may be configured to reactively identify (at the request of a user) the various portions of the encounter recording that are indicative of a specific medical condition.

[00228] Accordingly and referring also to FIG. 23, automated clinical

documentation process 10 may be configured to obtain 300 encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) of a patient encounter (e.g., a visit to a doctor's office).

[00229] As discussed above, virtual assistant 238 may be configured to aid medical professionals (e.g., doctors, nurses, physician's assistants, lab technicians, physical therapists, scribes (e.g., a transcriptionist) and/or staff members involved in the patient encounter) with the gathering of encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) during various portions of the patient encounter (e.g., encounter participant 228 visiting the doctor's office).

[00230] Accordingly and when obtaining 300 encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106), automated clinical documentation process 10 may utilize 312 a virtual assistant (e.g., virtual assistant 238) to prompt the patient to provide at least a portion of the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) during a pre-visit portion of the patient encounter (e.g., a visit to a doctor's office).

[00231] Further and when obtaining 300 encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106), automated clinical documentation process 10 may utilize 314 a virtual assistant (e.g., virtual assistant 238) to prompt the patient to provide at least a portion of the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) during a post-visit portion of the patient encounter (e.g., a visit to a doctor's office).

[00232] As discussed above, since machine vision system 100 and audio recording system 104 may be positioned throughout monitored space 130, all of the interactions between medical professionals (e.g., encounter participant 226), patients (e.g., encounter participant 228) and third parties (e.g., encounter participant 230) that occur during the patient encounter (e.g., encounter participant 228 visiting the doctor's office) within the monitored space (e.g., monitored space 130) of the clinical environment (e.g., the doctor's

office) may be monitored / recorded / processed. Accordingly, a patient "check-in" area within monitored space 130 may be monitored to obtain encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) during this pre-visit portion of the patient encounter (e.g., encounter participant 228 visiting the doctor's office). Additionally and as discussed above, this pre-visit encounter information may be obtained via e.g., virtual assistant 238 before the patient (e.g., encounter participant 228) has entered monitored space 130. Further, various rooms within monitored space 130 may be monitored to obtain encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) during these various portions of the patient encounter (e.g., while meeting with the doctor, while vital signs and statistics are obtained, and while imaging is performed). Further, a patient "check-out" area within monitored space 130 may be monitored to obtain encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) during this post-visit portion of the patient encounter (e.g., encounter participant 228 visiting the doctor's office). Additionally and as discussed above, this post-visit encounter information may be obtained via e.g., virtual assistant 238 after the patient (e.g., encounter participant 228) has left monitored space 130. Further and via machine vision encounter information 102, visual speech recognition (via visual lip reading functionality) may be utilized by automated clinical documentation process 10 to further effectuate the gathering of audio encounter information 106.

[00233] Accordingly, a complete recording of the patient encounter (e.g., encounter participant 228 visiting the doctor's office) may be generated, wherein this encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) may be processed 302 to generate an encounter transcript (e.g., encounter transcript 234) and at least a portion of this encounter transcript (e.g., encounter transcript 234) may be processed 304 to populate at least a portion of a medical record (e.g., medical record 236) associated with the patient encounter (e.g., the visit to the doctor's office).

[00234] Automated clinical documentation process 10 may receive 1150 a request from a user (e.g., a user of modular ACD system 54) concerning a specific medical condition. When receiving 1150 a request from a user (e.g., a user of modular ACD system 54), automated clinical documentation process 10 may: receive 1152 a verbal request from the user (e.g., a user of modular ACD system 54) concerning the specific medical condition; and/or receive 1154 a text-based request from the user (e.g., a user of modular ACD system 54) concerning the specific medical condition.

[00235] For example, assume that the user of modular ACD system 54 is encounter participant 226 (e.g., the doctor) who is examining encounter participant 228 (e.g., the patient). Accordingly, assume that encounter participant 226 (e.g., the doctor) is concerned that encounter participant 228 (e.g., the patient) may have diabetes. Accordingly, automated clinical documentation process 10 may receive 1150 a request (either verbal or text-based) from encounter participant 226 requesting that automated clinical documentation process 10 identify any portions of the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) that may be indicative of the presence of diabetes with respect to encounter participant 228.

[00236] In response to receiving 1150 the request, automated clinical documentation process 10 may process 1156 the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) to determine if the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) is indicative of this specific medical condition and to generate a result set.

[00237] As discussed above, ACD compute system 12 may be configured to access one or more datasources 118 (e.g., plurality of individual datasources 120, 122, 124, 126, 128), examples of which may include but are not limited to one or more of a user profile datasource, a voice print datasource, a voice characteristics datasource (e.g., for adapting the automated speech recognition models), a face print datasource, a humanoid shape

datasource, an utterance identifier datasource, a wearable token identifier datasource, an interaction identifier datasource, a medical conditions symptoms datasource, a prescriptions compatibility datasource, a medical insurance coverage datasource, and a home healthcare datasource.

[00238] Accordingly, automated clinical documentation process 10 may access the appropriate datasource to identify the symptoms for diabetes and may compare those identified symptoms to the data included within the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106).

[00239] When processing 1156 the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106), automated clinical documentation process 10 may identify 1158 one or more portions of the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) that concern the specific medical condition (in this example, diabetes), thus defining one or more condition-related encounter potions. Automated clinical documentation process 10 may then filter 1160 the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) to highlight the one or more condition-related encounter portions (thus defining result set 1016).

[00240] Automated clinical documentation process 10 may then provide 1162 result set 1016 to the user (e.g., encounter participant 226). When providing 1162 result set 1016 to the user (e.g., encounter participant 226), automated clinical documentation process 10 may render 1164 a visual representation of result set 1016 for the user (e.g., encounter participant 226) and/or may render 1166 an audible representation of result set 1016 for the user (e.g., encounter participant 226).

[00241] For example, automated clinical documentation process 10 may provide 1162 result set 1016 to encounter participant 226 in the manner shown in FIG. 20, wherein result set 1016 is visually indicative of the portions of the encounter information that concern a specific medical condition (in this example, diabetes). Additionally /

alternatively, automated clinical documentation process 10 may provide 1162 result set 1016 as a private verbal message (e.g., that is rendered on an earbud worn by encounter participant 226) that provides the information requested by encounter participant 226 (e.g., "There are 23 portions of this patient encounter that indicate that this patient may have diabetes. An A1C test is recommended".

Invention #20

[00242] Automated clinical documentation process 10 may be configured to proactively scan the entire encounter recording to identify any specific medical conditions.

[00243] Accordingly and referring also to FIG. 24, automated clinical documentation process 10 may be configured to obtain 300 encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) of a patient encounter (e.g., a visit to a doctor's office).

[00244] As discussed above, virtual assistant 238 may be configured to aid medical professionals (e.g., doctors, nurses, physician's assistants, lab technicians, physical therapists, scribes (e.g., a transcriptionist) and/or staff members involved in the patient encounter) with the gathering of encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) during various portions of the patient encounter (e.g., encounter participant 228 visiting the doctor's office).

[00245] Accordingly and when obtaining 300 encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106), automated clinical documentation process 10 may utilize 312 a virtual assistant (e.g., virtual assistant 238) to prompt the patient to provide at least a portion of the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) during a pre-visit portion of the patient encounter (e.g., a visit to a doctor's office).

[00246] Further and when obtaining 300 encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106), automated clinical documentation process 10 may utilize 314 a virtual assistant (e.g., virtual assistant

238) to prompt the patient to provide at least a portion of the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) during a post-visit portion of the patient encounter (e.g., a visit to a doctor's office).

[00247] As discussed above, since machine vision system 100 and audio recording system 104 may be positioned throughout monitored space 130, all of the interactions between medical professionals (e.g., encounter participant 226), patients (e.g., encounter participant 228) and third parties (e.g., encounter participant 230) that occur during the patient encounter (e.g., encounter participant 228 visiting the doctor's office) within the monitored space (e.g., monitored space 130) of the clinical environment (e.g., the doctor's office) may be monitored / recorded / processed. Accordingly, a patient "check-in" area within monitored space 130 may be monitored to obtain encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) during this pre-visit portion of the patient encounter (e.g., encounter participant 228 visiting the doctor's office). Additionally and as discussed above, this pre-visit encounter information may be obtained via e.g., virtual assistant 238 before the patient (e.g., encounter participant 228) has entered monitored space 130. Further, various rooms within monitored space 130 may be monitored to obtain encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) during these various portions of the patient encounter (e.g., while meeting with the doctor, while vital signs and statistics are obtained, and while imaging is performed). Further, a patient "check-out" area within monitored space 130 may be monitored to obtain encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) during this post-visit portion of the patient encounter (e.g., encounter participant 228 visiting the doctor's office). Additionally and as discussed above, this post-visit encounter information may be obtained via e.g., virtual assistant 238 after the patient (e.g., encounter participant 228) has left monitored space 130. Further and via machine vision encounter information 102, visual speech recognition (via visual lip reading functionality) may be utilized by

automated clinical documentation process 10 to further effectuate the gathering of audio encounter information 106.

[00248] Accordingly, a complete recording of the patient encounter (e.g., encounter participant 228 visiting the doctor's office) may be generated, wherein this encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) may be processed 302 to generate an encounter transcript (e.g., encounter transcript 234) and at least a portion of this encounter transcript (e.g., encounter transcript 234) may be processed 304 to populate at least a portion of a medical record (e.g., medical record 236) associated with the patient encounter (e.g., the visit to the doctor's office).

[00249] Automated clinical documentation process 10 may proactively process 1200 the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) to determine if the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) is indicative of one or more medical conditions and to generate one or more result sets. For example, automated clinical documentation process 10 may continuously (or regularly) scan the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) to determine if this encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) is indicative of one or more medical conditions.

[00250] As discussed above, ACD compute system 12 may be configured to access one or more datasources 118 (e.g., plurality of individual datasources 120, 122, 124, 126, 128), examples of which may include but are not limited to one or more of a user profile datasource, a voice print datasource, a voice characteristics datasource (e.g., for adapting the automated speech recognition models), a face print datasource, a humanoid shape datasource, an utterance identifier datasource, a wearable token identifier datasource, an interaction identifier datasource, a medical conditions symptoms datasource, a prescriptions compatibility datasource, a medical insurance coverage datasource, and a

home healthcare datasource. Accordingly, automated clinical documentation process 10 may proactively access the appropriate datasource to identify the symptoms of various medical conditions (e.g., diabetes) and may compare the identified symptoms of the various medical conditions to the data included within the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106).

[00251] When proactively processing 1200 the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106), automated clinical documentation process 10 may identify 1202 one or more portions of the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) that concern one or more medical conditions, thus defining one or more condition-related encounter potions. Automated clinical documentation process 10 may then filter 1204 the encounter information (e.g., machine vision encounter information 102 and/or audio encounter information 106) to highlight the one or more condition-related encounter portions.

[00252] Automated clinical documentation process 10 may provide 1206 the one or more result sets (e.g., result set 1016) to the user (e.g., encounter participant 226). The one or more result sets (e.g., result set 1016) may include: a first result set indicative of a first medical condition; and at least a second result set indicative of at least a second medical condition. For example, while FIG. 20 illustrates a single / consolidated result set, this is for illustrative purpose only and is not intended to be a limitation of this disclosure, as other configurations are possible and are considered to be within the scope of this disclosure. For example, assume that automated clinical documentation process 10 found (within the encounter information) data that indicates that encounter participant 228 may have diabetes and may have heart disease. Accordingly and in such a situation, result set 1016 may include a first result set that is indicative of diabetes and a second result set indicative of heart disease.

[00253] When providing 1206 the one or more result sets (e.g., result set 1016) to

the user (e.g., encounter participant 226), automated clinical documentation process 10 may render 1208 a visual representation of the one or more result sets (e.g., result set 1016) for the user (e.g., encounter participant 226) and/or may render 1210 an audible representation of the one or more result sets (e.g., result set 1016) for the user (e.g., encounter participant 226).

[00254] For example, automated clinical documentation process 10 may provide 1206 result set 1016 to encounter participant 226 in the manner shown in FIG. 20, wherein result set 1016 is visually indicative of the portions of the encounter information that concern a specific medical condition (in this example, diabetes and/or heart disease). Additionally / alternatively, automated clinical documentation process 10 may provide 1206 result set 1016 as a private verbal message (e.g., that is rendered on an earbud worn by encounter participant 226) that provides the information requested by encounter participant 226 (e.g., "There are 23 portions of this patient encounter that indicate that this patient may have diabetes. An A1C test is recommended There are 16 portions of this patient encounter that indicate that this patient may have heart disease. An echocardiogram is recommended."

General:

[00255] As will be appreciated by one skilled in the art, the present disclosure may be embodied as a method, a system, or a computer program product. Accordingly, the present disclosure may take the form of an entirely hardware embodiment, an entirely software embodiment (including firmware, resident software, micro-code, etc.) or an embodiment combining software and hardware aspects that may all generally be referred to herein as a "circuit," "module" or "system." Furthermore, the present disclosure may take the form of a computer program product on a computer-usable storage medium having computer-usable program code embodied in the medium.

[00256] Any suitable computer usable or computer readable medium may be utilized. The computer-usable or computer-readable medium may be, for example but not

limited to, an electronic, magnetic, optical, electromagnetic, infrared, or semiconductor system, apparatus, device, or propagation medium. More specific examples (a non-exhaustive list) of the computer-readable medium may include the following: an electrical connection having one or more wires, a portable computer diskette, a hard disk, a random access memory (RAM), a read-only memory (ROM), an erasable programmable read-only memory (EPROM or Flash memory), an optical fiber, a portable compact disc read-only memory (CD-ROM), an optical storage device, a transmission media such as those supporting the Internet or an intranet, or a magnetic storage device. The computer-usable or computer-readable medium may also be paper or another suitable medium upon which the program is printed, as the program can be electronically captured, via, for instance, optical scanning of the paper or other medium, then compiled, interpreted, or otherwise processed in a suitable manner, if necessary, and then stored in a computer memory. In the context of this document, a computer-usable or computer-readable medium may be any medium that can contain, store, communicate, propagate, or transport the program for use by or in connection with the instruction execution system, apparatus, or device. The computer-usable medium may include a propagated data signal with the computer-usable program code embodied therewith, either in baseband or as part of a carrier wave. The computer usable program code may be transmitted using any appropriate medium, including but not limited to the Internet, wireline, optical fiber cable, RF, etc.

[00257] Computer program code for carrying out operations of the present disclosure may be written in an object oriented programming language such as Java, Smalltalk, C++ or the like. However, the computer program code for carrying out operations of the present disclosure may also be written in conventional procedural programming languages, such as the "C" programming language or similar programming languages. The program code may execute entirely on the user's computer, partly on the user's computer, as a stand-alone software package, partly on the user's computer and partly on a remote computer or entirely on the remote computer or server. In the latter scenario,

the remote computer may be connected to the user's computer through a local area network / a wide area network / the Internet (e.g., network 14).

[00258] The present disclosure is described with reference to flowchart illustrations and/or block diagrams of methods, apparatus (systems) and computer program products according to embodiments of the disclosure. It will be understood that each block of the flowchart illustrations and/or block diagrams, and combinations of blocks in the flowchart illustrations and/or block diagrams, may be implemented by computer program instructions. These computer program instructions may be provided to a processor of a general purpose computer / special purpose computer / other programmable data processing apparatus, such that the instructions, which execute via the processor of the computer or other programmable data processing apparatus, create means for implementing the functions/acts specified in the flowchart and/or block diagram block or blocks.

[00259] These computer program instructions may also be stored in a computer-readable memory that may direct a computer or other programmable data processing apparatus to function in a particular manner, such that the instructions stored in the computer-readable memory produce an article of manufacture including instruction means which implement the function/act specified in the flowchart and/or block diagram block or blocks.

[00260] The computer program instructions may also be loaded onto a computer or other programmable data processing apparatus to cause a series of operational steps to be performed on the computer or other programmable apparatus to produce a computer implemented process such that the instructions which execute on the computer or other programmable apparatus provide steps for implementing the functions/acts specified in the flowchart and/or block diagram block or blocks.

[00261] The flowcharts and block diagrams in the figures may illustrate the architecture, functionality, and operation of possible implementations of systems, methods

and computer program products according to various embodiments of the present disclosure. In this regard, each block in the flowchart or block diagrams may represent a module, segment, or portion of code, which comprises one or more executable instructions for implementing the specified logical function(s). It should also be noted that, in some alternative implementations, the functions noted in the block may occur out of the order noted in the figures. For example, two blocks shown in succession may, in fact, be executed substantially concurrently, or the blocks may sometimes be executed in the reverse order, depending upon the functionality involved. It will also be noted that each block of the block diagrams and/or flowchart illustrations, and combinations of blocks in the block diagrams and/or flowchart illustrations, may be implemented by special purpose hardware-based systems that perform the specified functions or acts, or combinations of special purpose hardware and computer instructions.

[00262] The terminology used herein is for the purpose of describing particular embodiments only and is not intended to be limiting of the disclosure. As used herein, the singular forms "a", "an" and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will be further understood that the terms "comprises" and/or "comprising," when used in this specification, specify the presence of stated features, integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, integers, steps, operations, elements, components, and/or groups thereof.

[00263] The corresponding structures, materials, acts, and equivalents of all means or step plus function elements in the claims below are intended to include any structure, material, or act for performing the function in combination with other claimed elements as specifically claimed. The description of the present disclosure has been presented for purposes of illustration and description, but is not intended to be exhaustive or limited to the disclosure in the form disclosed. Many modifications and variations will be apparent to those of ordinary skill in the art without departing from the scope and spirit of the

disclosure. The embodiment was chosen and described in order to best explain the principles of the disclosure and the practical application, and to enable others of ordinary skill in the art to understand the disclosure for various embodiments with various modifications as are suited to the particular use contemplated.

[00264] A number of implementations have been described. Having thus described the disclosure of the present application in detail and by reference to embodiments thereof, it will be apparent that modifications and variations are possible without departing from the scope of the disclosure defined in the appended claims.

What Is Claimed Is:

Invention #19

1. A computer-implemented method for reactive encounter scanning, executed on a computing device, comprising:

obtaining encounter information of a patient encounter;

receiving a request from a user concerning a specific medical condition;

in response to receiving the request, processing the encounter information to determine if the encounter information is indicative of the specific medical condition and to generate a result set; and

providing the result set to the user.

2. The computer-implemented method of claim 1 wherein receiving a request from a user includes one or more of:

receiving a verbal request from the user concerning the specific medical condition; and

receiving a text-based request from the user concerning the specific medical condition.

3. The computer-implemented method of claim 1 wherein processing the encounter information includes:

identifying one or more portions of the encounter information that concern the specific medical condition, thus defining one or more condition-related encounter potions.

4. The computer-implemented method of claim 3 wherein processing the encounter information further includes:

filtering the encounter information to highlight the one or more condition-

related encounter portions.

5. The computer-implemented method of claim 1 wherein providing the result set to the user includes:

rendering a visual representation of the result set for the user.

6. The computer-implemented method of claim 1 wherein providing the result set to the user includes:

rendering an audible representation of the result set for the user.

7. The computer-implemented method of claim 1 wherein obtaining encounter information includes one or more of:

utilizing a virtual assistant to prompt the patient to provide at least a portion of the encounter information during a pre-visit portion of the patient encounter; and

utilizing a virtual assistant to prompt the patient to provide at least a portion of the encounter information during a post-visit portion of the patient encounter.

8. A computer program product residing on a computer readable medium having a plurality of instructions stored thereon which, when executed by a processor, cause the processor to perform operations comprising:

obtaining encounter information of a patient encounter;

receiving a request from a user concerning a specific medical condition;

in response to receiving the request, processing the encounter information to determine if the encounter information is indicative of the specific medical condition and to generate a result set; and

providing the result set to the user.

9. The computer program product of claim 8 wherein receiving a request from a user includes one or more of:

receiving a verbal request from the user concerning the specific medical condition; and

receiving a text-based request from the user concerning the specific medical condition.

10. The computer program product of claim 8 wherein processing the encounter information includes:

identifying one or more portions of the encounter information that concern the specific medical condition, thus defining one or more condition-related encounter potions.

11. The computer program product of claim 10 wherein processing the encounter information further includes:

filtering the encounter information to highlight the one or more condition-related encounter portions.

12. The computer program product of claim 8 wherein providing the result set to the user includes:

rendering a visual representation of the result set for the user.

13. The computer program product of claim 8 wherein providing the result set to the user includes:

rendering an audible representation of the result set for the user.

14. The computer program product of claim 8 wherein obtaining encounter information includes one or more of:

utilizing a virtual assistant to prompt the patient to provide at least a portion of the encounter information during a pre-visit portion of the patient encounter; and

utilizing a virtual assistant to prompt the patient to provide at least a portion of the encounter information during a post-visit portion of the patient encounter.

15. A computing system including a processor and memory configured to perform operations comprising:

obtaining encounter information of a patient encounter;

receiving a request from a user concerning a specific medical condition;

in response to receiving the request, processing the encounter information to determine if the encounter information is indicative of the specific medical condition and to generate a result set; and

providing the result set to the user.

16. The computing system of claim 15 wherein receiving a request from a user includes one or more of:

receiving a verbal request from the user concerning the specific medical condition; and

receiving a text-based request from the user concerning the specific medical condition.

17. The computing system of claim 15 wherein processing the encounter information includes:

identifying one or more portions of the encounter information that concern the specific medical condition, thus defining one or more condition-related encounter potions.

18. The computing system of claim 17 wherein processing the encounter information further includes:

filtering the encounter information to highlight the one or more condition-related encounter portions.

19. The computing system of claim 15 wherein providing the result set to the user includes:

rendering a visual representation of the result set for the user.

20. The computing system of claim 15 wherein providing the result set to the user includes:

rendering an audible representation of the result set for the user.

21. The computing system of claim 15 wherein obtaining encounter information includes one or more of:

utilizing a virtual assistant to prompt the patient to provide at least a portion of the encounter information during a pre-visit portion of the patient encounter; and

utilizing a virtual assistant to prompt the patient to provide at least a portion of the encounter information during a post-visit portion of the patient encounter.

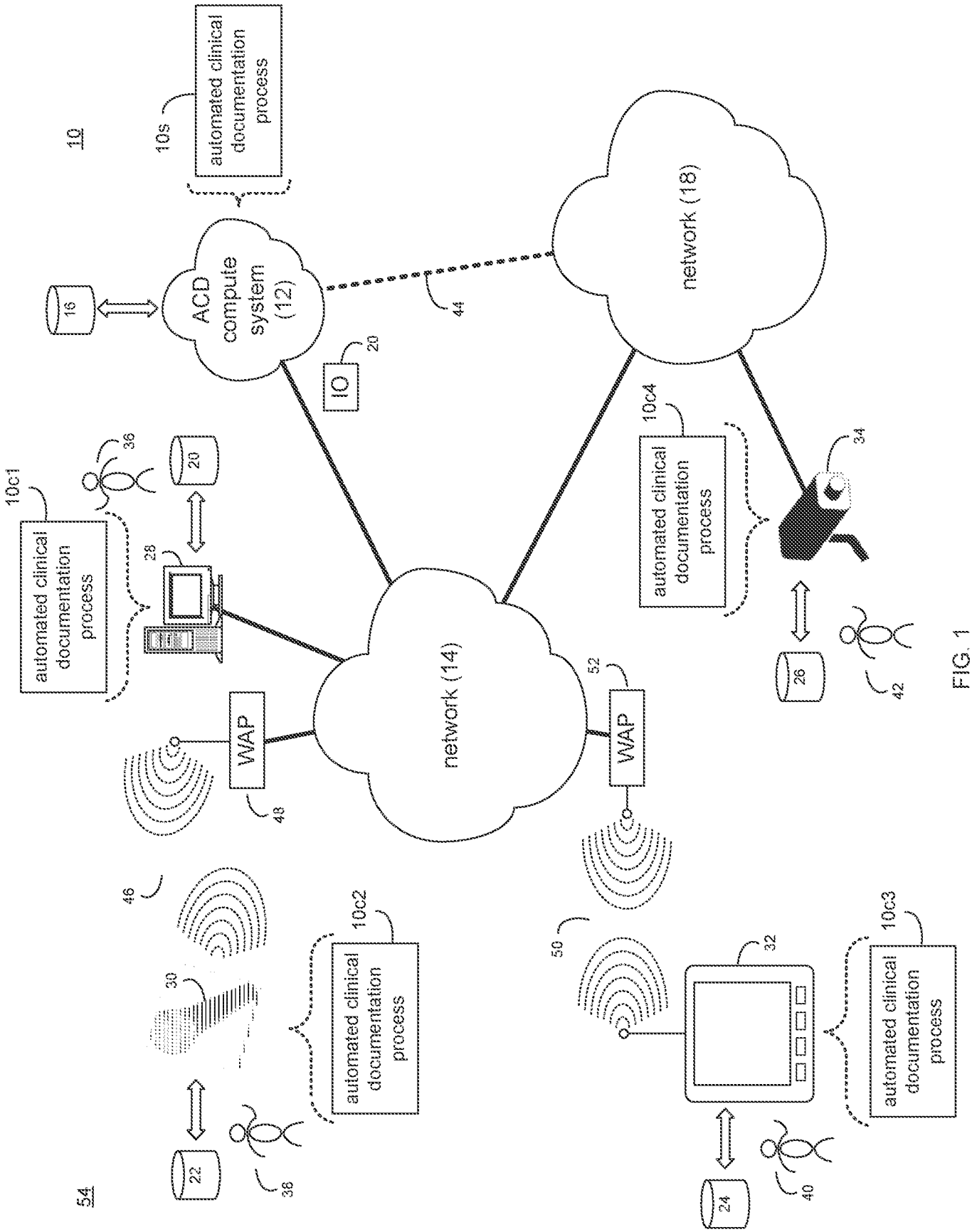
10
10s
automated clinical documentation process
16
ACD compute system (12)
44
network (18)
20
IO
10c1
automated clinical documentation process
36
20
28
10c4
automated clinical documentation process
34
26
42
network (14)
WAP
48
52
WAP
46
30
10c2
automated clinical documentation process
22
38
54
50
32
10c3
automated clinical documentation process
24
40

FIG. 1

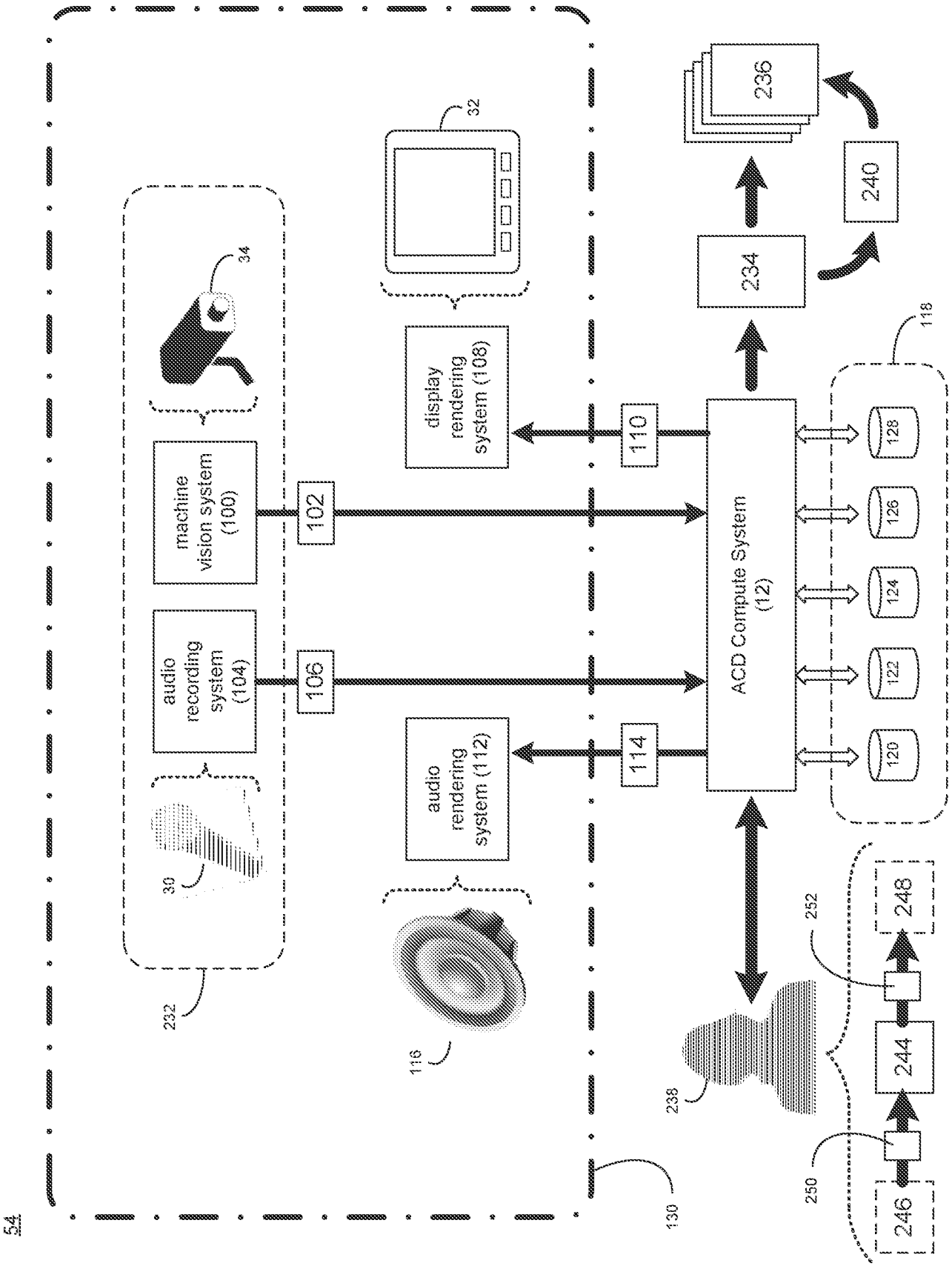
54
232
30
audio recording system (104)
34
machine vision system (100)
106
102
116
audio rendering system (112)
114
32
display rendering system (108)
110
130
ACD Compute System (12)
118
120
122
124
126
128
238
234
236
240
250
244
246
252
248

FIG. 2

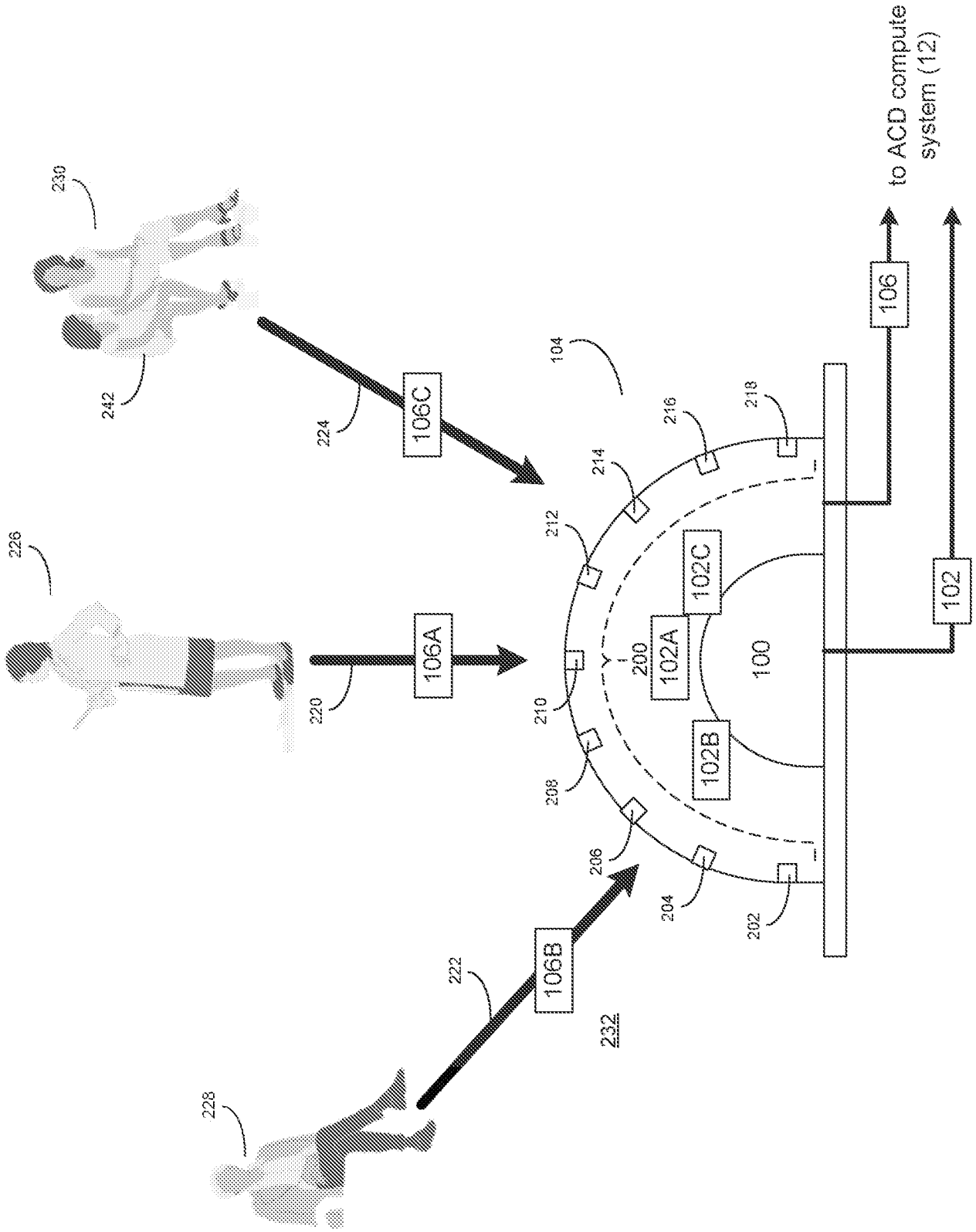
230
242
224
106C
226
220
106A
228
222
106B
232
104
202
204
206
208
210
212
214
216
218
200
102A
102B
102C
100
106
102
to ACD compute system (12)

FIG. 3

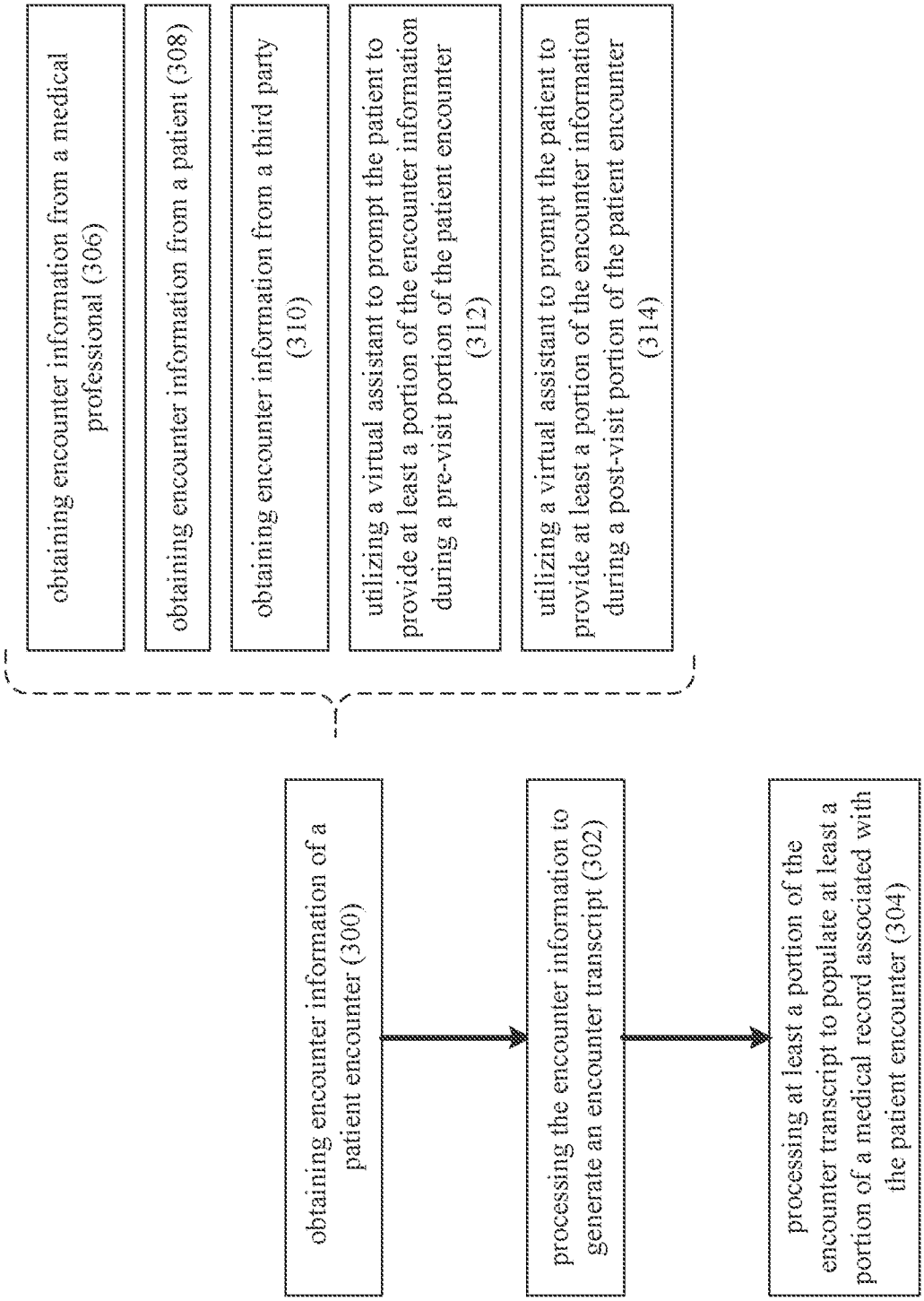
obtaining encounter information from a medical professional (306)
obtaining encounter information from a patient (308)
obtaining encounter information from a third party (310)
utilizing a virtual assistant to prompt the patient to provide at least a portion of the encounter information during a pre-visit portion of the patient encounter (312)
utilizing a virtual assistant to prompt the patient to provide at least a portion of the encounter information during a post-visit portion of the patient encounter (314)
obtaining encounter information of a patient encounter (300)
processing the encounter information to generate an encounter transcript (302)
processing at least a portion of the encounter transcript to populate at least a portion of a medical record associated with the patient encounter (304)

FIG. 4

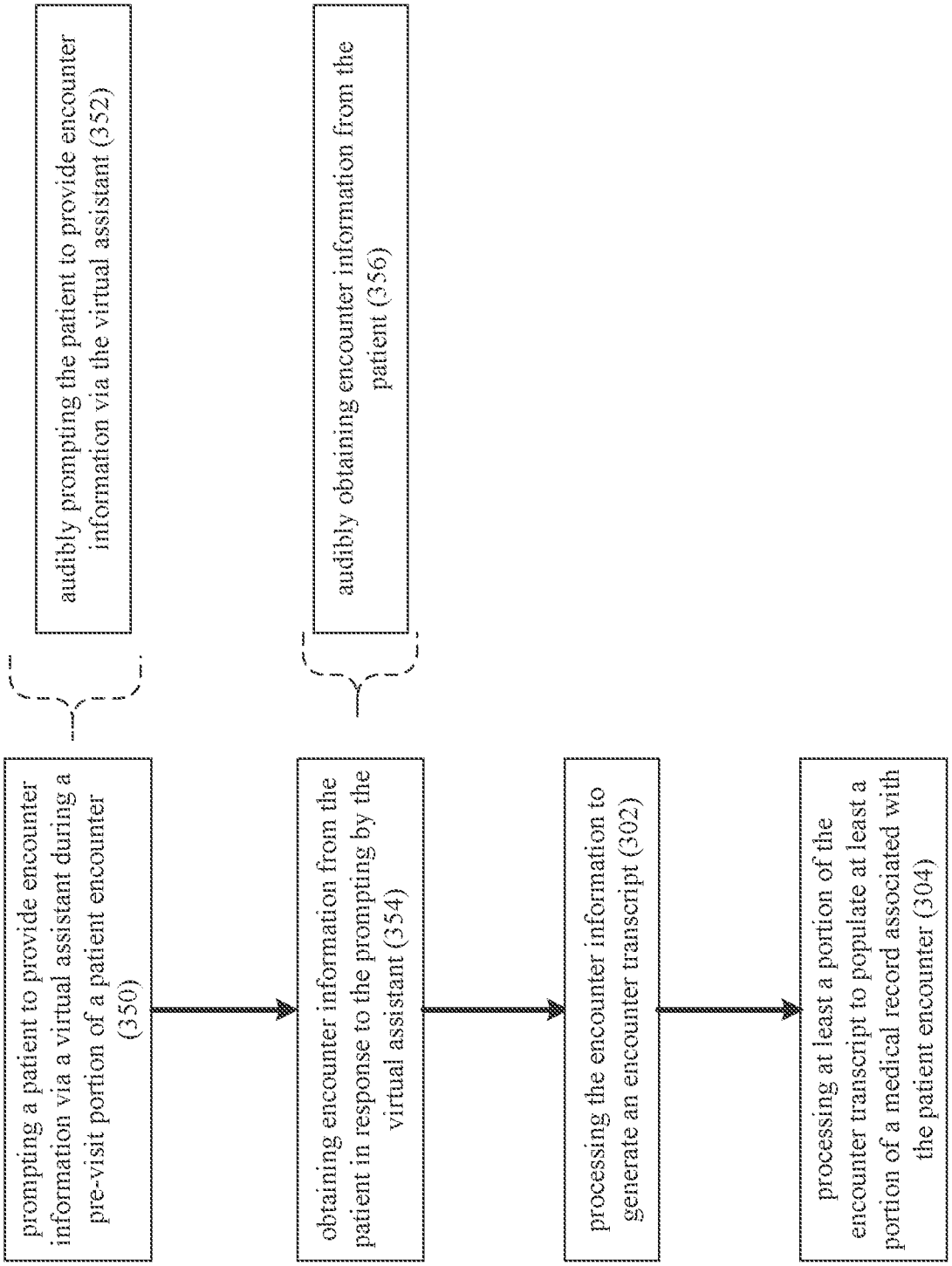
prompting a patient to provide encounter information via a virtual assistant during a pre-visit portion of a patient encounter (350)
audibly prompting the patient to provide encounter information via the virtual assistant (352)
obtaining encounter information from the patient in response to the prompting by the virtual assistant (354)
audibly obtaining encounter information from the patient (356)
processing the encounter information to generate an encounter transcript (302)
processing at least a portion of the encounter transcript to populate at least a portion of a medical record associated with the patient encounter (304)

FIG. 5

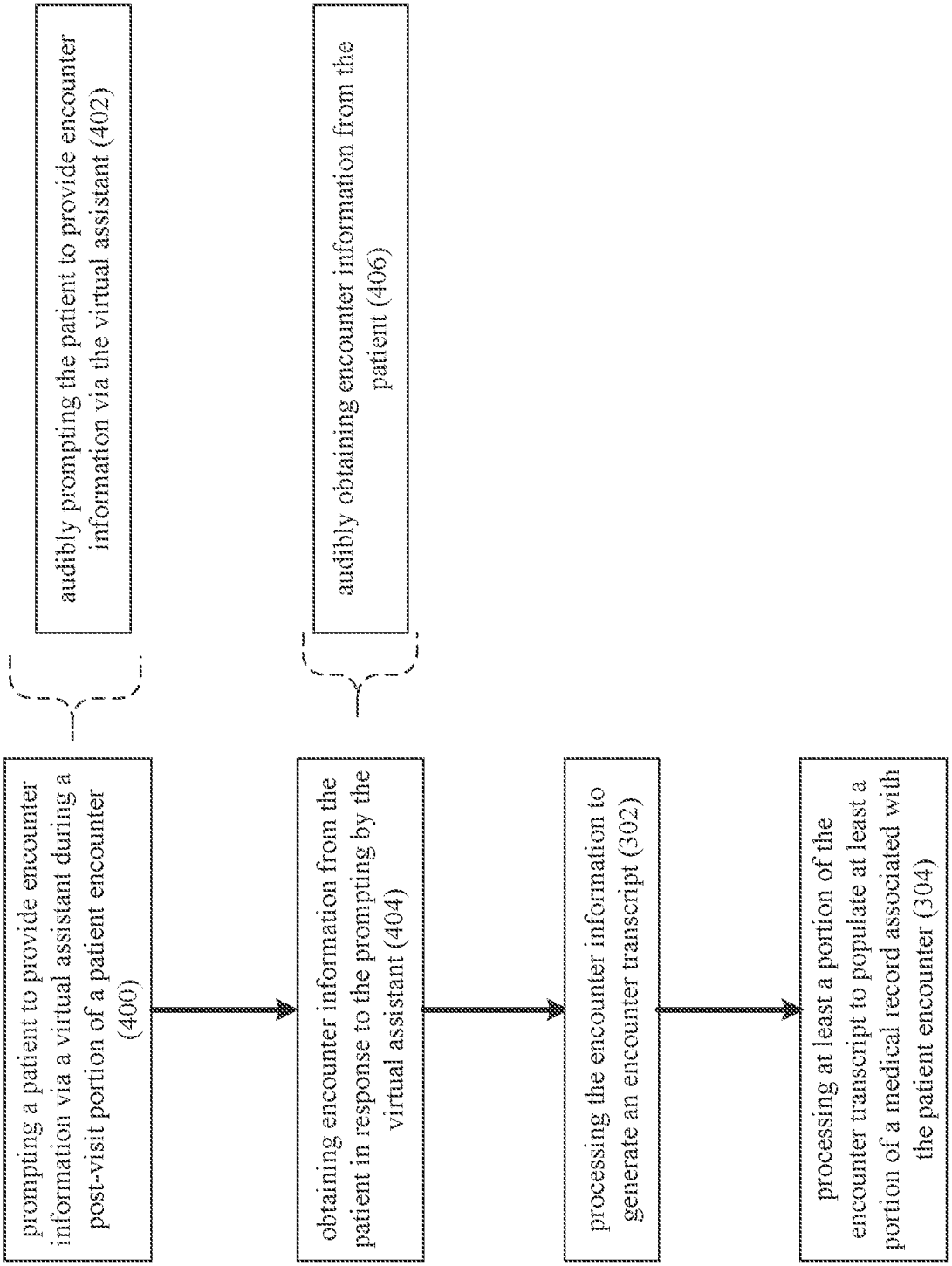
prompting a patient to provide encounter information via a virtual assistant during a post-visit portion of a patient encounter (400)
audibly prompting the patient to provide encounter information via the virtual assistant (402)
obtaining encounter information from the patient in response to the prompting by the virtual assistant (404)
audibly obtaining encounter information from the patient (406)
processing the encounter information to generate an encounter transcript (302)
processing at least a portion of the encounter transcript to populate at least a portion of a medical record associated with the patient encounter (304)

FIG. 6

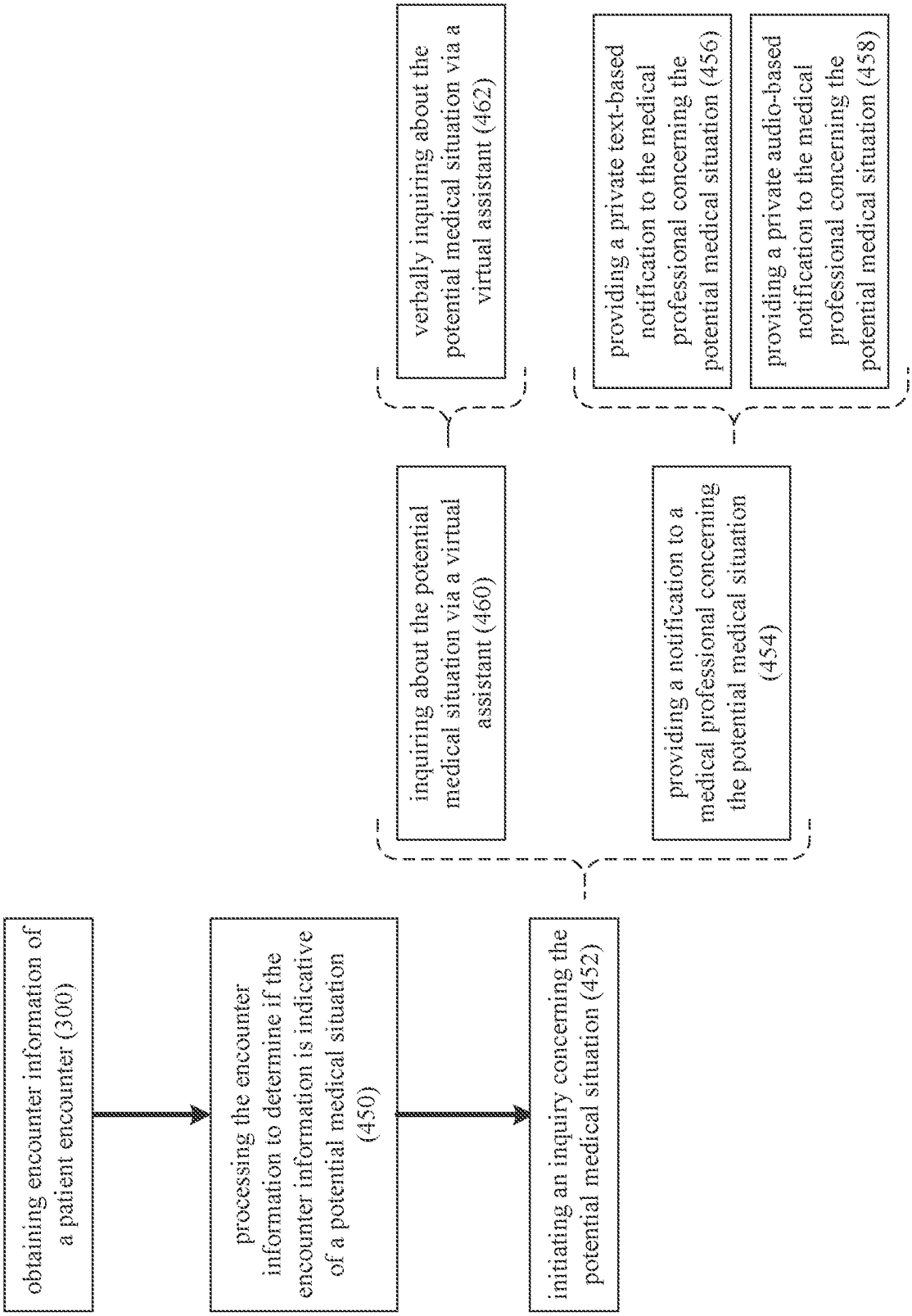
obtaining encounter information of a patient encounter (300)
processing the encounter information to determine if the encounter information is indicative of a potential medical situation (450)
initiating an inquiry concerning the potential medical situation (452)
inquiring about the potential medical situation via a virtual assistant (460)
providing a notification to a medical professional concerning the potential medical situation (454)
verbally inquiring about the potential medical situation via a virtual assistant (462)
providing a private text-based notification to the medical professional concerning the potential medical situation (456)
providing a private audio-based notification to the medical professional concerning the potential medical situation (458)

FIG. 7

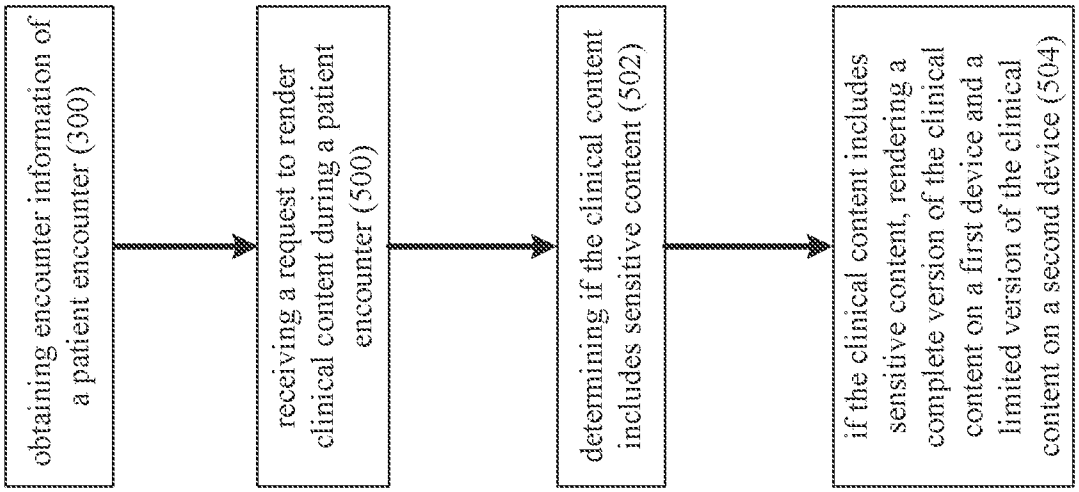
obtaining encounter information of a patient encounter (300)
receiving a request to render clinical content during a patient encounter (500)
determining if the clinical content includes sensitive content (502)
if the clinical content includes sensitive content, rendering a complete version of the clinical content on a first device and a limited version of the clinical content on a second device (504)

FIG. 8

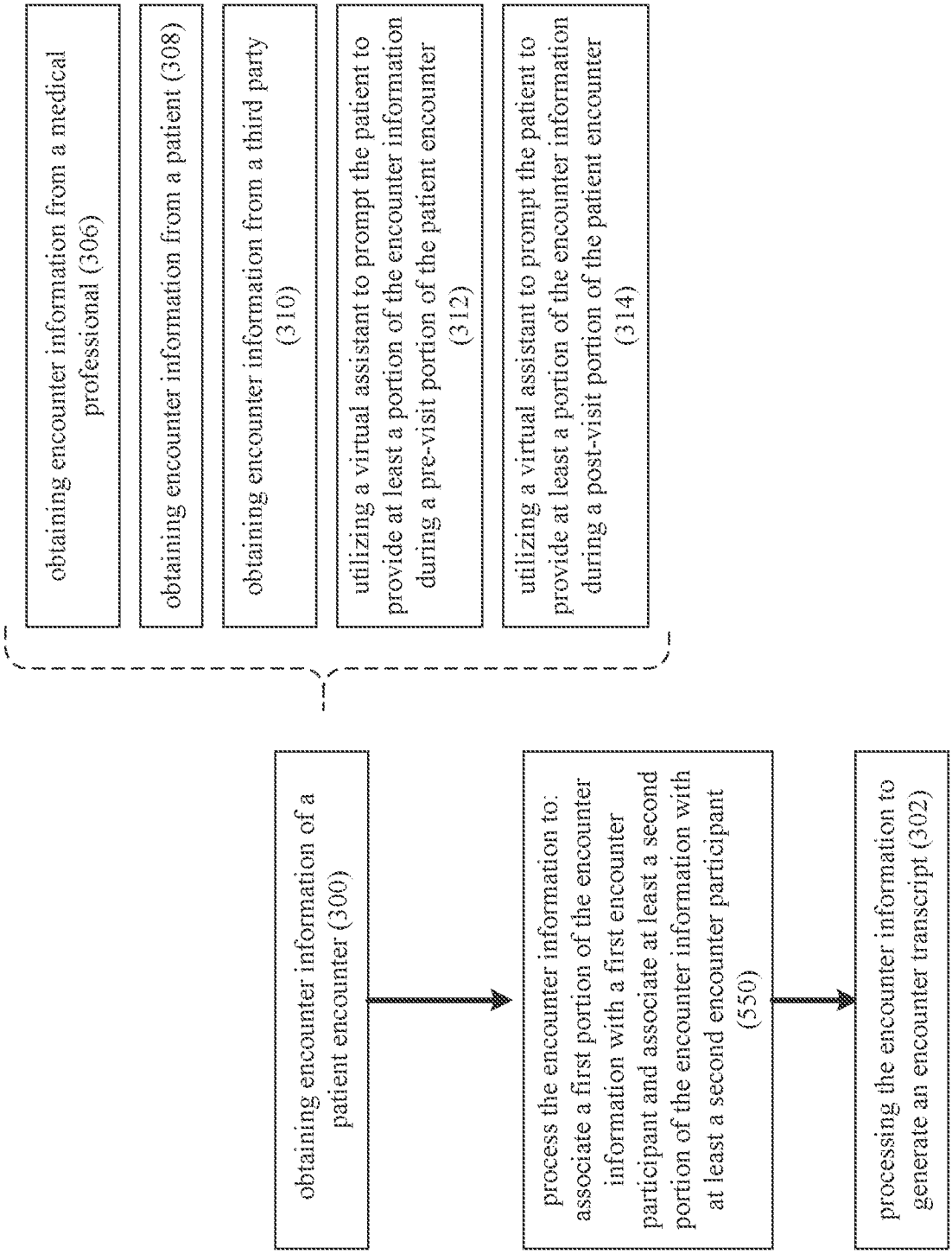
obtaining encounter information from a medical professional (306)
obtaining encounter information from a patient (308)
obtaining encounter information from a third party (310)
utilizing a virtual assistant to prompt the patient to provide at least a portion of the encounter information during a pre-visit portion of the patient encounter (312)
utilizing a virtual assistant to prompt the patient to provide at least a portion of the encounter information during a post-visit portion of the patient encounter (314)
obtaining encounter information of a patient encounter (300)
process the encounter information to: associate a first portion of the encounter information with a first encounter participant and associate at least a second portion of the encounter information with at least a second encounter participant (550)
processing the encounter information to generate an encounter transcript (302)

FIG. 9

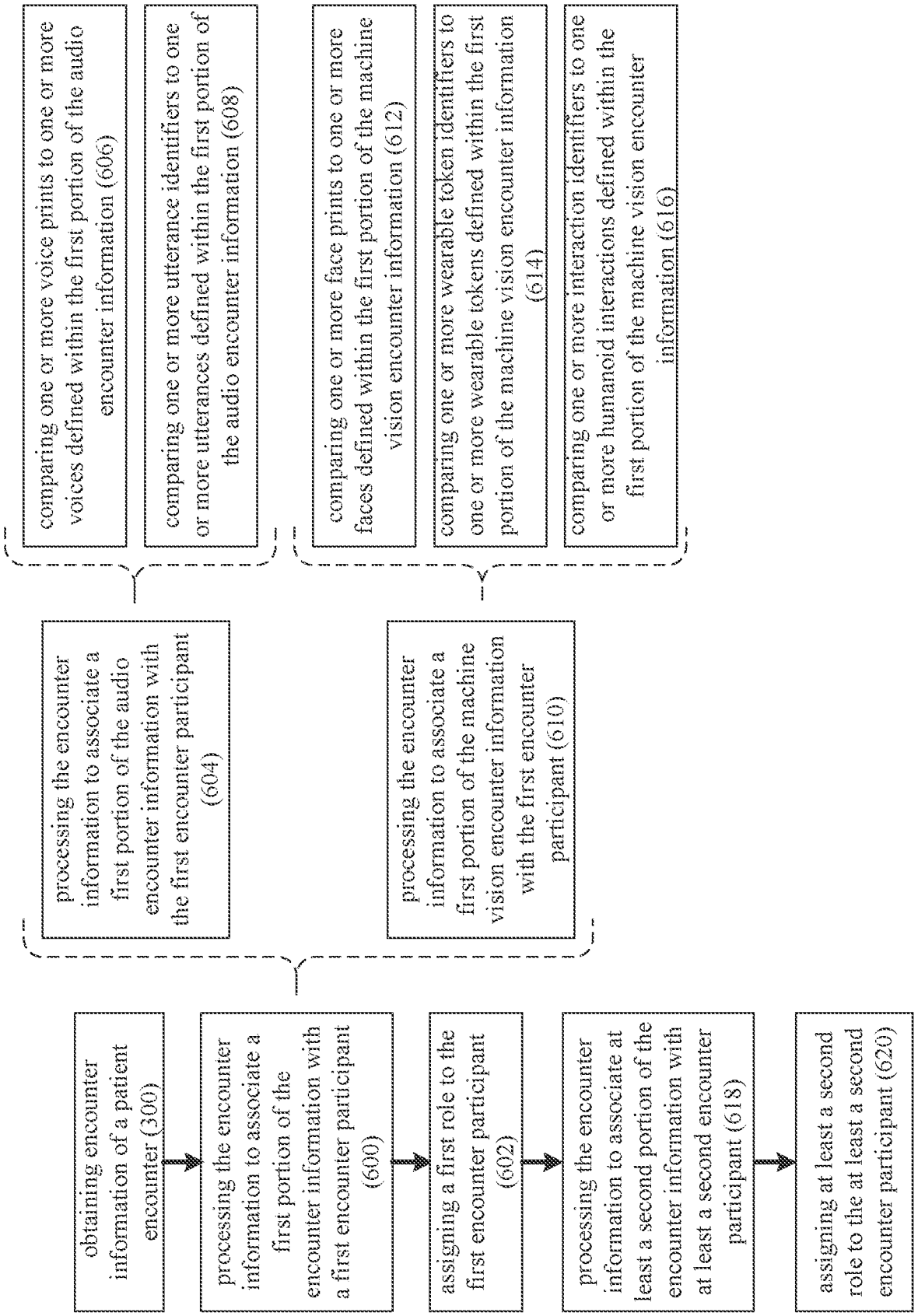
obtaining encounter information of a patient encounter (300)
processing the encounter information to associate a first portion of the encounter information with a first encounter participant (600)
processing the encounter information to associate a first portion of the audio encounter information with the first encounter participant (604)
comparing one or more voice prints to one or more voices defined within the first portion of the audio encounter information (606)
comparing one or more utterance identifiers to one or more utterances defined within the first portion of the audio encounter information (608)
processing the encounter information to associate a first portion of the machine vision encounter information with the first encounter participant (610)
comparing one or more face prints to one or more faces defined within the first portion of the machine vision encounter information (612)
comparing one or more wearable token identifiers to one or more wearable tokens defined within the first portion of the machine vision encounter information (614)
comparing one or more interaction identifiers to one or more humanoid interactions defined within the first portion of the machine vision encounter information (616)
assigning a first role to the first encounter participant (602)
processing the encounter information to associate at least a second portion of the encounter information with at least a second encounter participant (618)
assigning at least a second role to the at least a second encounter participant (620)

FIG. 10

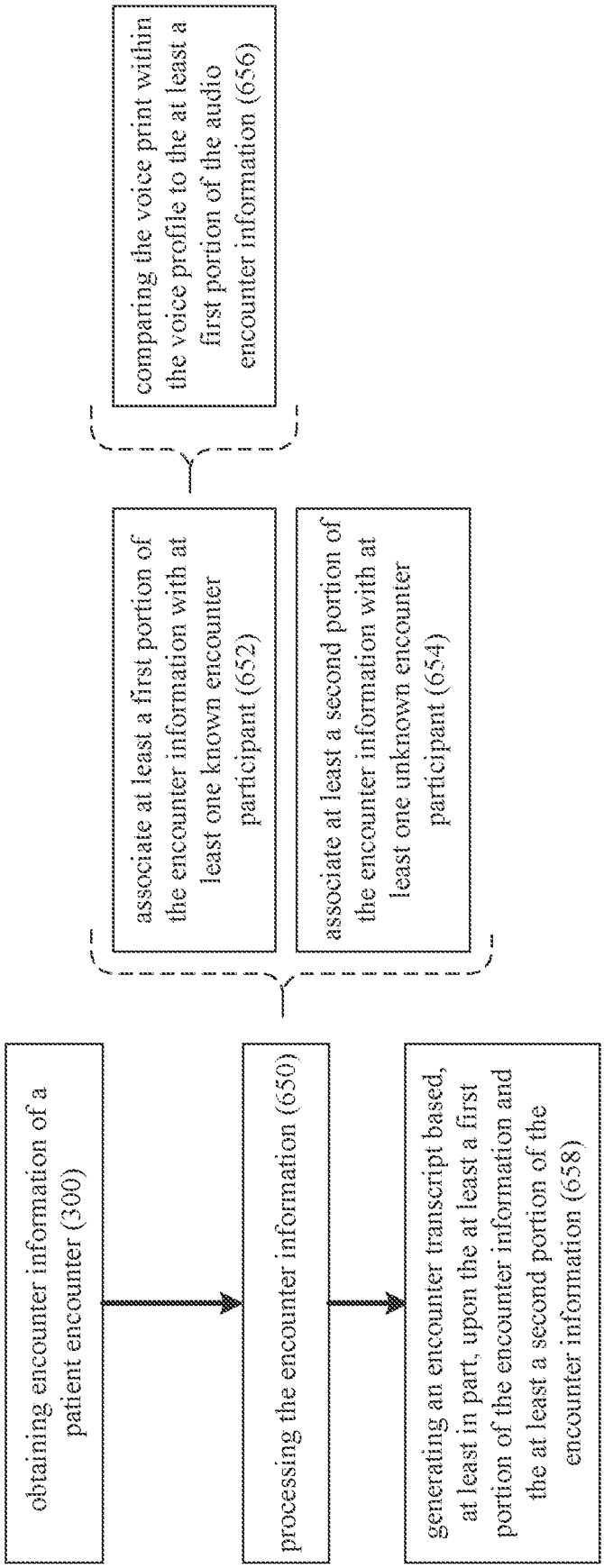
obtaining encounter information of a patient encounter (300)
processing the encounter information (650)
associate at least a first portion of the encounter information with at least one known encounter participant (652)
associate at least a second portion of the encounter information with at least one unknown encounter participant (654)
comparing the voice print within the voice profile to the at least a first portion of the audio encounter information (656)
generating an encounter transcript based, at least in part, upon the at least a first portion of the encounter information and the at least a second portion of the encounter information (658)

FIG. 11

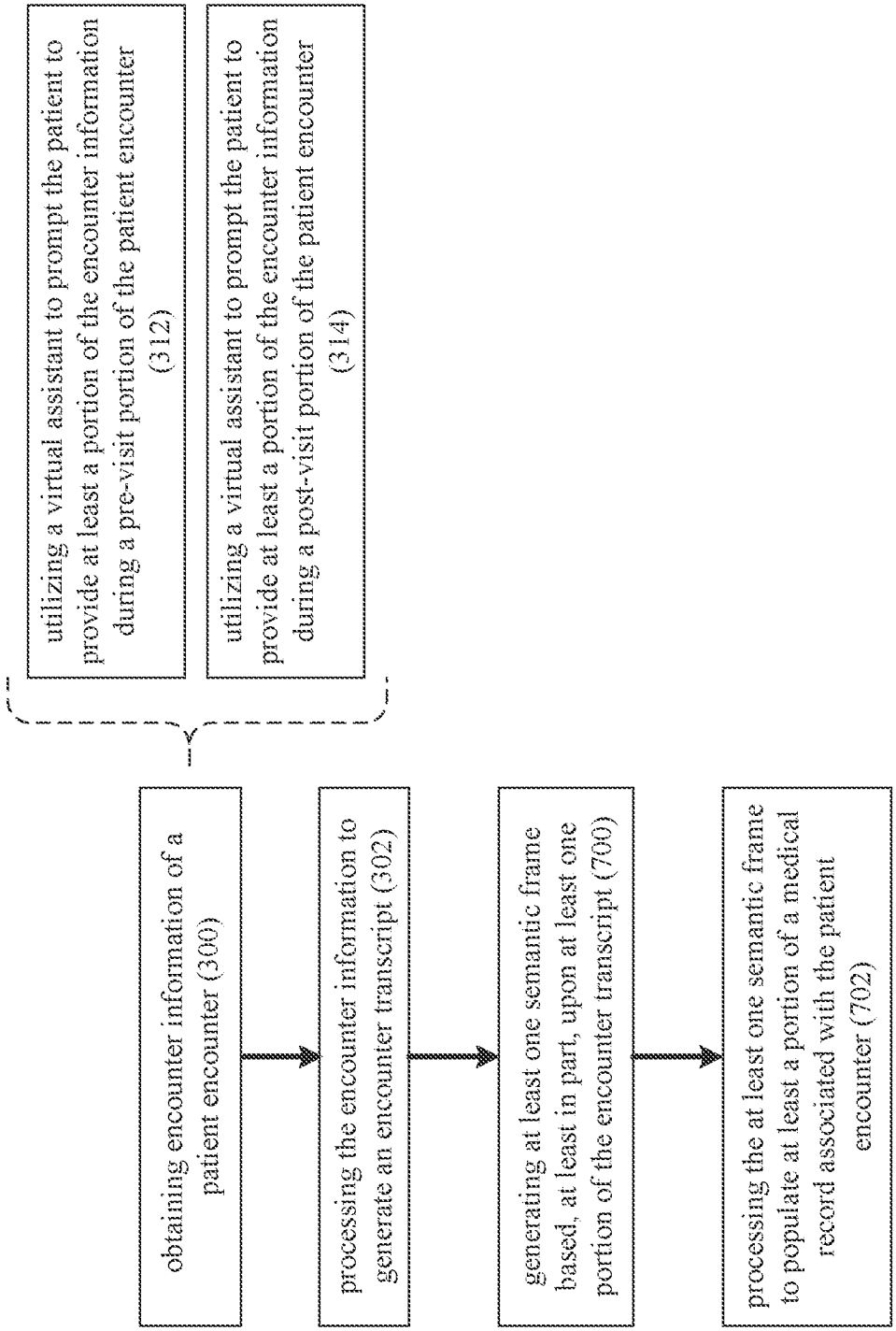
utilizing a virtual assistant to prompt the patient to provide at least a portion of the encounter information during a pre-visit portion of the patient encounter (312)
utilizing a virtual assistant to prompt the patient to provide at least a portion of the encounter information during a post-visit portion of the patient encounter (314)
obtaining encounter information of a patient encounter (300)
processing the encounter information to generate an encounter transcript (302)
generating at least one semantic frame based, at least in part, upon at least one portion of the encounter transcript (700)
processing the at least one semantic frame to populate at least a portion of a medical record associated with the patient encounter (702)

FIG. 12

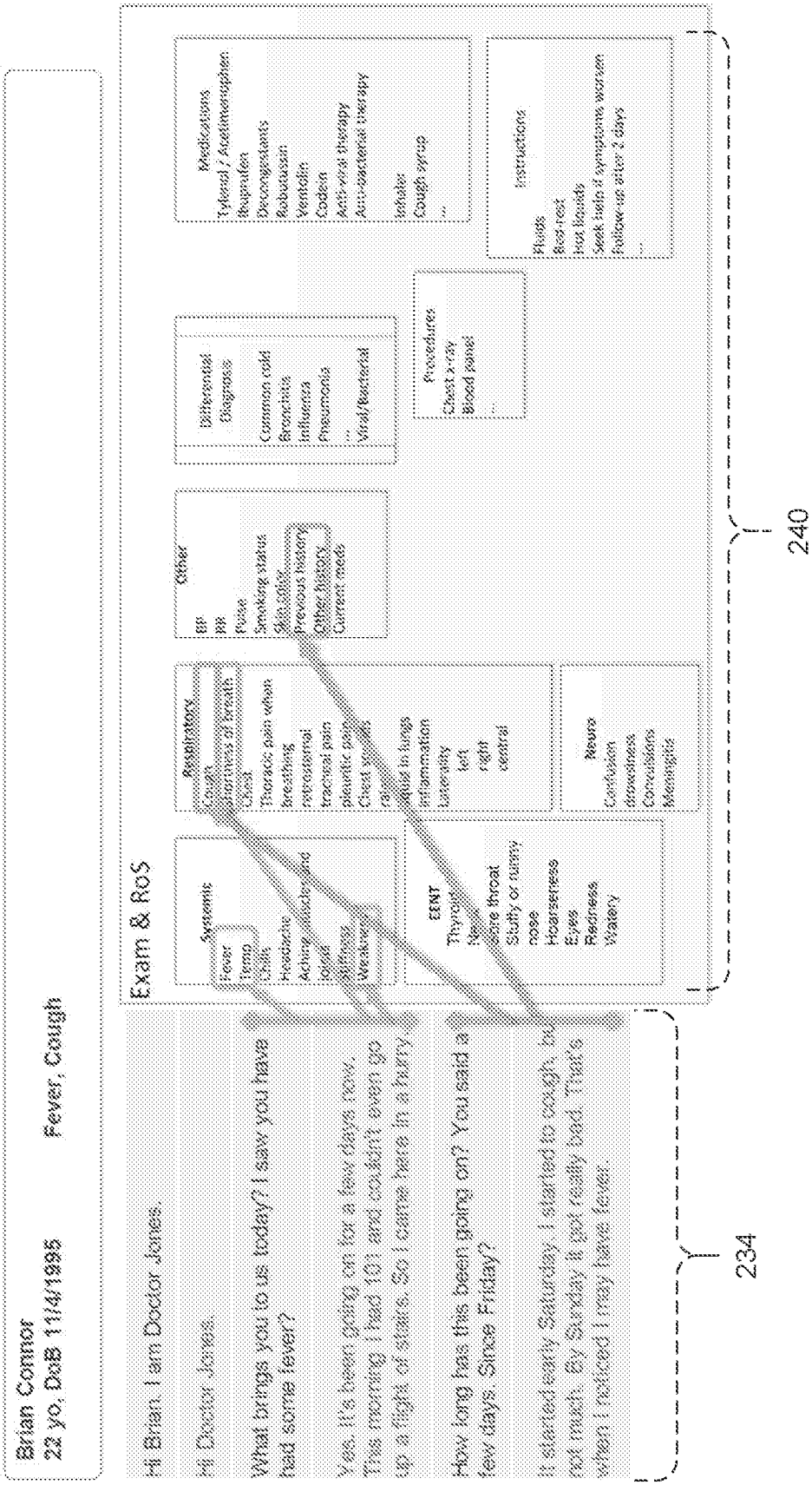
Brian Connor
22 yo, DoB 11/4/1995
Fever, Cough
Hi Brian. I am Doctor Jones.
Hi Doctor Jones.
What brings you to us today? I saw you have had some fever?
Yes. It's been going on for a few days now. This morning I had 101 and couldn't even go up a flight of stairs. So I came here in a hurry.
How long has this been going on? You said a few days. Since Friday?
It started early Saturday. I started to cough, not much. By Sunday it got really bad. That's when I noticed I may have fever.
Exam & RoS
Systemic
Fever
Temp
Chills
Headache
Aching
Tired
Stiffness
Weakness
Respiratory
Cough
Shortness of breath
Chest
Thoracic pain when breathing
retrosternal
tracheal pain
pleuritic pain
Chest sounds
rales
fluid in lungs
inflammation
Laterality
left
right
central
Other
BP
RR
Pulse
Smoking status
Skin color
Previous history
Other history
Current meds
Differential Diagnosis
Common cold
Bronchitis
Influenza
Pneumonia
...
Viral/Bacterial
Procedures
Chest x-ray
Blood panel
...
Medications
Tylenol / Acetinoraphen
Ibuprofen
Decongestants
Robutussin
Ventolin
Codein
Anti-viral therapy
Anti-bacterial therapy
Inhaler
Cough syrup
...
Instructions
Fluids
Bed rest
Hot liquids
Seek help if symptoms worsen
Follow-up after 2 days
...
EENT
Thyroid
Neck
Sore throat
Stuffy or runny nose
Hoarseness
Eyes
Redness
Watery
Neuro
Confusion
drowsiness
Convulsions
Meningitis
234
240

FIG. 13A

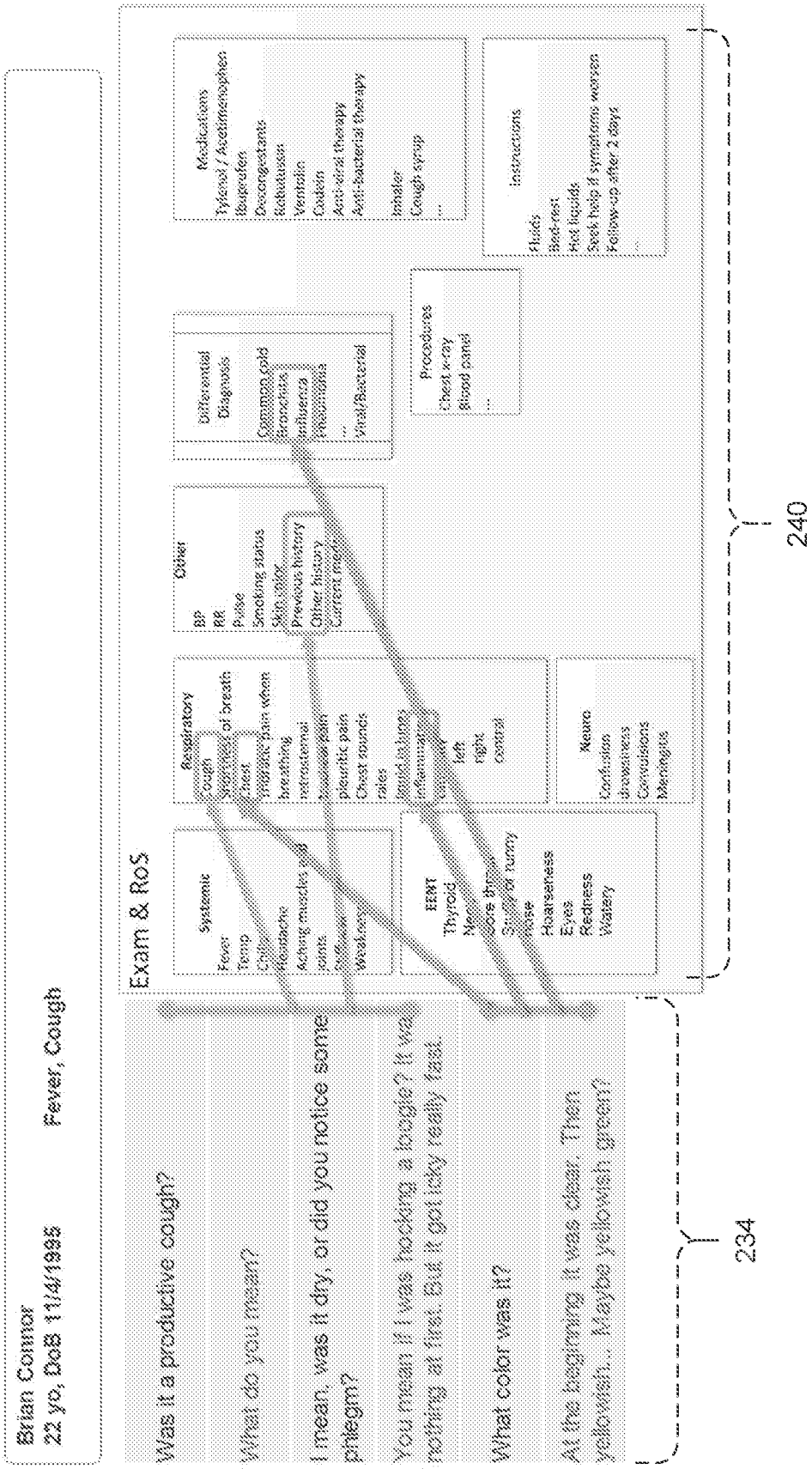
Brian Connor
22 yo, DoB 11/4/1995
Fever, Cough
Was it a productive cough?
What do you mean?
I mean, was it dry, or did you notice some phlegm?
You mean if I was hocking a loogie? It was nothing at first. But it got icky really fast.
What color was it?
At the beginning it was clear. Then yellowish... Maybe yellowish green?
234
Exam & RoS
Systemic
Fever
Temp
Chills
Headache
Aching muscles and joints
Weakness
EENT
Thyroid
Neck
Sore throat
Stuffy or runny nose
Hoarseness
Eyes
Redness
Watery
Respiratory
Cough
Shortness of breath
Chest
Thoracic pain when breathing
retrosternal
Pleuritic pain
Chest sounds
rales
Liquid in lungs
Inflammation
left
right
central
Neuro
Confusion
drowsiness
Convulsions
Meningitis
Other
BP
RR
Pulse
Smoking status
Skin color
Previous history
Other history
Current medi
Differential Diagnosis
Common cold
Bronchitis
Influenza
Pneumonia
...
Viral/Bacterial
Procedures
Chest x-ray
Blood panel
...
Medications
Tylenol / Acetimenophen
Ibuprofen
Decongestants
Robutussin
Ventolin
Codein
Anti-viral therapy
Anti-bacterial therapy
Inhaler
Cough syrup
...
Instructions
Fluids
Bed-rest
Hot liquids
Seek help if symptoms worsen
Follow-up after 2 days
...
240

FIG. 13B

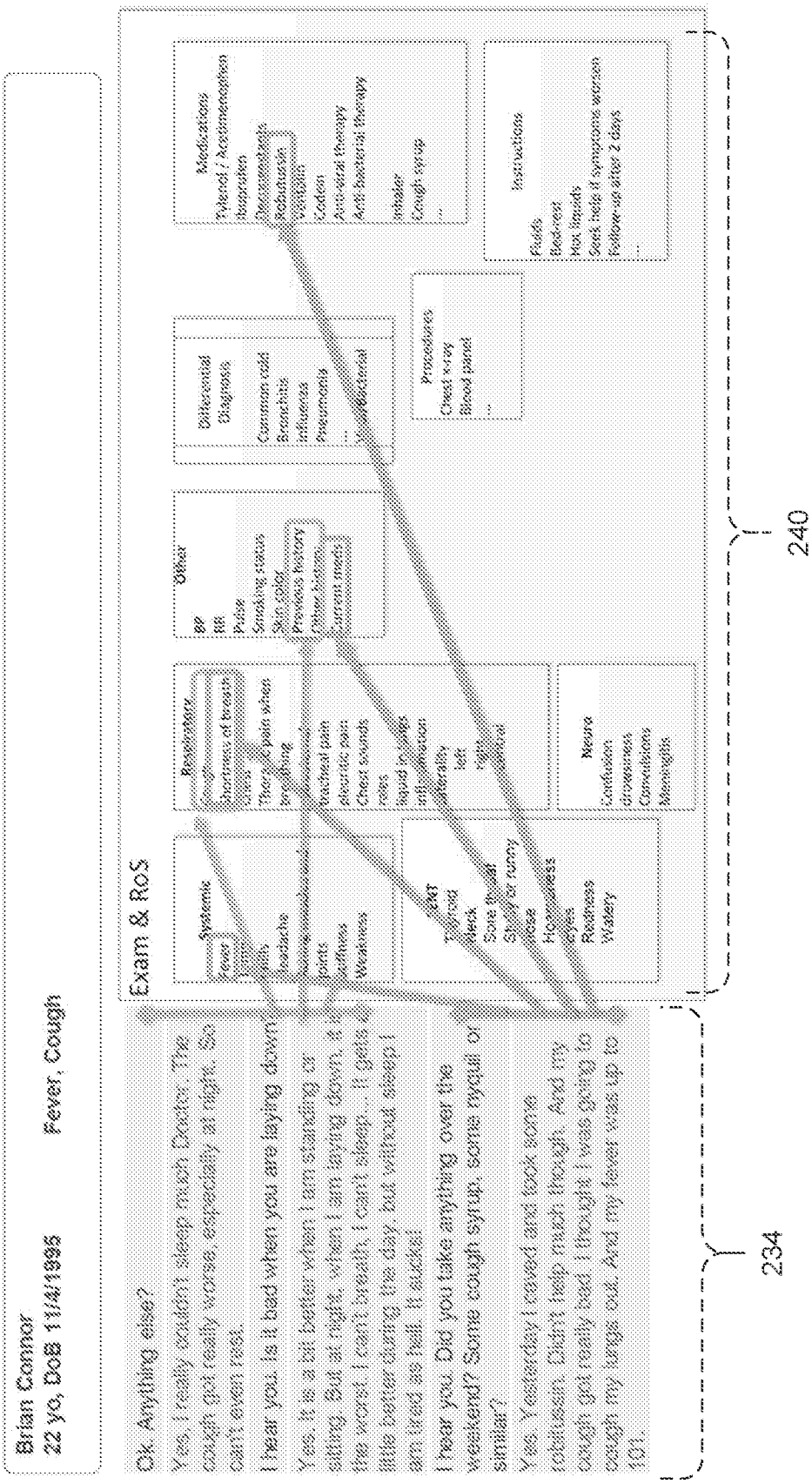
Brian Connor
22 yo, DoB 11/4/1995
Fever, Cough
Ok. Anything else?
Yes, I really couldn't sleep much Doctor. The cough got really worse, especially at night. So can't even rest.
I hear you. Is it bad when you are laying down?
Yes. It is a bit better when I am standing or sitting. But at night, when I am laying down, it is the worst. I can't breath, I can't sleep... It gets a little better during the day, but without sleep I am tired as hell. It sucks!
I hear you. Did you take anything over the weekend? Some cough syrup, some nyquil or similar?
Yes. Yesterday I caved and took some robitussin. Didn't help much though. And my cough got really bad. I thought I was going to cough my lungs out. And my fever was up to 101.
Exam & RoS
Systemic
Fever
Weakness
Respiratory
Shortness of breath
Chest
Chest sounds
Neura
Confusion
Drowsiness
Convulsions
Meningitis
Other
BP
RR
Pulse
Smoking status
Skin color
Previous history
Other history
Current meds
Differential Diagnosis
Common cold
Bronchitis
Influenza
Pneumonia
Procedures
Chest x-ray
Blood panel
Medications
Tylenol / Acetimenophen
Ibuprofen
Decongestants
Robitussin
Codein
Anti-viral therapy
Anti-bacterial therapy
Inhaler
Cough syrup
Instructions
Fluids
Bed-rest
Hot liquids
Seek help if symptoms worsen
Follow-up after 2 days
234
240

FIG. 13C

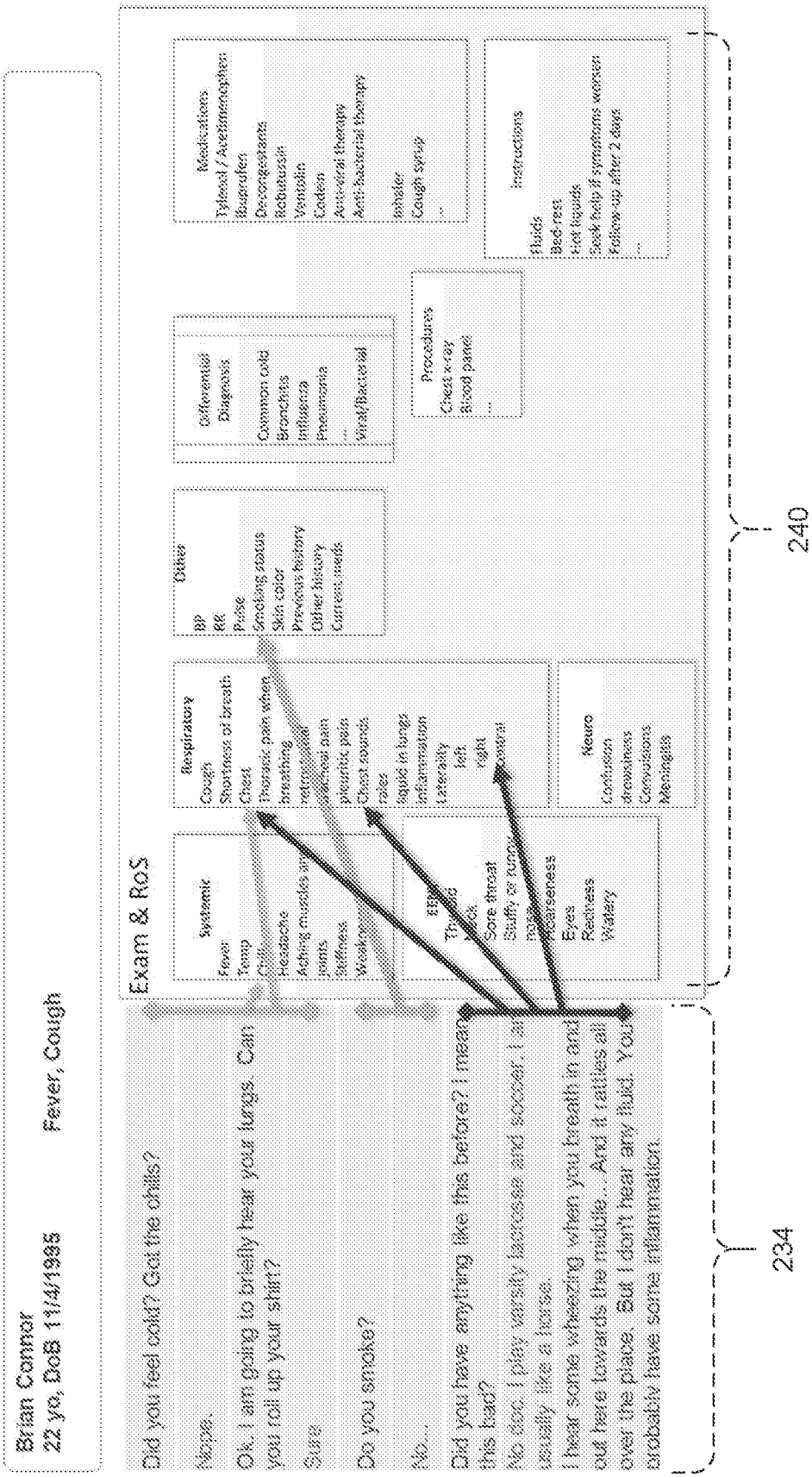
Brian Connor
22 yo, DoB 11/4/1995
Fever, Cough
Did you feel cold? Got the chills?
Nope.
Ok. I am going to briefly hear your lungs. Can you roll up your shirt?
Sure
Do you smoke?
No...
Did you have anything like this before? I mean this bad?
No doc. I play varsity lacrosse and soccer. I ca usually like a horse.
I hear some wheezing when you breath in and out here towards the middle... And it rattles all over the place. But I don't hear any fluid. You probably have some inflammation.
Exam & RoS
Systemic
Fever
Temp
Chills
Headache
Aching muscles
joints
Stiffness
Weak
Respiratory
Cough
Shortness of breath
Chest
Thoracic pain when breathing
pleuritic pain
Chest sounds
rales
liquid in lungs
inflammation
Laterality
left
right
central
Neuro
Confusion
drowsiness
Convulsions
Meningitis
Coarseness
Eyes
Redness
Watery
Other
BP
RR
Pulse
Smoking status
Skin color
Previous history
Other history
Current meds
Differential Diagnosis
Common cold
Bronchitis
Influenza
Pneumonia
...
Viral/Bacterial
Procedures
Chest x-ray
Blood panel
...
Medications
Tylenol / Acetaminophen
Ibuprofen
Decongestants
Robitussin
Ventolin
Codein
Anti-viral therapy
Anti-bacterial therapy
Inhaler
Cough syrup
...
Instructions
Fluids
Bed-rest
Hot liquids
Seek help if symptoms worsen
Follow-up after 2 days
...
234
240

FIG. 13D

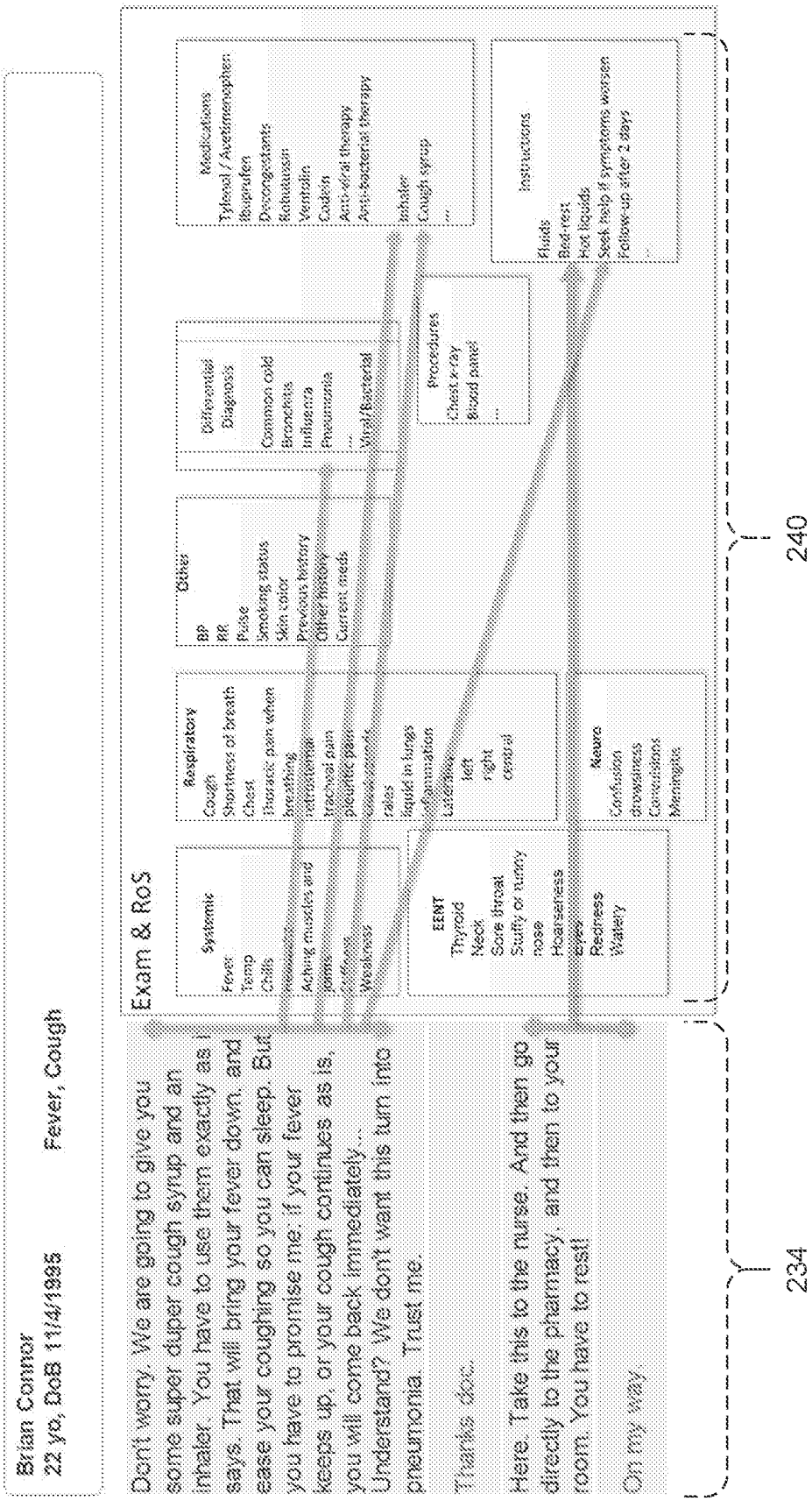
Brian Connor
22 yo, DoB 11/4/1995
Fever, Cough
Don't worry. We are going to give you some super duper cough syrup and an inhaler. You have to use them exactly as I says. That will bring your fever down, and ease your coughing so you can sleep. But you have to promise me: if your fever keeps up, or your cough continues as is, you will come back immediately... Understand? We don't want this turn into pneumonia. Trust me.
Thanks doc.
Here. Take this to the nurse. And then go directly to the pharmacy, and then to your room. You have to rest!
On my way.
Exam & RoS
Systemic
Fever
Temp
Chills
Aching muscles and joints
Weakness
Respiratory
Cough
Shortness of breath
Chest
Thoracic pain when breathing
retrosternal
tracheal pain
pleuritic pain
rales
liquid in lungs
inflammation
Laterality
left
right
central
Other
BP
RR
Pulse
Smoking status
Skin color
Previous history
Other history
Current meds
Differential Diagnosis
Common cold
Bronchitis
Influenza
Pneumonia
Viral/Bacterial
Medications
Tylenol / Acetimenophen
Ibuprofen
Decongestants
Robutussin
Ventolin
Codein
Anti-viral therapy
Anti-bacterial therapy
Inhaler
Cough syrup
EENT
Thyroid
Neck
Sore throat
Stuffy or runny nose
Hoarseness
Eyes
Redness
Watery
Neuro
Confusion
drowsiness
Convulsions
Meningitis
Procedures
Chest x-ray
Blood panel
Instructions
Fluids
Bed-rest
Hot liquids
Seek help if symptoms worsen
Follow-up after 2 days
234
240

FIG. 13E

Brian Connor
22 yo, DoB 11/4/1995 Fever, Cough

Subjective	
Cough, worse at night	Gets better during the day
Started 3 days ago	Couldn't go up a flight of stairs
Difficulty breathing at night	Non-smoker
No chills	Yellowish green phlegm
Fever 101	No fluids in the fluids
Took Robutussin	Otherwise healthy

OBJECTIVE:

Blood pressure is 120/80, pulse is 90 and regular, temperature is 101° orally, respiratory rate is 18

[redacted]

Lungs show inspiratory and expiratory wheezes over the middle lung fields. There are scattered rales. There is no dullness, egophony or decreased breathing [redacted]

IMPRESSION/ASSESSMENT:
[redacted]

PLAN:
[redacted]

FIG. 14A

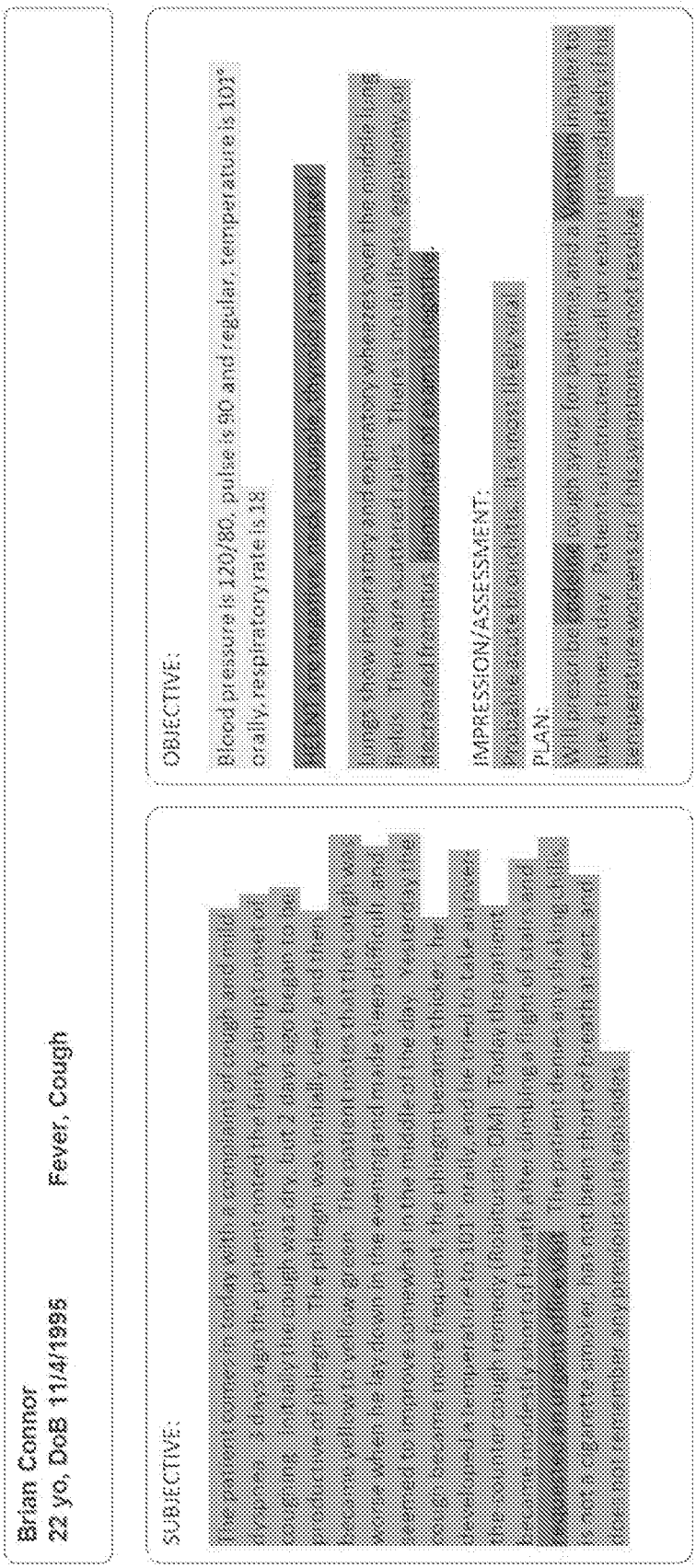
Brian Connor
22 yo, DoB 11/4/1995
Fever, Cough
SUBJECTIVE:
OBJECTIVE:
Blood pressure is 120/80, pulse is 90 and regular, temperature is 101°
orally, respiratory rate is 18
IMPRESSION/ASSESSMENT:
PLAN:

FIG. 14B

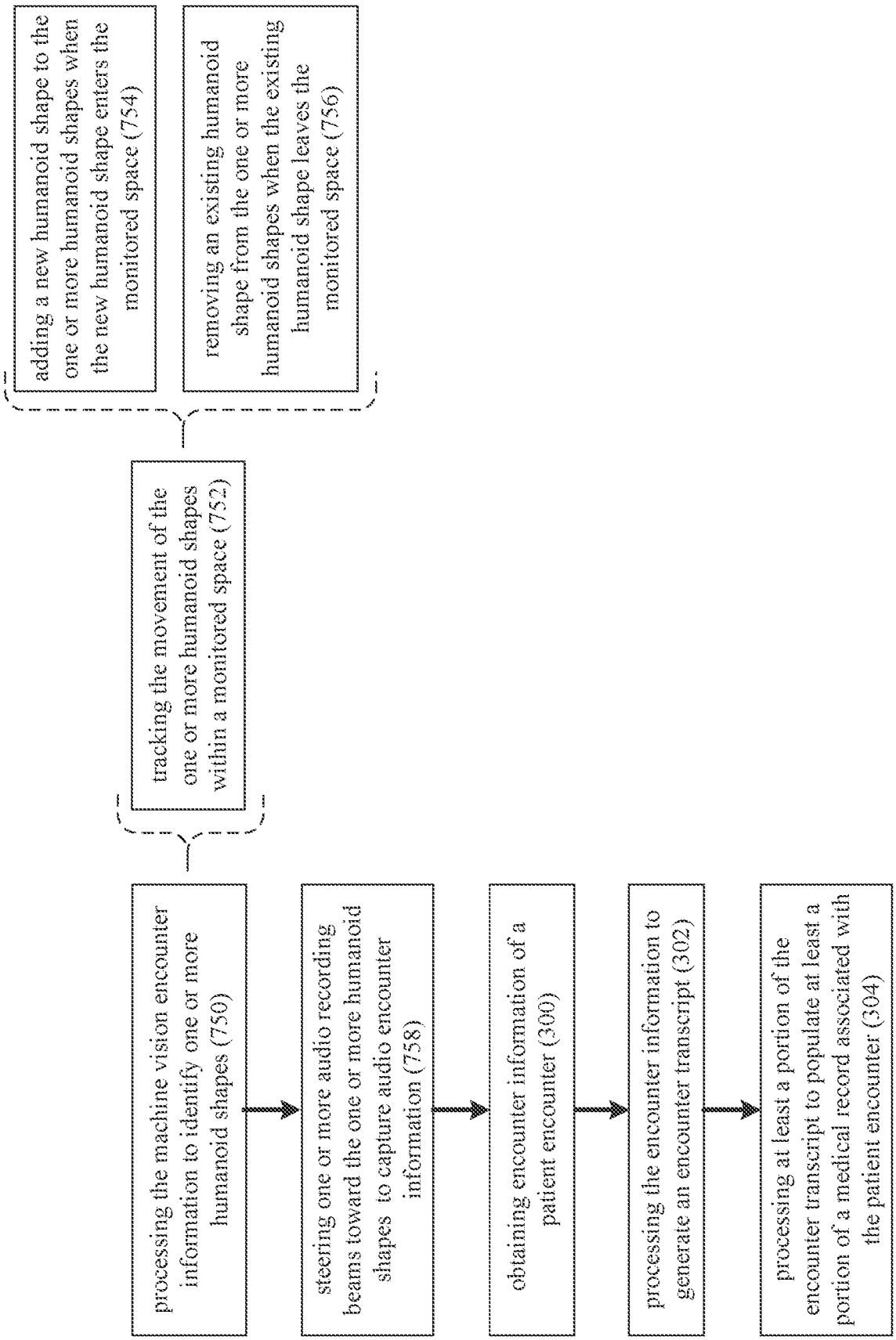
processing the machine vision encounter information to identify one or more humanoid shapes (750)
tracking the movement of the one or more humanoid shapes within a monitored space (752)
adding a new humanoid shape to the one or more humanoid shapes when the new humanoid shape enters the monitored space (754)
removing an existing humanoid shape from the one or more humanoid shapes when the existing humanoid shape leaves the monitored space (756)
steering one or more audio recording beams toward the one or more humanoid shapes to capture audio encounter information (758)
obtaining encounter information of a patient encounter (300)
processing the encounter information to generate an encounter transcript (302)
processing at least a portion of the encounter transcript to populate at least a portion of a medical record associated with the patient encounter (304)

FIG. 15

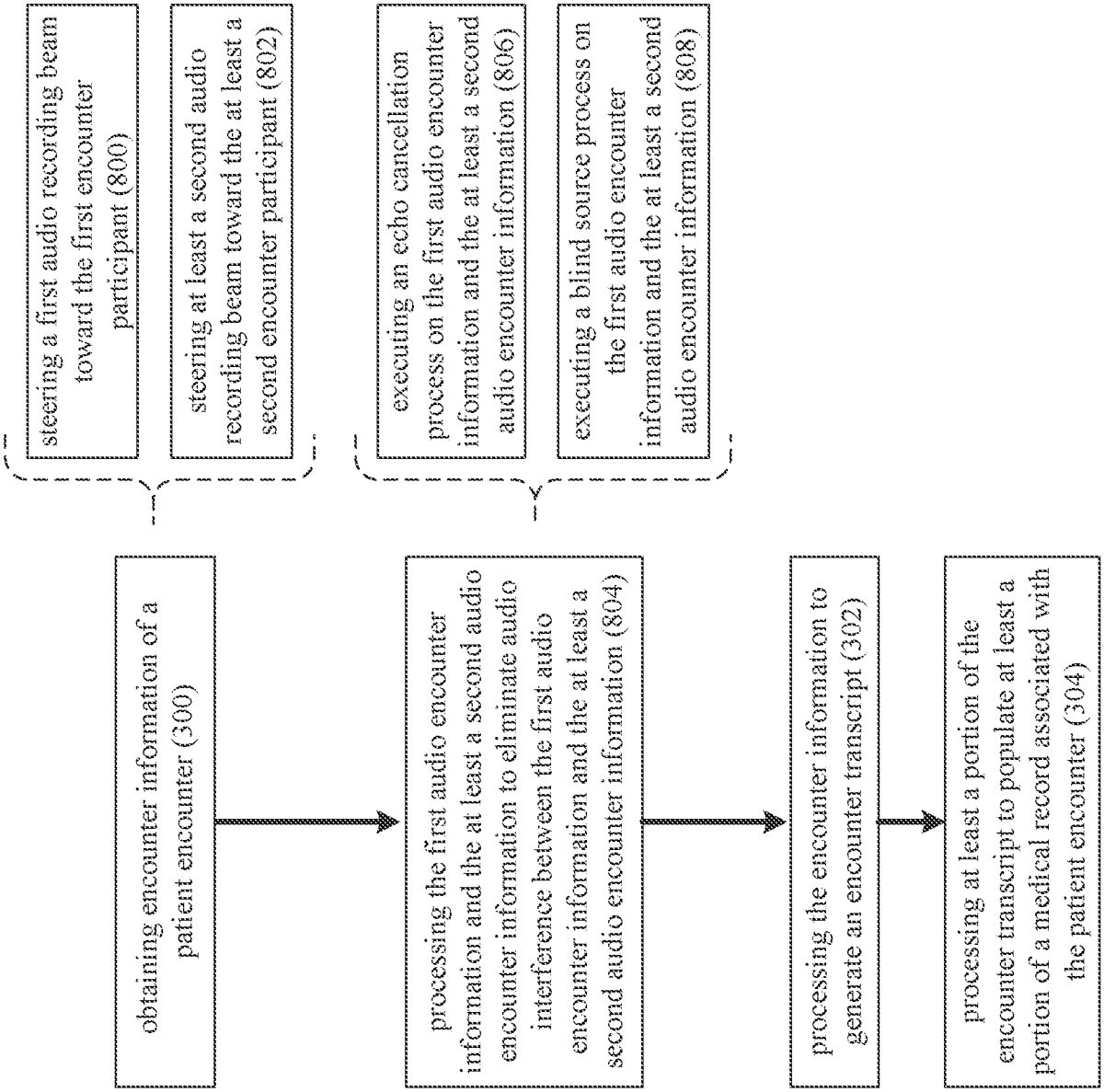
steering a first audio recording beam toward the first encounter participant (800)
steering at least a second audio recording beam toward the at least a second encounter participant (802)
executing an echo cancellation process on the first audio encounter information and the at least a second audio encounter information (806)
executing a blind source process on the first audio encounter information and the at least a second audio encounter information (808)
obtaining encounter information of a patient encounter (300)
processing the first audio encounter information and the at least a second audio encounter information to eliminate audio interference between the first audio encounter information and the at least a second audio encounter information (804)
processing the encounter information to generate an encounter transcript (302)
processing at least a portion of the encounter transcript to populate at least a portion of a medical record associated with the patient encounter (304)

FIG. 16

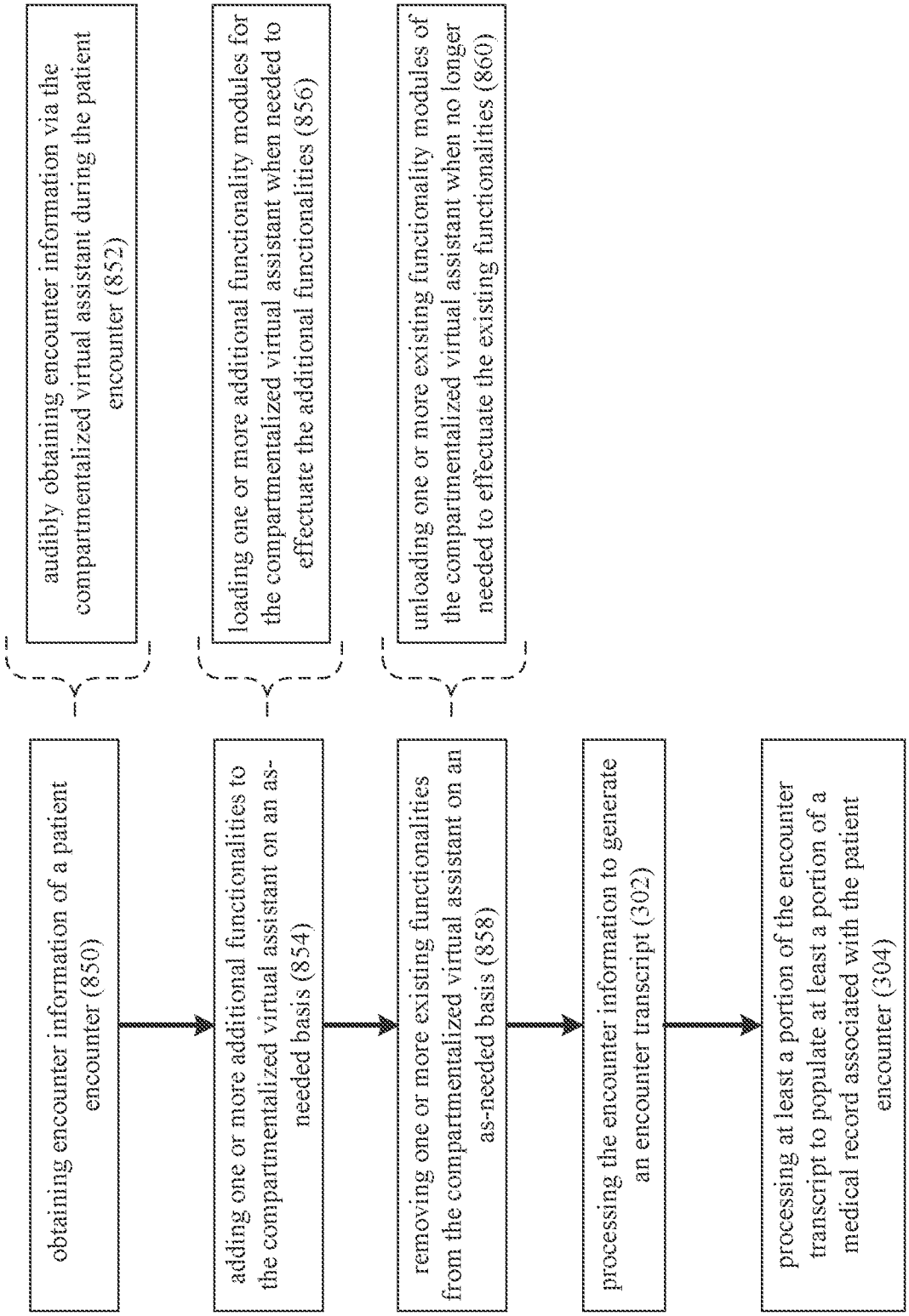
obtaining encounter information of a patient encounter (850)
adding one or more additional functionalities to the compartmentalized virtual assistant on an as-needed basis (854)
removing one or more existing functionalities from the compartmentalized virtual assistant on an as-needed basis (858)
processing the encounter information to generate an encounter transcript (302)
processing at least a portion of the encounter transcript to populate at least a portion of a medical record associated with the patient encounter (304)
audibly obtaining encounter information via the compartmentalized virtual assistant during the patient encounter (852)
loading one or more additional functionality modules for the compartmentalized virtual assistant when needed to effectuate the additional functionalities (856)
unloading one or more existing functionality modules of the compartmentalized virtual assistant when no longer needed to effectuate the existing functionalities (860)

FIG. 17

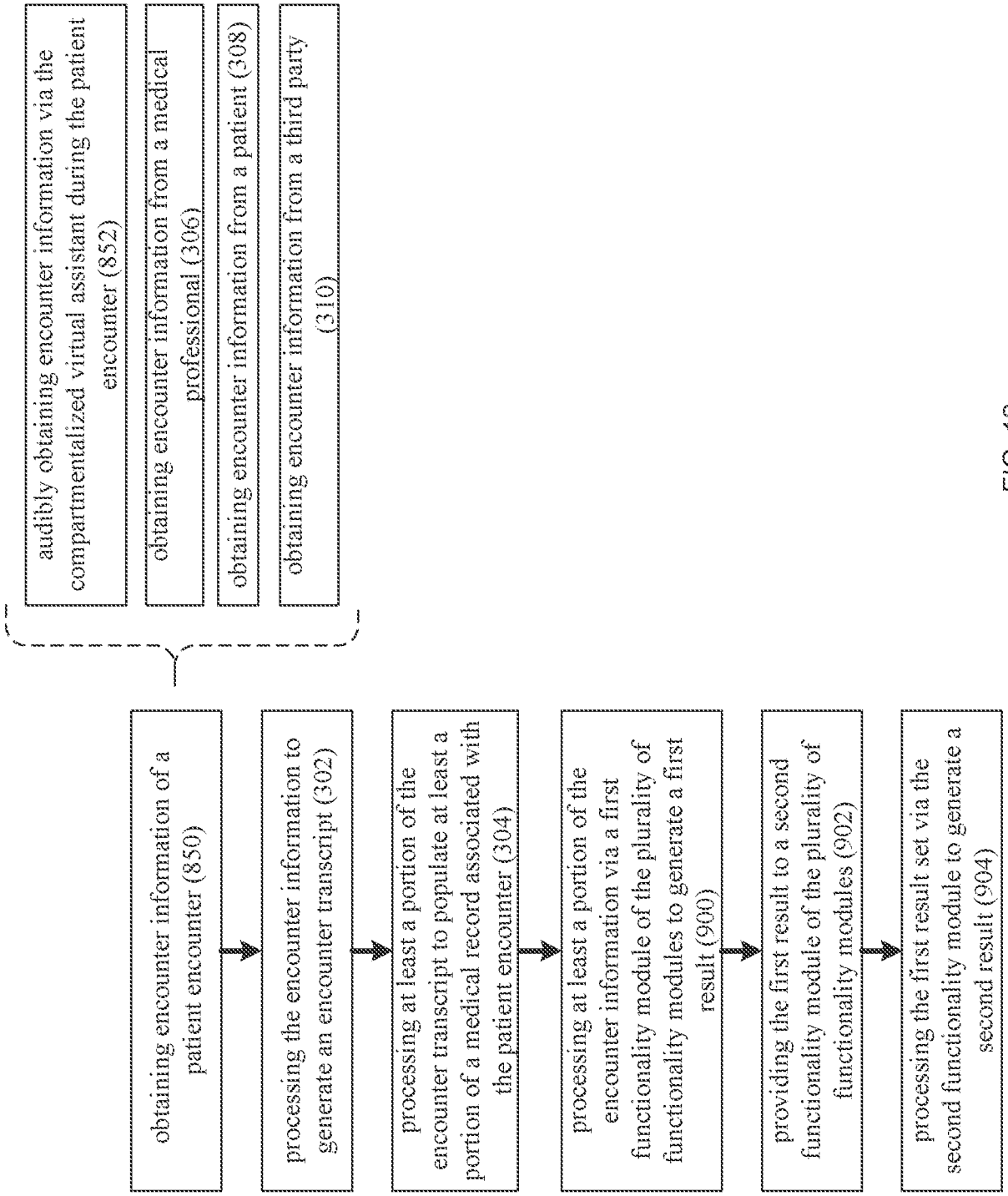
audibly obtaining encounter information via the compartmentalized virtual assistant during the patient encounter (852)
obtaining encounter information from a medical professional (306)
obtaining encounter information from a patient (308)
obtaining encounter information from a third party (310)
obtaining encounter information of a patient encounter (850)
processing the encounter information to generate an encounter transcript (302)
processing at least a portion of the encounter transcript to populate at least a portion of a medical record associated with the patient encounter (304)
processing at least a portion of the encounter information via a first functionality module of the plurality of functionality modules to generate a first result (900)
providing the first result to a second functionality module of the plurality of functionality modules (902)
processing the first result set via the second functionality module to generate a second result (904)

FIG. 18

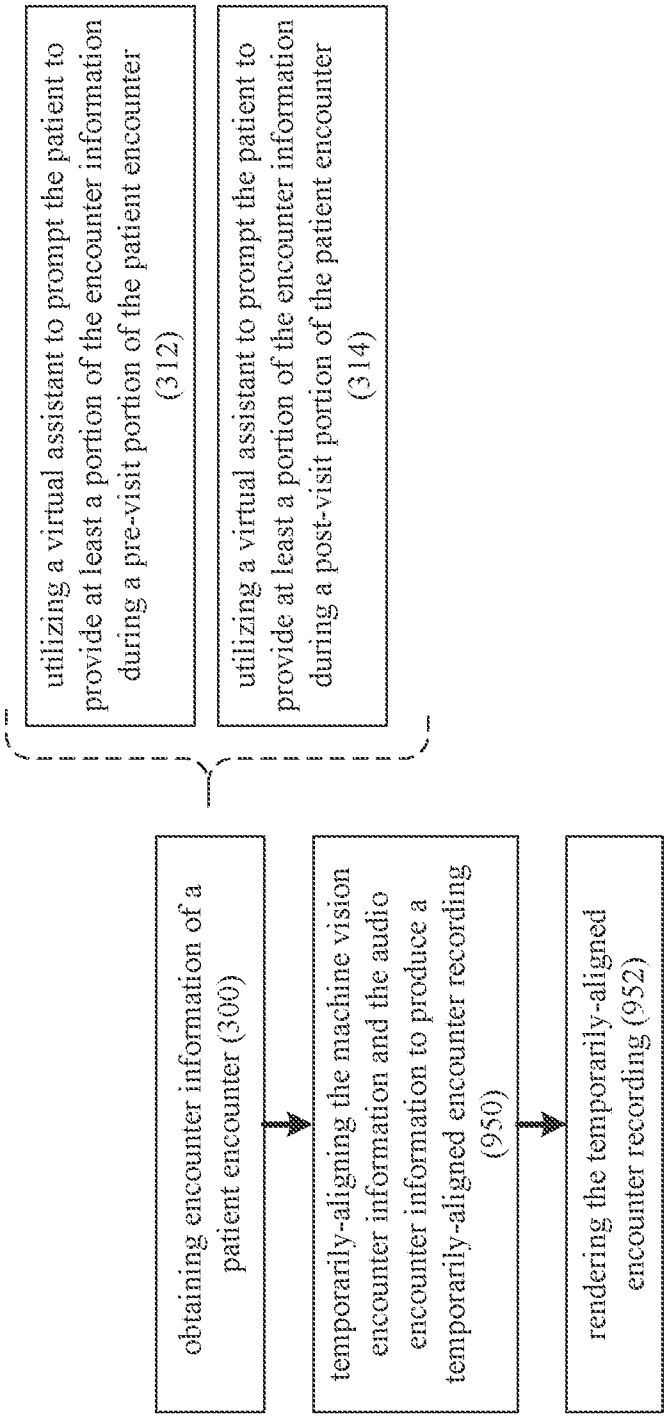
utilizing a virtual assistant to prompt the patient to provide at least a portion of the encounter information during a pre-visit portion of the patient encounter (312)
utilizing a virtual assistant to prompt the patient to provide at least a portion of the encounter information during a post-visit portion of the patient encounter (314)
obtaining encounter information of a patient encounter (300)
temporarily-aligning the machine vision encounter information and the audio encounter information to produce a temporarily-aligned encounter recording (950)
rendering the temporarily-aligned encounter recording (952)

FIG. 19

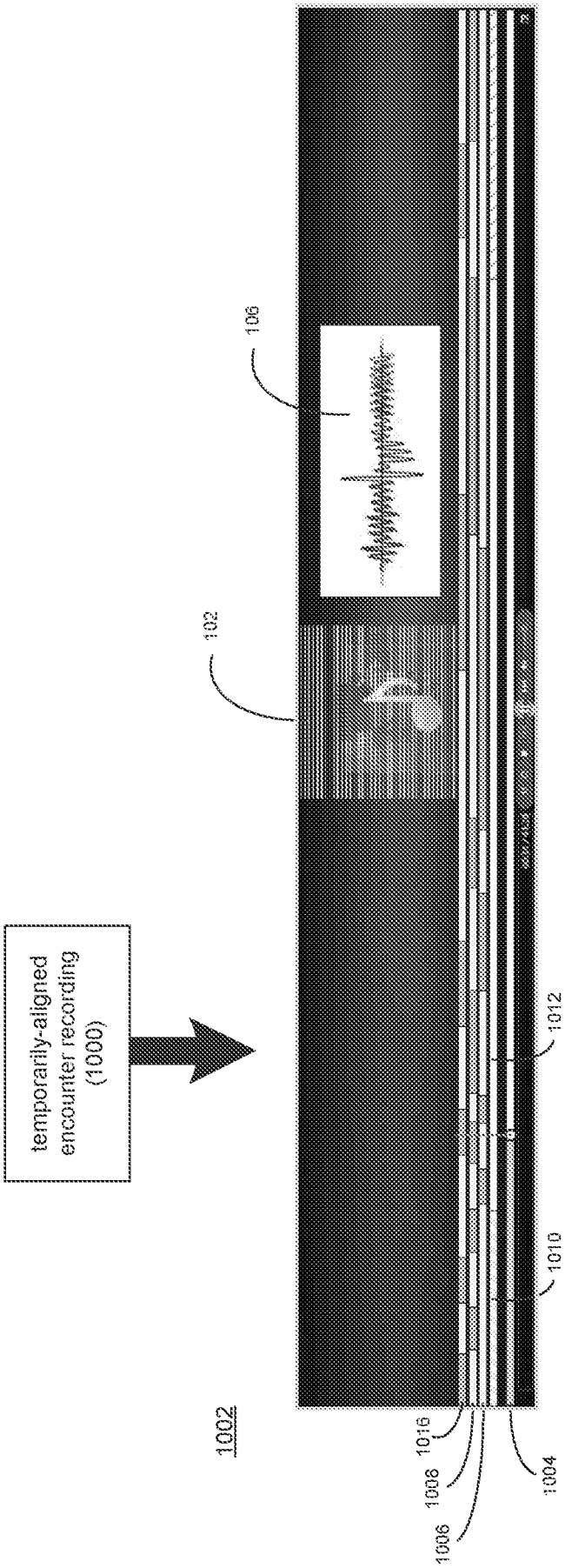
temporarily-aligned encounter recording (1000)
1002
1016
1008
1006
1004
1010
1012
102
106

FIG. 20

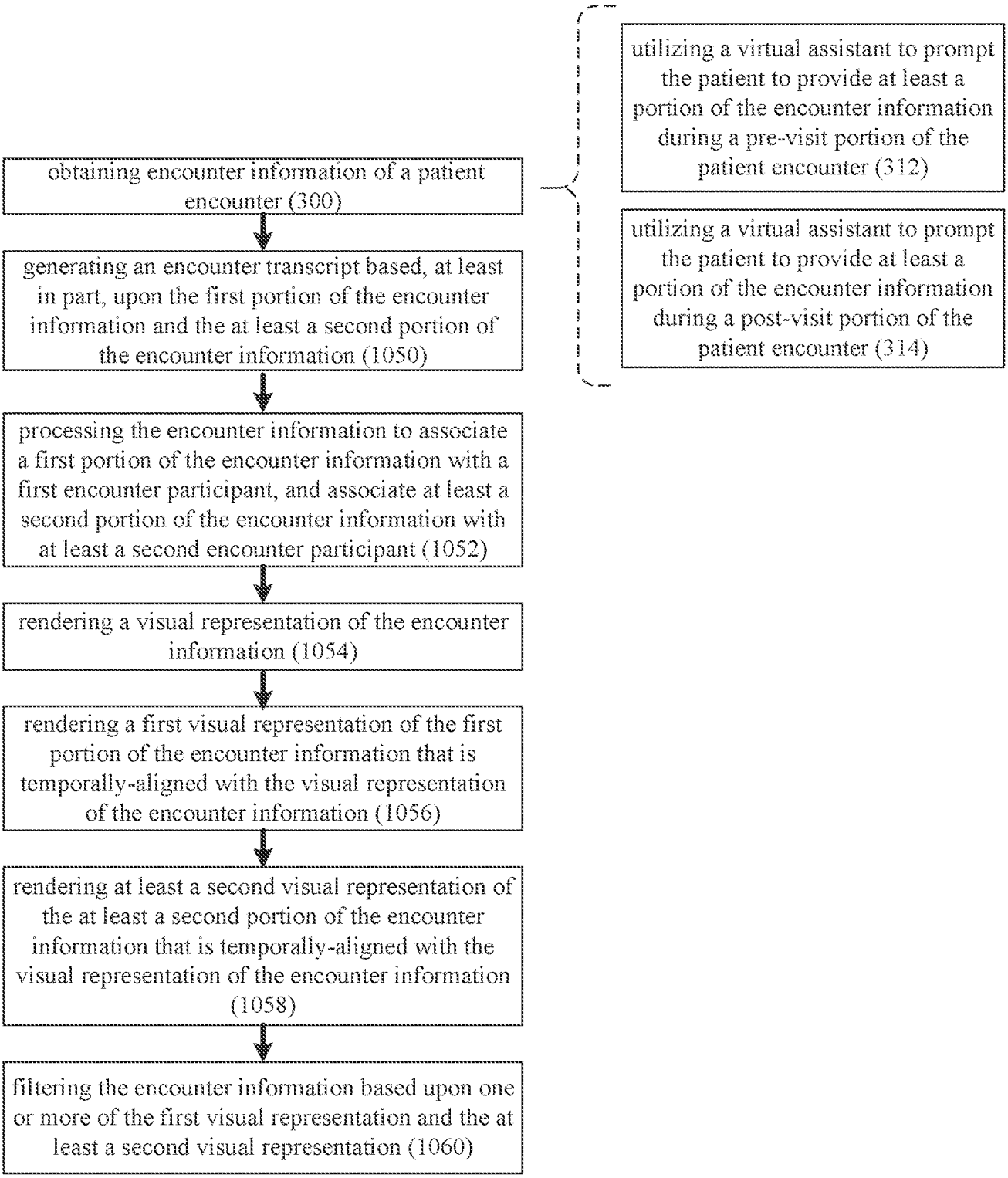
obtaining encounter information of a patient encounter (300)
generating an encounter transcript based, at least in part, upon the first portion of the encounter information and the at least a second portion of the encounter information (1050)
processing the encounter information to associate a first portion of the encounter information with a first encounter participant, and associate at least a second portion of the encounter information with at least a second encounter participant (1052)
rendering a visual representation of the encounter information (1054)
rendering a first visual representation of the first portion of the encounter information that is temporally-aligned with the visual representation of the encounter information (1056)
rendering at least a second visual representation of the at least a second portion of the encounter information that is temporally-aligned with the visual representation of the encounter information (1058)
filtering the encounter information based upon one or more of the first visual representation and the at least a second visual representation (1060)
utilizing a virtual assistant to prompt the patient to provide at least a portion of the encounter information during a pre-visit portion of the patient encounter (312)
utilizing a virtual assistant to prompt the patient to provide at least a portion of the encounter information during a post-visit portion of the patient encounter (314)

FIG. 21

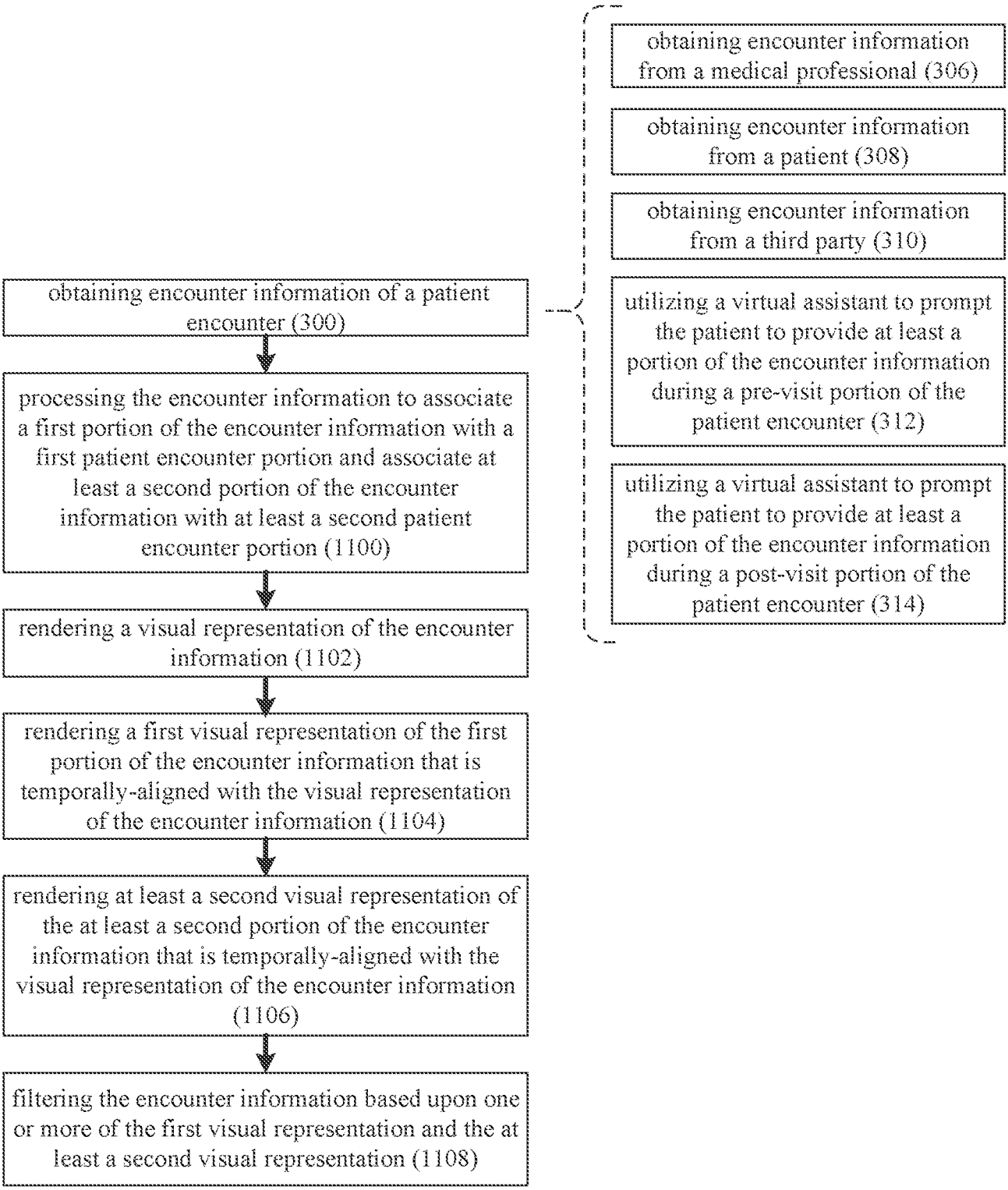
obtaining encounter information of a patient encounter (300)
processing the encounter information to associate a first portion of the encounter information with a first patient encounter portion and associate at least a second portion of the encounter information with at least a second patient encounter portion (1100)
rendering a visual representation of the encounter information (1102)
rendering a first visual representation of the first portion of the encounter information that is temporally-aligned with the visual representation of the encounter information (1104)
rendering at least a second visual representation of the at least a second portion of the encounter information that is temporally-aligned with the visual representation of the encounter information (1106)
filtering the encounter information based upon one or more of the first visual representation and the at least a second visual representation (1108)
obtaining encounter information from a medical professional (306)
obtaining encounter information from a patient (308)
obtaining encounter information from a third party (310)
utilizing a virtual assistant to prompt the patient to provide at least a portion of the encounter information during a pre-visit portion of the patient encounter (312)
utilizing a virtual assistant to prompt the patient to provide at least a portion of the encounter information during a post-visit portion of the patient encounter (314)

FIG. 22

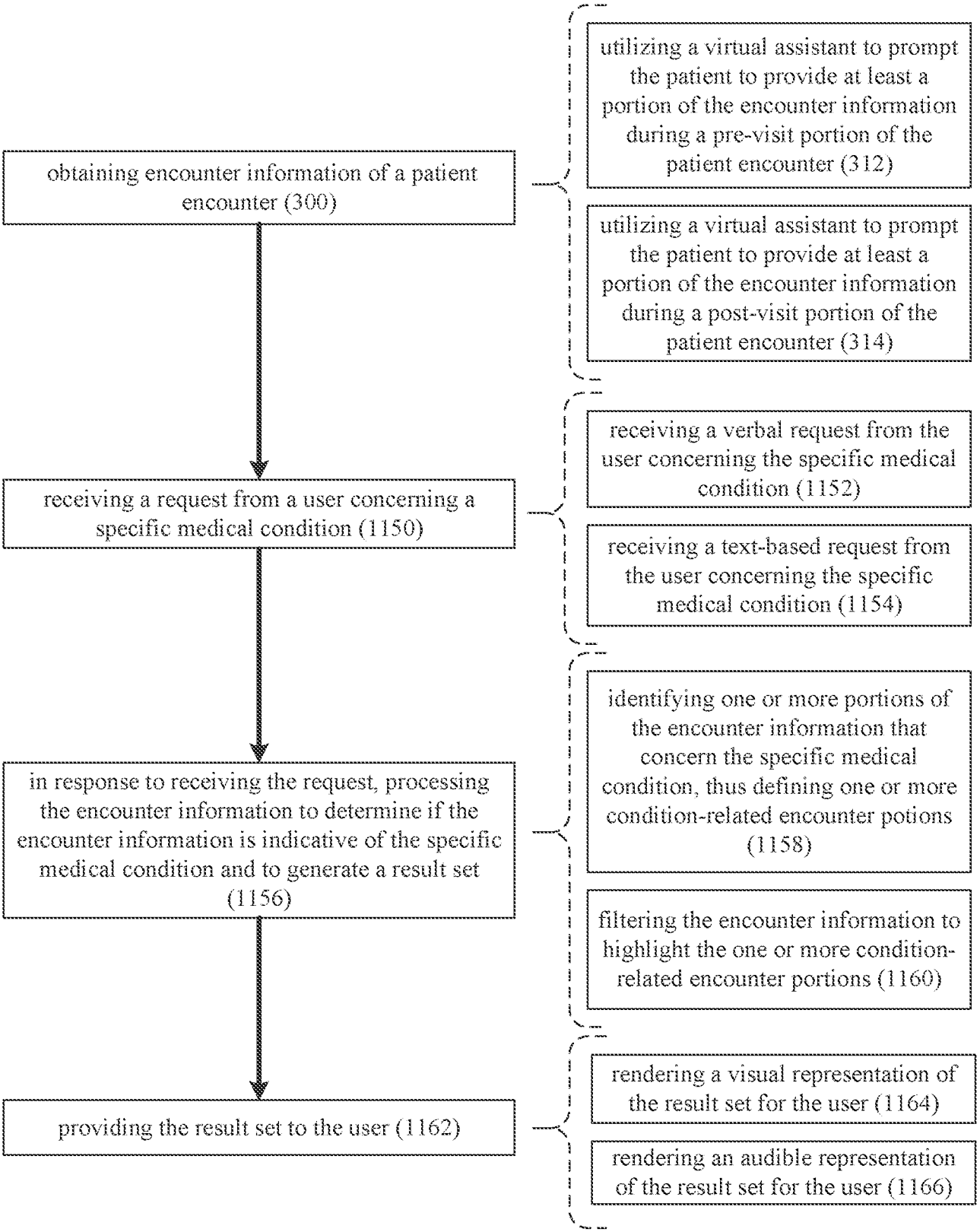
obtaining encounter information of a patient encounter (300)
utilizing a virtual assistant to prompt the patient to provide at least a portion of the encounter information during a pre-visit portion of the patient encounter (312)
utilizing a virtual assistant to prompt the patient to provide at least a portion of the encounter information during a post-visit portion of the patient encounter (314)
receiving a request from a user concerning a specific medical condition (1150)
receiving a verbal request from the user concerning the specific medical condition (1152)
receiving a text-based request from the user concerning the specific medical condition (1154)
in response to receiving the request, processing the encounter information to determine if the encounter information is indicative of the specific medical condition and to generate a result set (1156)
identifying one or more portions of the encounter information that concern the specific medical condition, thus defining one or more condition-related encounter potions (1158)
filtering the encounter information to highlight the one or more condition-related encounter portions (1160)
providing the result set to the user (1162)
rendering a visual representation of the result set for the user (1164)
rendering an audible representation of the result set for the user (1166)

FIG. 23

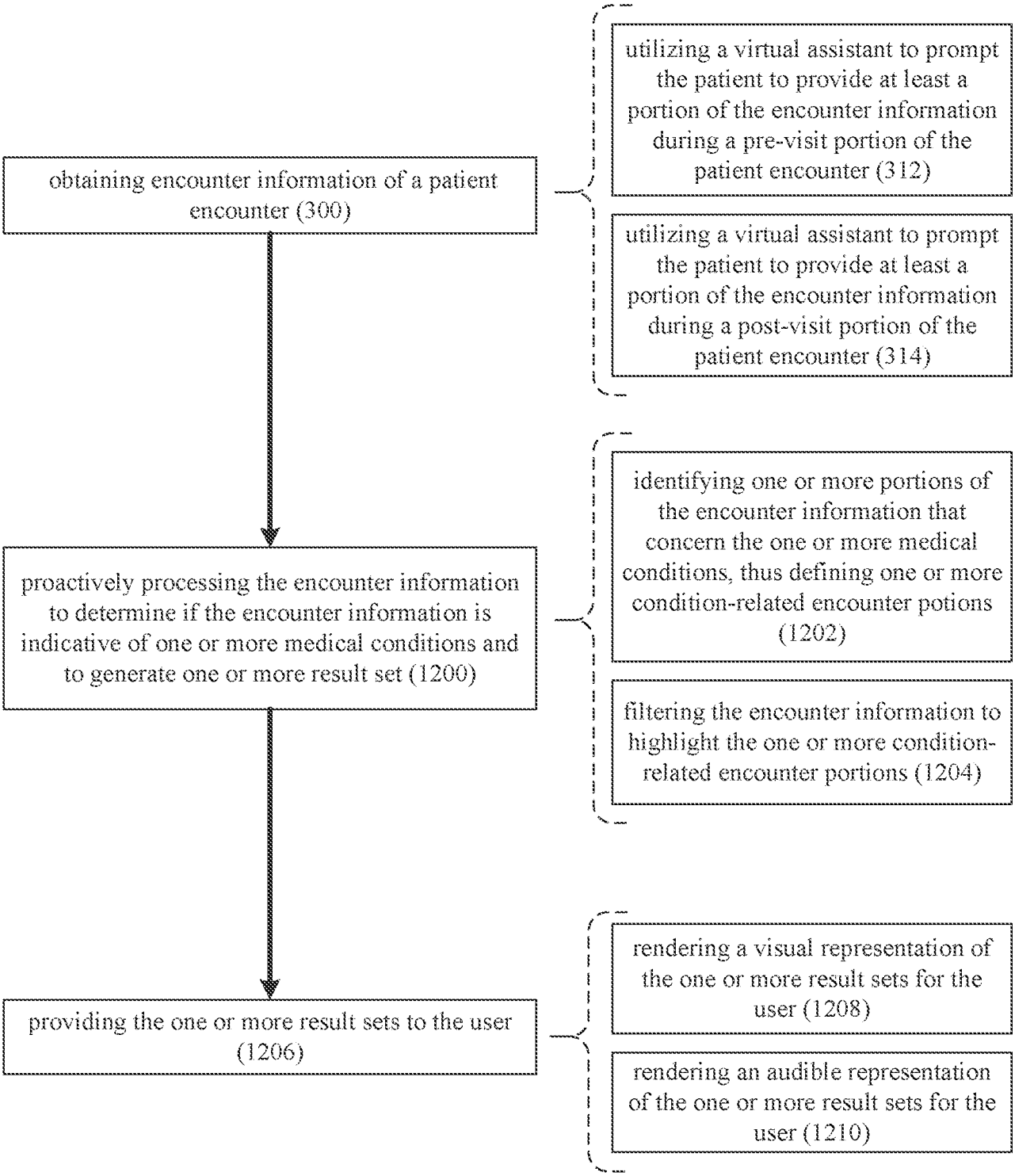
obtaining encounter information of a patient encounter (300)
utilizing a virtual assistant to prompt the patient to provide at least a portion of the encounter information during a pre-visit portion of the patient encounter (312)
utilizing a virtual assistant to prompt the patient to provide at least a portion of the encounter information during a post-visit portion of the patient encounter (314)
proactively processing the encounter information to determine if the encounter information is indicative of one or more medical conditions and to generate one or more result set (1200)
identifying one or more portions of the encounter information that concern the one or more medical conditions, thus defining one or more condition-related encounter potions (1202)
filtering the encounter information to highlight the one or more condition-related encounter portions (1204)
providing the one or more result sets to the user (1206)
rendering a visual representation of the one or more result sets for the user (1208)
rendering an audible representation of the one or more result sets for the user (1210)

FIG. 24

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 18/46041

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - G06F 19/00 (2018.01)
CPC - G16H 10/60, G16H 10/00, G06Q 10/00, G06Q 10/06, G06Q 10/10, G06F 19/00, G06Q 50/24, G16H 15/00

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.
X	US 2003/0216937 A1 (Schreiber et al.) 20 November 2003 (20.11.2003) entire documentation especially Abstract, para [0038], para [0052]-[0062]	1-21
A	US 2013/0297348 A1 (Nuance Communications, Inc.) 07 November 2013 (07.11.2013) entire document	1-21

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

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier 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	Date of mailing of the international search report
26 September 2018	24 OCT 2018
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-8300	Authorized officer: Lee W. Young PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774