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(54) **OBSERVATION-BASED TRAINING OF ARTIFICIAL INTELLIGENCE CHARACTER MODELS**

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G06F 40/40 (2020.01)
G06N 20/00 (2019.01)

(52) **U.S. Cl.**
CPC ***G06F 40/40*** (2020.01); ***G06N 20/00*** (2019.01); ***G10L 15/22*** (2013.01)

(58) **Field of Classification Search**
CPC G10L 15/22; G06N 20/00
See application file for complete search history.

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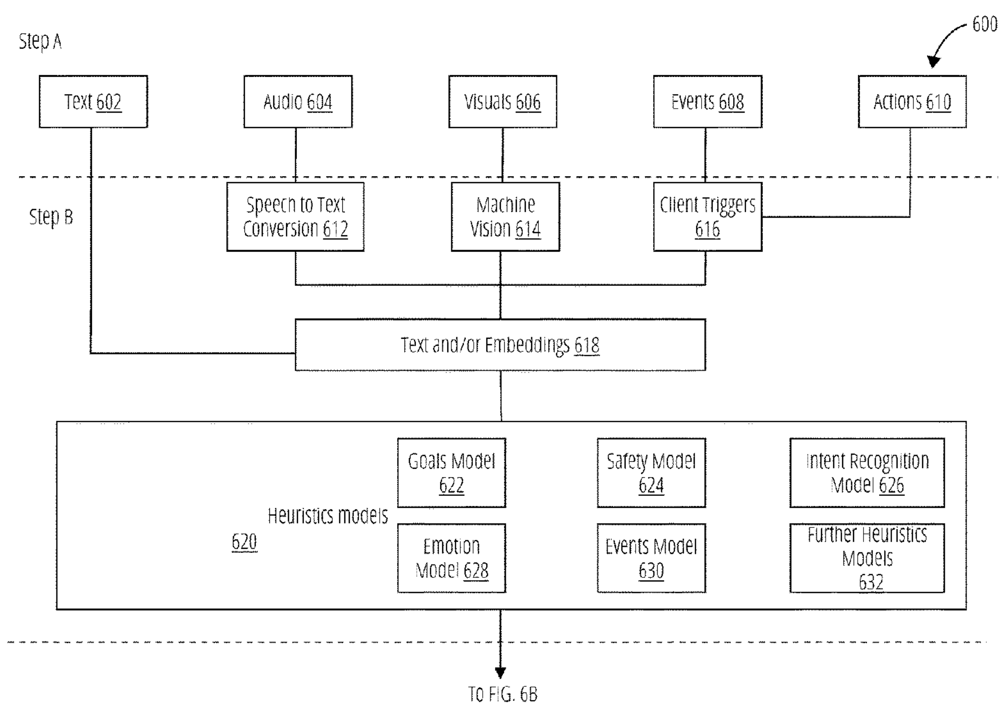
(57) **ABSTRACT**

Systems and methods for observation-based training of an Artificial Intelligence (AI) character model are provided. An example method includes receiving log data including interactions of a first user and a second user and adjusting, based on the log data, parameters of the AI character model to cause the AI character model to mimic behavioral characteristics of the first user in follow-up conversations with further users.

20 Claims, 13 Drawing Sheets



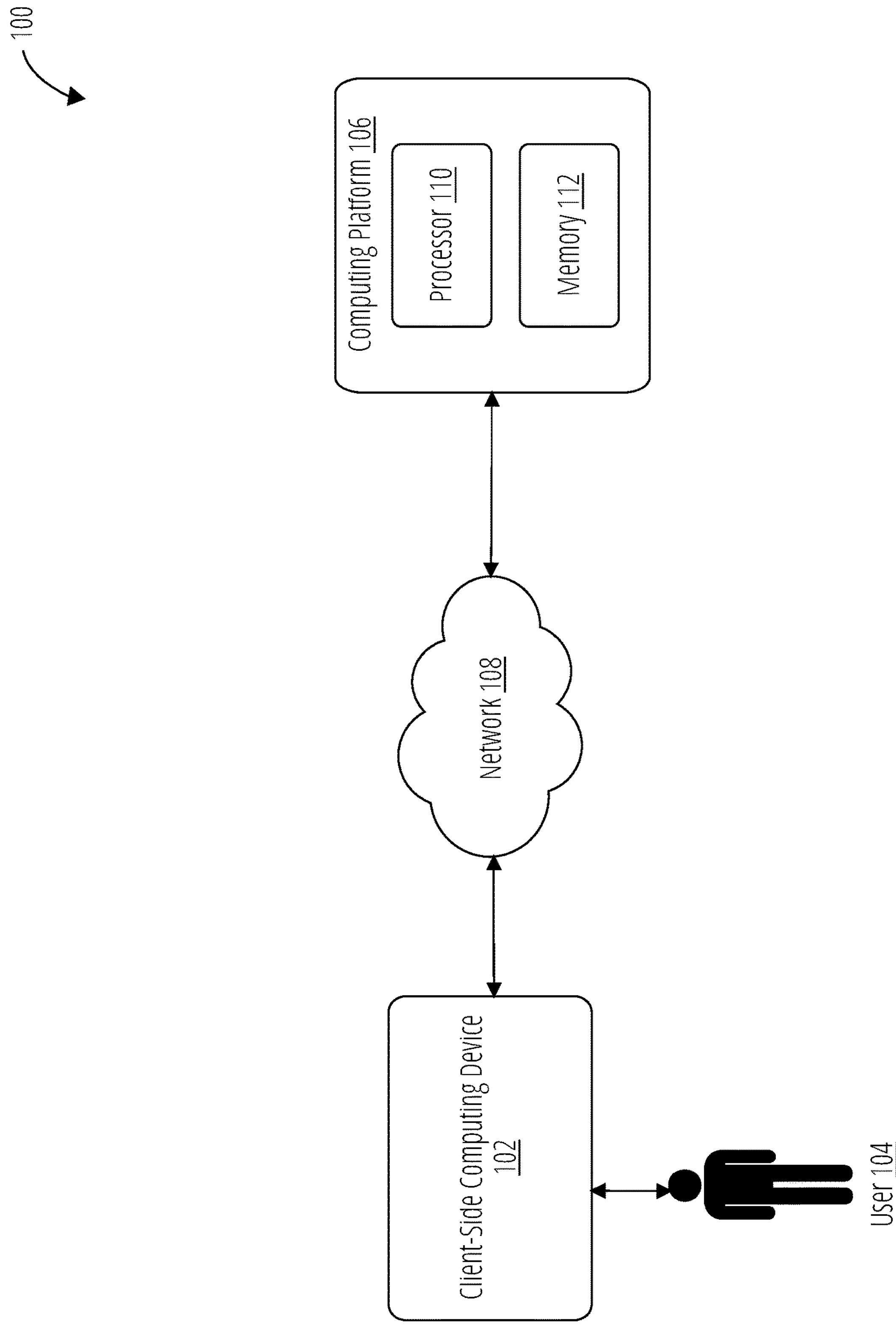

100
Computing Platform 106
Processor 110
Memory 112
Network 108
Client-Side Computing Device 102
User 104

FIG. 1

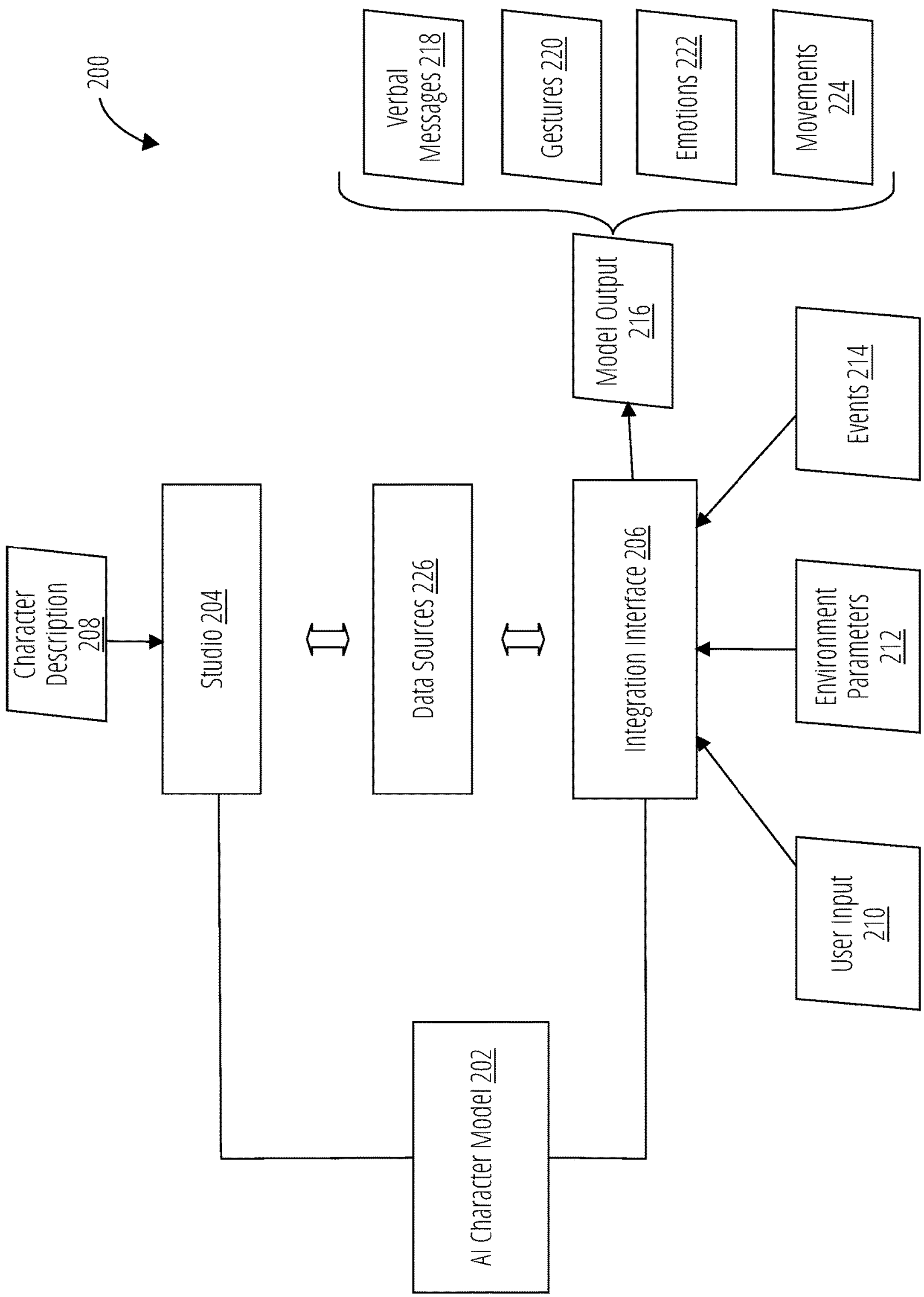

200
Verbal Messages 218
Gestures 220
Emotions 222
Movements 224
Model Output 216
Events 214
Character Description 208
Studio 204
Data Sources 226
Integration Interface 206
Environment Parameters 212
User Input 210
AI Character Model 202

FIG. 2

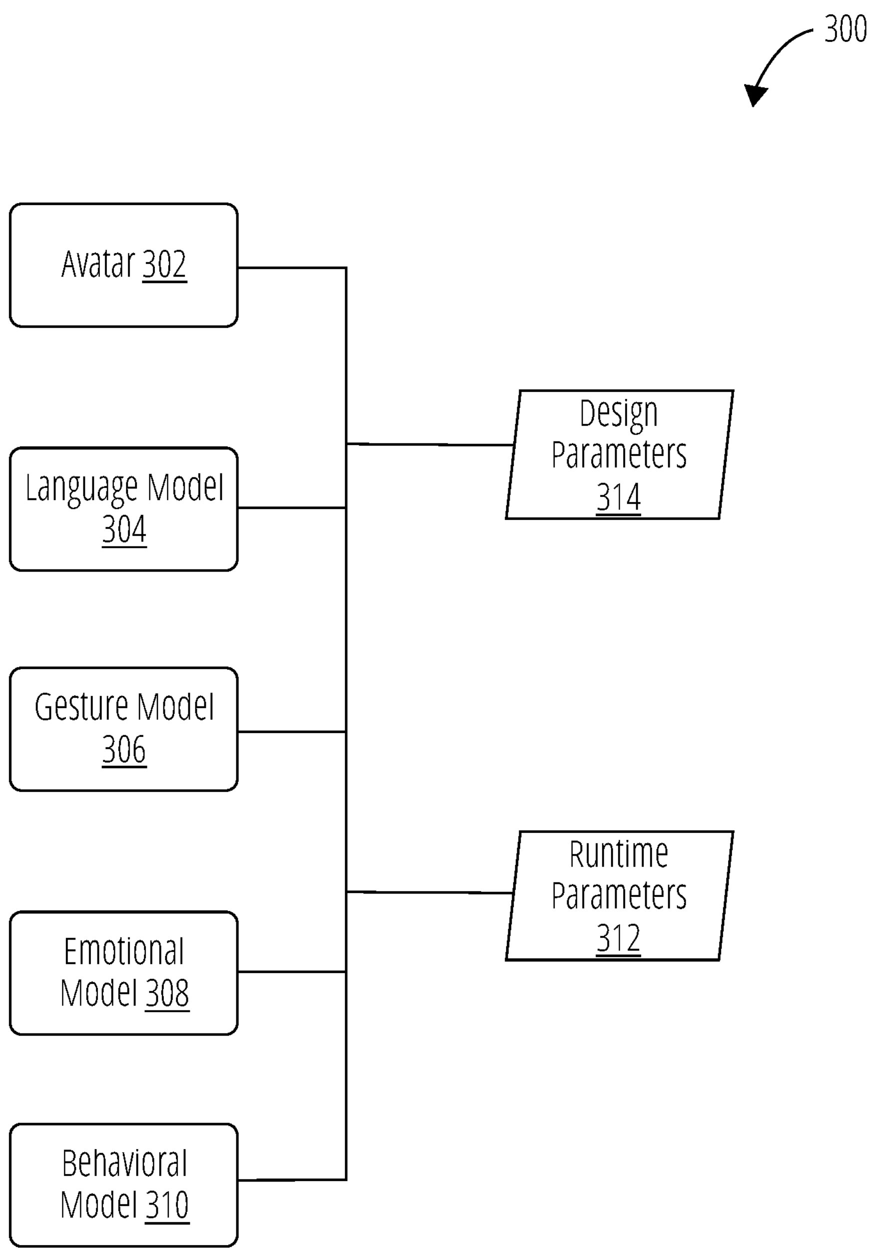

300
Avatar 302
Language Model 304
Gesture Model 306
Emotional Model 308
Behavioral Model 310
Design Parameters 314
Runtime Parameters 312

FIG. 3

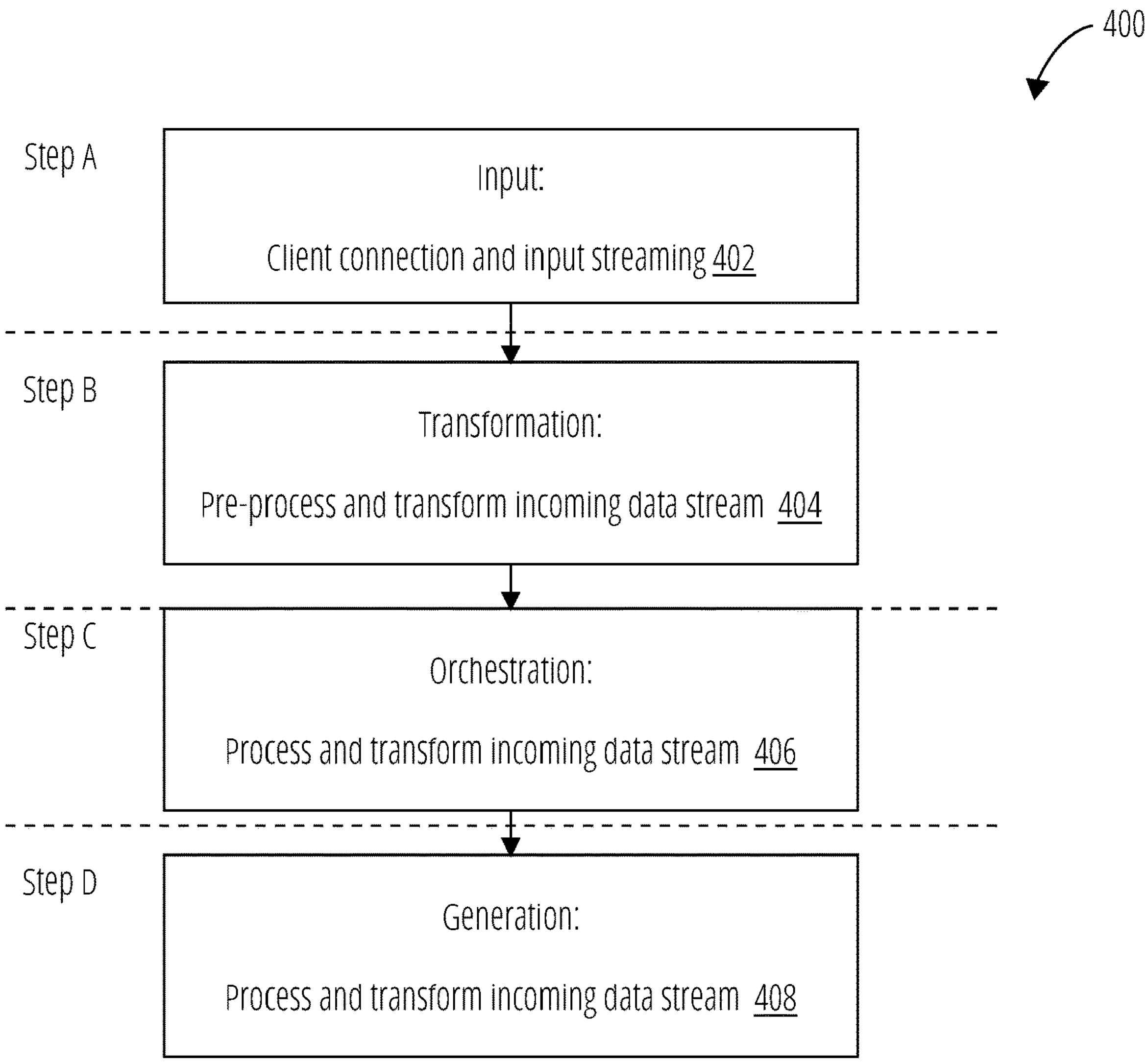

400
Step A
Input:
Client connection and input streaming 402
Step B
Transformation:
Pre-process and transform incoming data stream 404
Step C
Orchestration:
Process and transform incoming data stream 406
Step D
Generation:
Process and transform incoming data stream 408

FIG. 4

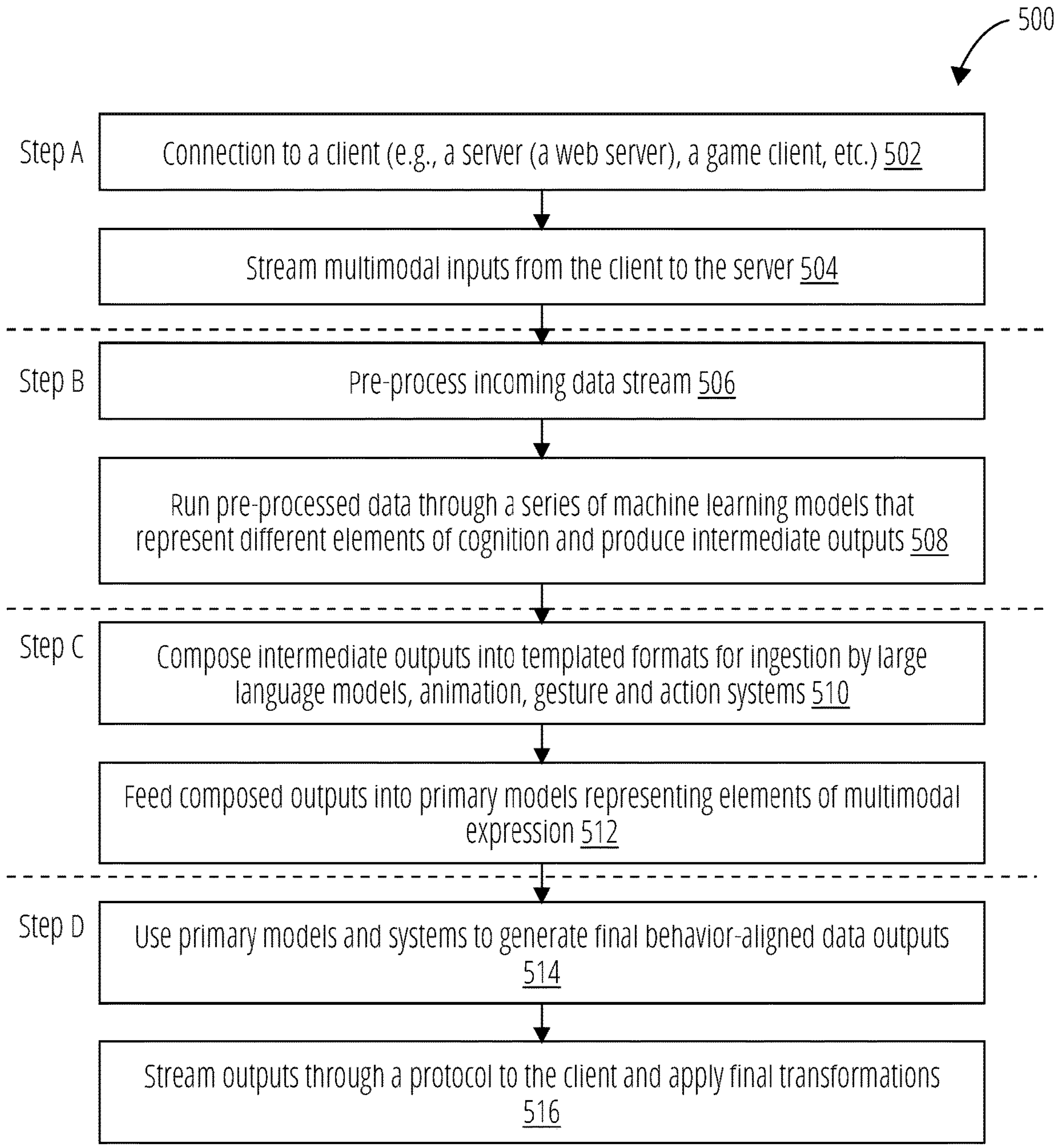

500
Step A
Connection to a client (e.g., a server (a web server), a game client, etc.) 502
Stream multimodal inputs from the client to the server 504
Step B
Pre-process incoming data stream 506
Run pre-processed data through a series of machine learning models that represent different elements of cognition and produce intermediate outputs 508
Step C
Compose intermediate outputs into templated formats for ingestion by large language models, animation, gesture and action systems 510
Feed composed outputs into primary models representing elements of multimodal expression 512
Step D
Use primary models and systems to generate final behavior-aligned data outputs 514
Stream outputs through a protocol to the client and apply final transformations 516

FIG. 5

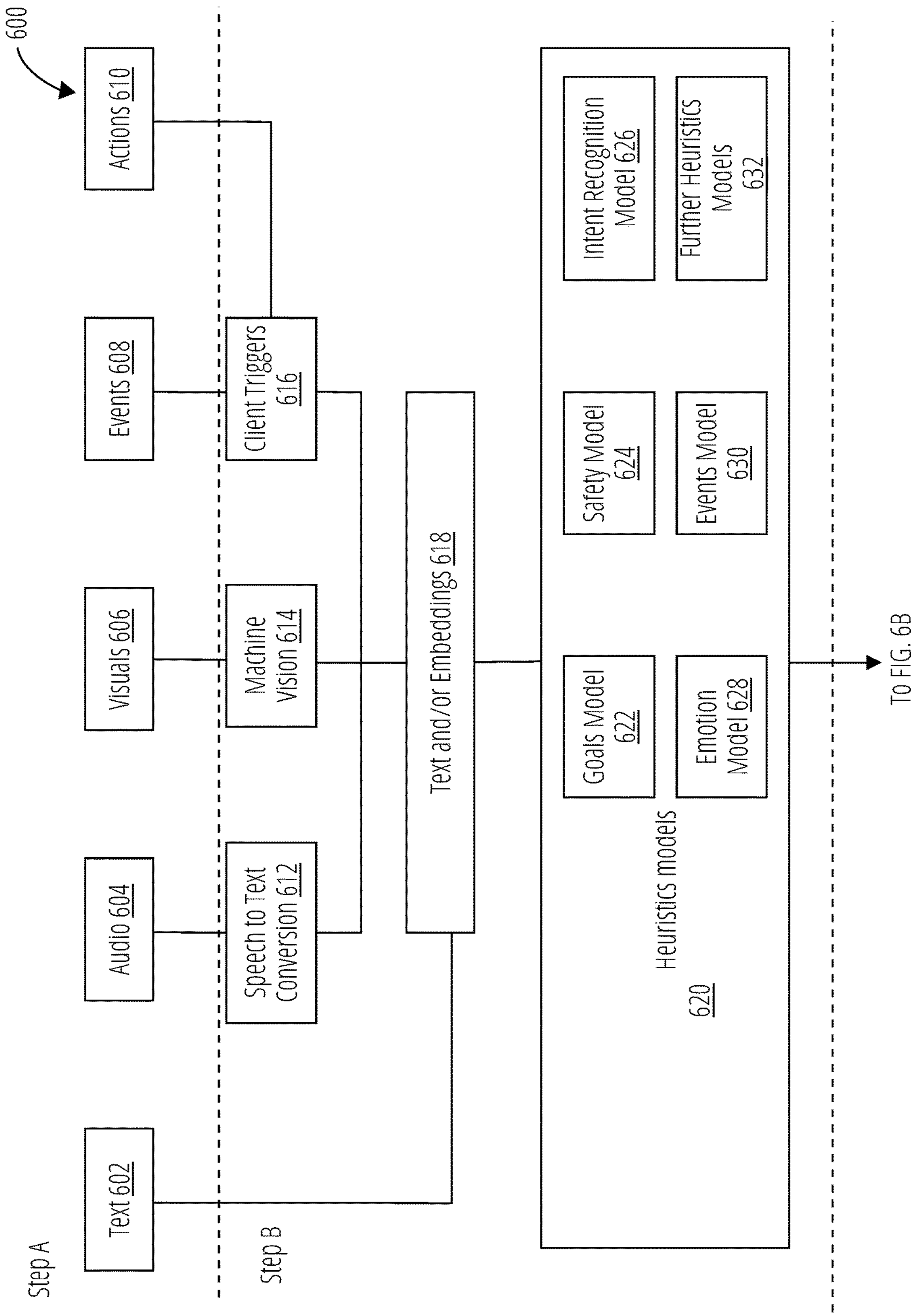

600
Step A
Step B
Text 602
Audio 604
Visuals 606
Events 608
Actions 610
Speech to Text Conversion 612
Machine Vision 614
Client Triggers 616
Text and/or Embeddings 618
Heuristics models 620
Goals Model 622
Safety Model 624
Intent Recognition Model 626
Emotion Model 628
Events Model 630
Further Heuristics Models 632
To FIG. 6B

FIG. 6A

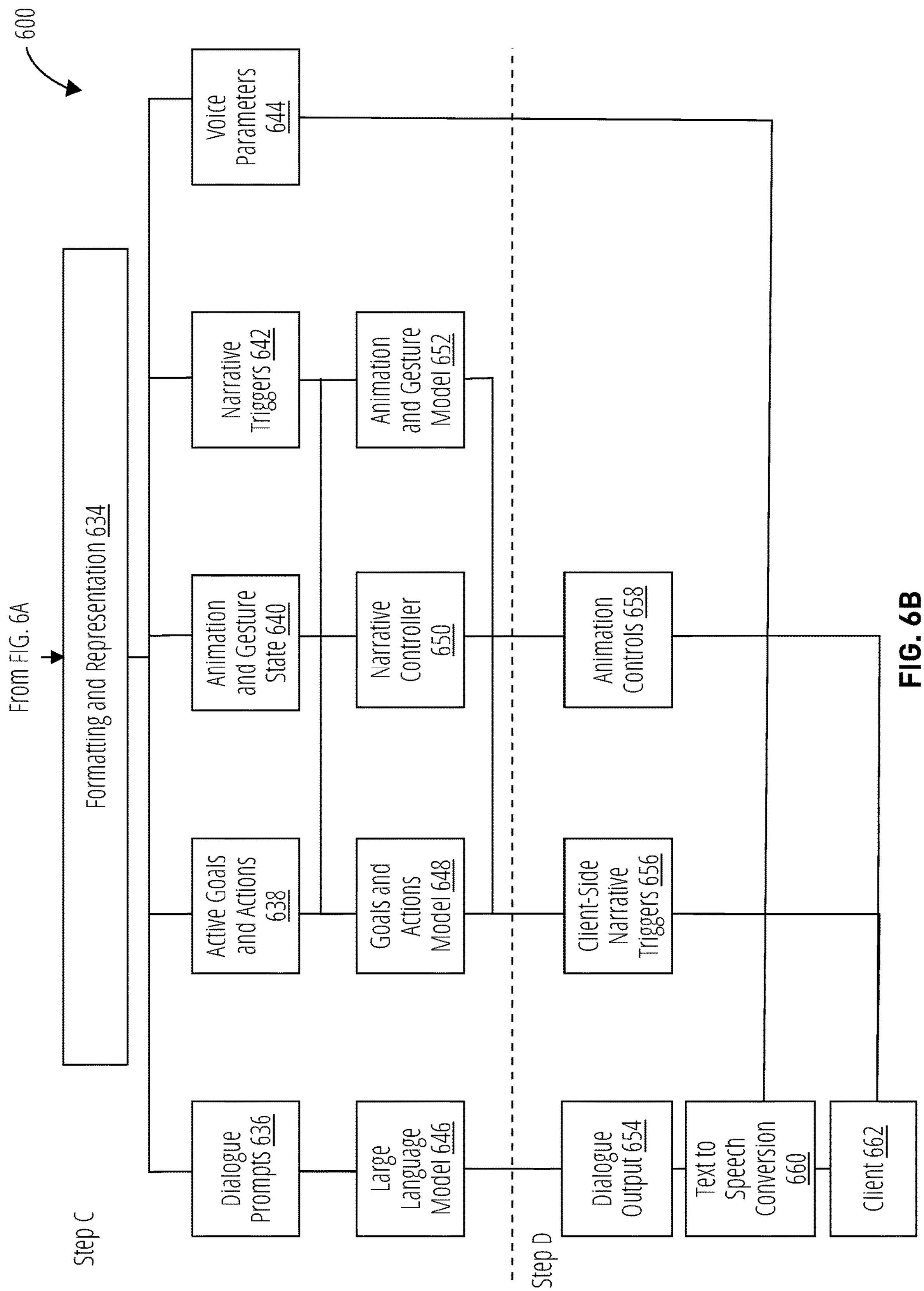

600
From FIG. 6A
Formatting and Representation 634
Step C
Dialogue Prompts 636
Active Goals and Actions 638
Animation and Gesture State 640
Narrative Triggers 642
Voice Parameters 644
Large Language Model 646
Goals and Actions Model 648
Narrative Controller 650
Animation and Gesture Model 652
Step D
Dialogue Output 654
Client-Side Narrative Triggers 656
Animation Controls 658
Text to Speech Conversion 660
Client 662

FIG. 6B

700

Possible User Inputs 702	Input Impact for Goals Model 704
AI Character Personality and Background Description 706	Allow Constitution of AI Character Personality and Style, Which Biases the Reason for Which, and Manner in Which, the AI Characters Pursue Goals 708
Motivations 710	Structure Top-Level Motivations That Underlie the Reasoning for All Character Behavior and Directions 712
Flaws and Challenges 714	Allow establishment of flaws and challenges, which may influence, motivate, or hinder goal enactment by an AI character 716
Identity Profile 718	Specify elements of an AI character (e.g., role, interests) which may have an influence on how the AI character pursues goals (e.g., a policeman trying to uncover information differently from a salesperson) 720
Emotional Profile 722	Establish an emotional profile of an AI character, such that it may influence expression of goals (e.g., more introverted character may be nervous if having to try and sell something) 724
Personal Memory 726	Provide an AI character with personal memories that may be brought up during the pursuit of a goal (e.g., if an AI character previously got bit by a dog and has to tie up a dog, the AI character may express fear or angst) 728
World Knowledge 730	Integrate information about the world to contextualize goal pursuit (e.g., the AI character may know that the police are corrupt in an area, and when pursuing an investigation show more caution) 732
Contextual Knowledge 734	Include information about an environment or context to contextualize goal pursuit (e.g., if a volcano just exploded and the AI character is asked to carry a girl to safety, the AI character may show more hurriedness) 736
Voice Configuration 738	Configuration of voice in real-time can allow AI characters to show different expressions during a goal (e.g., if an AI character is saving someone, the voice may be loud and forceful) 740
Dialogue Style Controls 742	Dialogue style influences the manner and style of speech (e.g., a Wild West bartender may still use slang when selling a drink) 744
Goals and Actions 746	Specify the goals that an AI character has per scene, and then set up the actions the AI character has available to pursue the goal 748
Animation Triggers and Controls 750	Determine which actual physical movements the AI character can take to pursue the goal (e.g., take an item off the shelf and show the player when selling) 752

To FIG. 7B

FIG. 7A

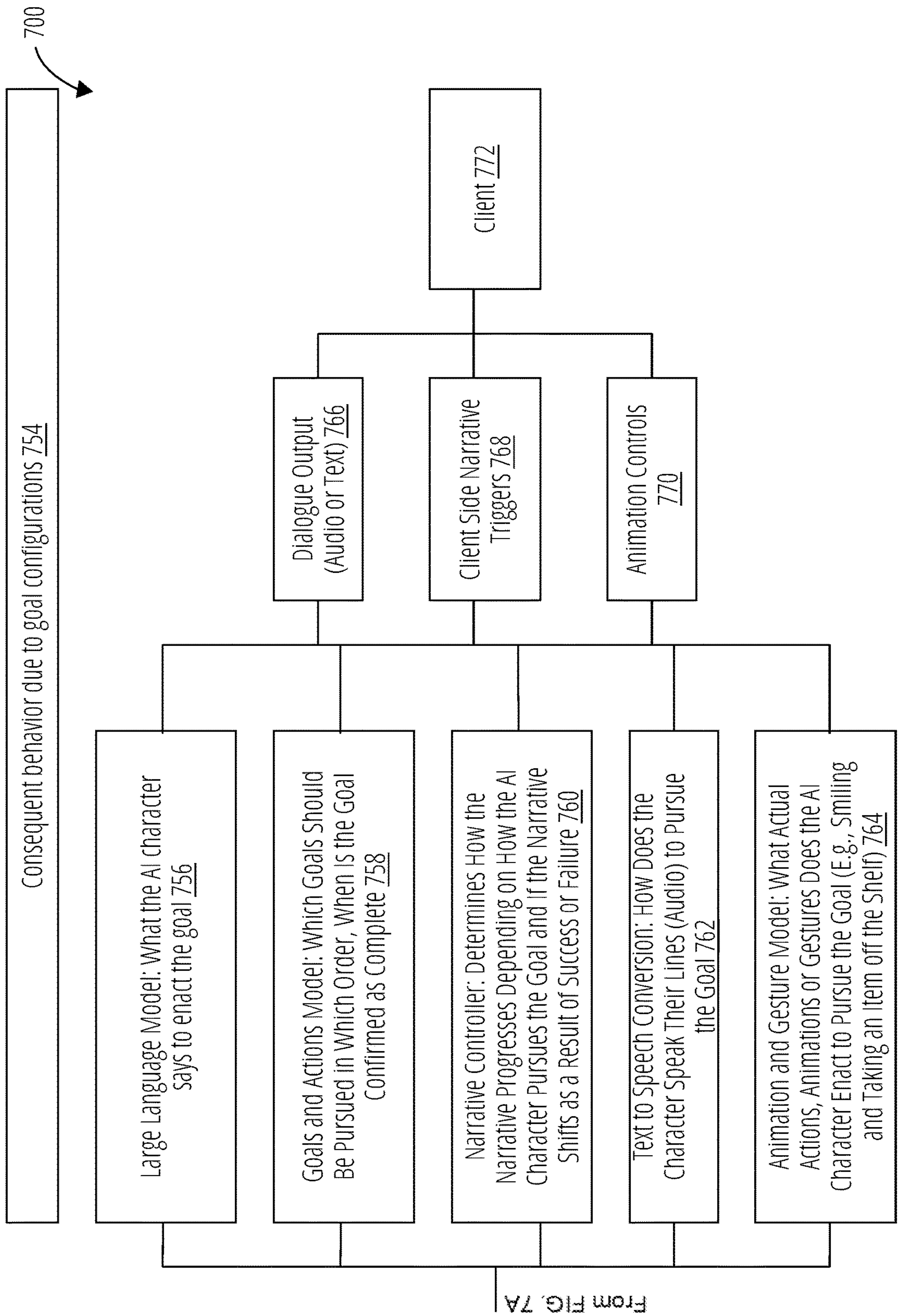

700
Consequent behavior due to goal configurations 754
Client 772
Dialogue Output (Audio or Text) 766
Client Side Narrative Triggers 768
Animation Controls 770
Large Language Model: What the AI character says to enact the goal 756
Goals and Actions Model: Which Goals Should Be Pursued in Which Order, When Is the Goal Confirmed as Complete 758
Narrative Controller: Determines How the Narrative Progresses Depending on How the AI Character Pursues the Goal and If the Narrative Shifts as a Result of Success or Failure 760
Text to Speech Conversion: How Does the Character Speak Their Lines (Audio) to Pursue the Goal 762
Animation and Gesture Model: What Actual Actions, Animations or Gestures Does the AI Character Enact to Pursue the Goal (E.g., Smiling and Taking an Item off the Shelf) 764
From FIG. 7A

FIG. 7B

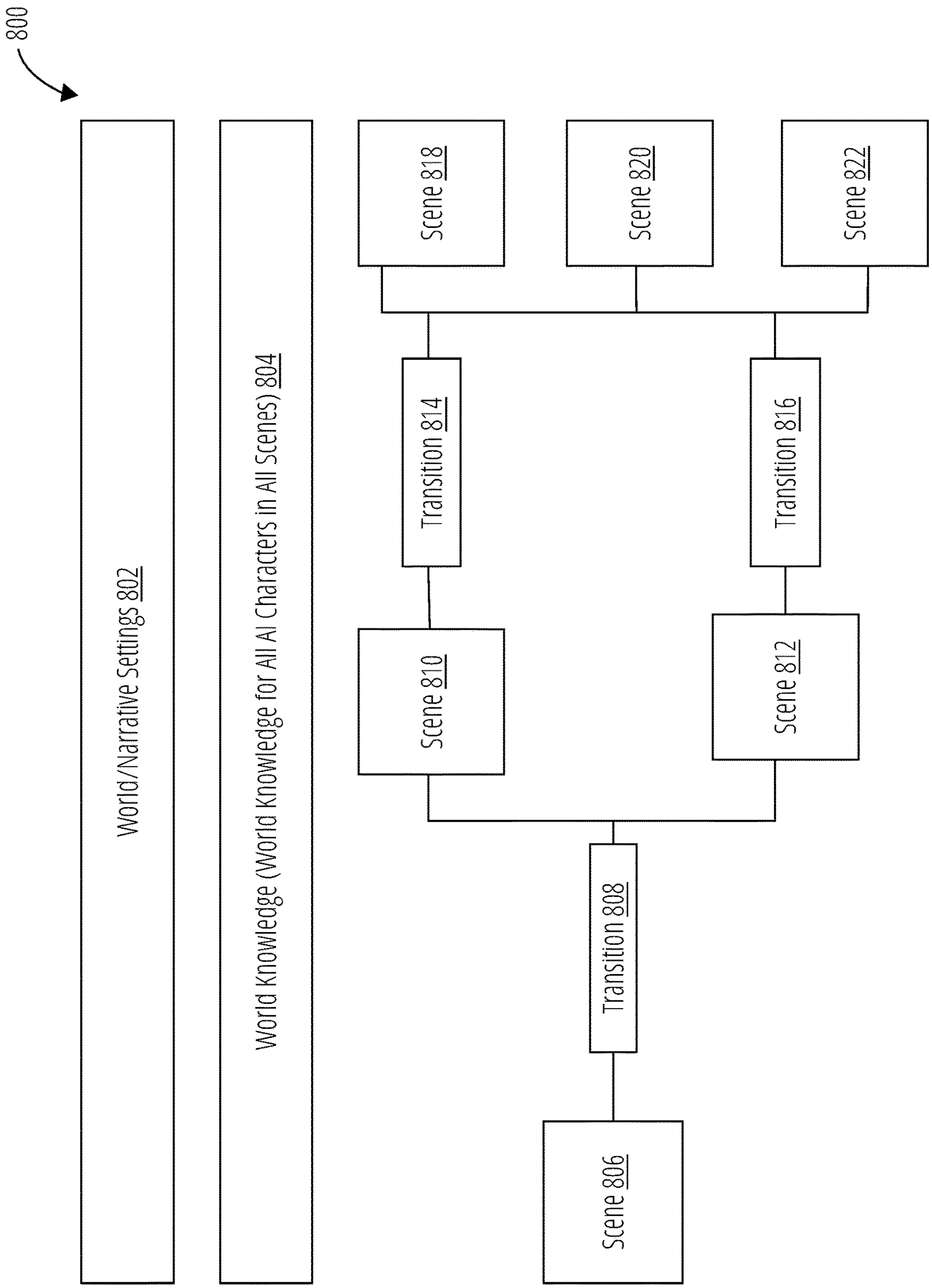

800
World/Narrative Settings 802
World Knowledge (World Knowledge for All AI Characters in All Scenes) 804
Scene 806
Transition 808
Scene 810
Scene 812
Transition 814
Transition 816
Scene 818
Scene 820
Scene 822

FIG. 8

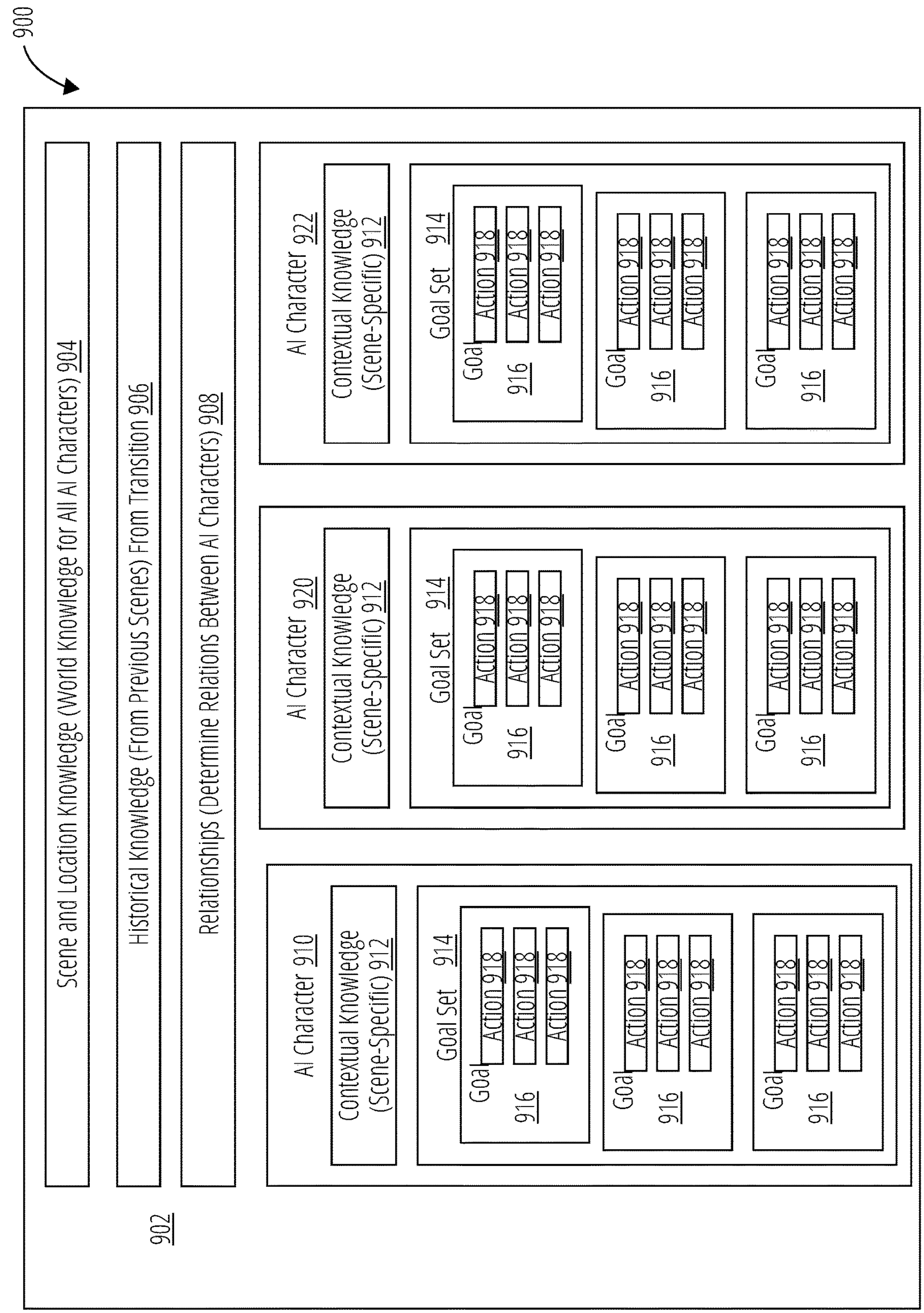

900
902
Scene and Location Knowledge (World Knowledge for All AI Characters) 904
Historical Knowledge (From Previous Scenes) From Transition 906
Relationships (Determine Relations Between AI Characters) 908
AI Character 910
AI Character 920
AI Character 922
Contextual Knowledge (Scene-Specific) 912
Goal Set 914
Goal 916
Action 918

FIG. 9

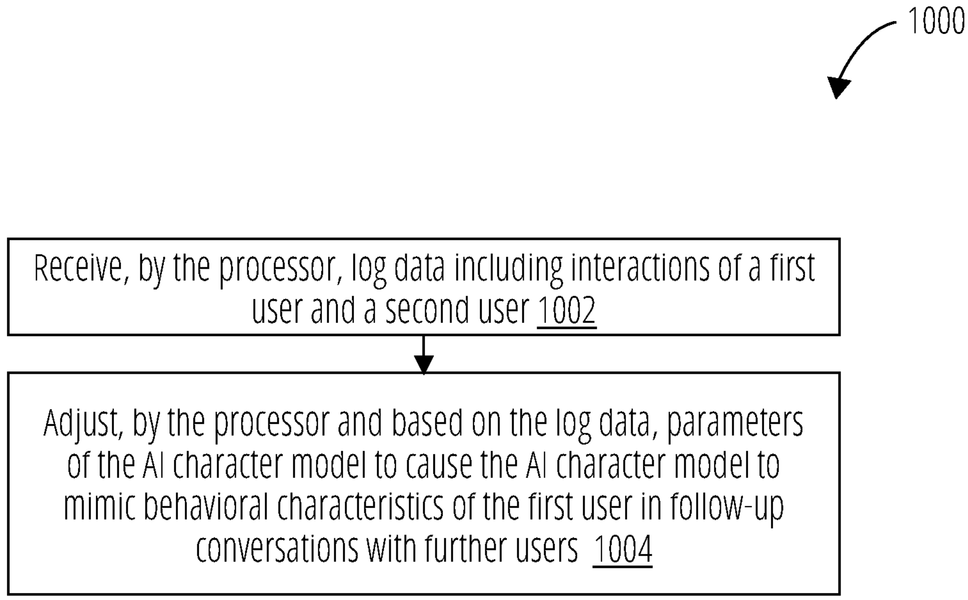

1000
Receive, by the processor, log data including interactions of a first user and a second user 1002
Adjust, by the processor and based on the log data, parameters of the AI character model to cause the AI character model to mimic behavioral characteristics of the first user in follow-up conversations with further users 1004

FIG. 10

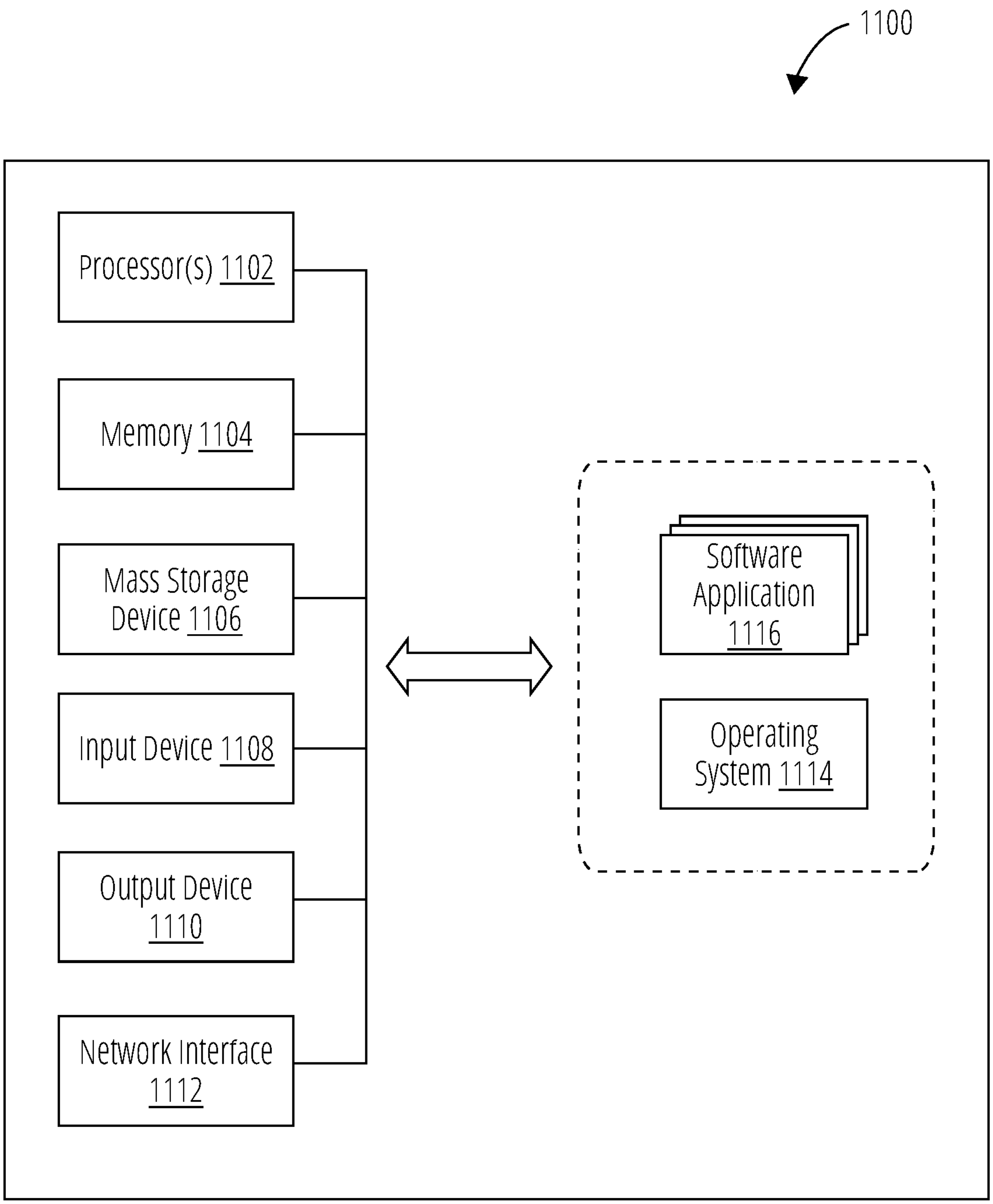

1100
Processor(s) 1102
Memory 1104
Mass Storage Device 1106
Input Device 1108
Output Device 1110
Network Interface 1112
Software Application 1116
Operating System 1114

FIG. 11

OBSERVATION-BASED TRAINING OF ARTIFICIAL INTELLIGENCE CHARACTER MODELS

CROSS-REFERENCE TO RELATED APPLICATIONS

The present application claims priority of U.S. Provisional Patent Application No. 63/335,929 filed on Apr. 28, 2022, entitled "OBSERVATION-BASED TRAINING OF ARTIFICIAL INTELLIGENCE CHARACTER MODELS." The subject matter of aforementioned application is incorporated herein by reference in its entirety for all purposes.

TECHNICAL FIELD

This disclosure generally relates to artificial intelligence (AI)-based character models. More particularly, this disclosure relates to observation-based training of AI character models.

BACKGROUND

Virtual characters are widely used in various software applications, such as games, metaverses, social media, messengers, video communication tools, and online training tools. Some of these applications allow users to interact with virtual characters. However, existing models of virtual characters are typically developed for specific applications and do not allow integration with other applications and environments. Moreover, existing virtual character models are typically based on descriptions of specific rules and logic.

Parameters of conventional virtual character models typically remain unchanged for the whole time of interaction between the users and the virtual characters. This approach results in virtual character models that lack the ability to modify their behavioral characteristics. Specifically, it is hard to change the behavior of the conventional virtual characters to mimic a desired behavior that some virtual characters or users previously had. Accordingly, tools are needed that would allow virtual character models to train to change their interactions with users based on observing interactions between users and virtual characters.

SUMMARY

This section is provided to introduce a selection of concepts in a simplified form that are further described below in the Detailed Description section. This summary is not intended to identify key features or essential features of the claimed subject matter, nor is it intended to be used as an aid in determining the scope of the claimed subject matter.

In one example embodiment, a computing platform for observation-based training of an AI character model is provided. The computing platform may include a processor and a memory storing instructions to be executed by the processor. The computing platform may be configured to receive log data that include interactions of a first user and a second user. The computing platform may be further configured to adjust, based on the log data, parameters of the AI character model to cause the AI character model to mimic behavioral characteristics of the first user in follow-up conversations with further users.

In another example embodiment, a method for observation-based training of an AI character model is provided.

The method may be implemented with a processor of a computing platform for observation-based training of an AI character model. The method may commence with receiving, by the processor, log data including interactions of a first user and a second user. Upon receiving the log data, the method may proceed with adjusting, by the processor and based on the log data, parameters of the AI character model to cause the AI character model to mimic behavioral characteristics of the first user in follow-up conversations with further users.

According to another example embodiment, provided is a non-transitory computer-readable storage medium having instructions stored thereon, which, when executed by one or more processors, cause the one or more processors to perform steps of the method for observation-based training of an AI character model.

Additional objects, advantages, and novel features of the examples will be set forth in part in the description which follows, and in part will become apparent to those skilled in the art upon examination of the following description and the accompanying drawings or may be learned by production or operation of the examples. The objects and advantages of the concepts may be realized and attained by means of the methodologies, instrumentalities and combinations particularly pointed out in the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

Embodiments are illustrated by way of example and not limitation in the figures of the accompanying drawings, in which like references indicate similar elements.

FIG. **1** illustrates an environment within which systems and methods for observation-based training of an AI character model can be implemented.

FIG. **2** is a block diagram illustrating a platform for generating an AI character model, according to an example embodiment.

FIG. **3** provides additional details for an AI character model, in accordance with an example embodiment.

FIG. **4** is an architecture diagram that shows using a surrounding architecture of an AI character model to control an output and behavior generated by large language models (LLMs), according to an example embodiment.

FIG. **5** is a detailed architecture diagram showing a surrounding architecture of an AI character model, according to an example embodiment.

FIG. **6**A is a detailed architecture diagram showing a surrounding architecture of an AI character model, according to an example embodiment.

FIG. **6**B is a detailed architecture diagram showing a surrounding architecture of an AI character model, according to an example embodiment.

FIG. **7**A shows an architecture diagram illustrating AI character models with goal-oriented behavior, according to an example embodiment.

FIG. **7**B shows an architecture diagram illustrating AI character models with goal-oriented behavior, according to an example embodiment.

FIG. **8** is a block diagram illustrating a narrative structure that shows a context of scenes used to distinguish context for goals, according to an example embodiment.

FIG. **9** is a block diagram illustrating a structure of goals within scenes, according to an example embodiment.

FIG. **10** illustrates a method for observation-based training of an AI character model, according to an example embodiment.

FIG. **11** is a high-level block diagram illustrating an example computer system, within which a set of instructions for causing the machine to perform any one or more of the methodologies discussed herein can be executed.

DETAILED DESCRIPTION

The following detailed description of embodiments includes references to the accompanying drawings, which form a part of the detailed description. Approaches described in this section are not prior art to the claims and are not admitted to be prior art by inclusion in this section. The drawings show illustrations in accordance with example embodiments. These example embodiments, which are also referred to herein as "examples," are described in enough detail to enable those skilled in the art to practice the present subject matter. The embodiments can be combined, other embodiments can be utilized, or structural, logical, and operational changes can be made without departing from the scope of what is claimed. The following detailed description is, therefore, not to be taken in a limiting sense, and the scope is defined by the appended claims and their equivalents.

The approaches described in this section could be pursued but are not necessarily approaches that have previously been conceived or pursued. Therefore, unless otherwise indicated, it should not be assumed that any of the approaches described in this section qualify as prior art merely by virtue of their inclusion in this section.

Reference will now be made in detail to embodiments, examples of which are illustrated in the accompanying drawings. In the following detailed description, numerous specific details are set forth in order to provide a thorough understanding of the present disclosure. However, it will be apparent to one of ordinary skill in the art that the present disclosure may be practiced without these specific details. In other instances, well-known methods, procedures, components, and circuits have not been described in detail so as not to unnecessarily obscure aspects of the embodiments.

Embodiments of the present disclosure are directed to a platform for generating AI character models and performing interactions between the AI character models and users. In one example embodiment, the platform may receive a description of a character and generate an AI character model capable of interacting with users verbally and through emotions, gestures, actions, and movements. The description can be provided as natural language describing a role, motivation, and environment of an AI character. The platform may utilize a common knowledge concerning the AI character to train the AI character model in order to interact with the users. The AI character model may evolve its characteristics, change emotions, and acquire knowledge based on conversations with the users.

The AI character model may utilize a LLM in conversations with the users. In order to obtain more effective and appropriate responses to user questions and messages, the platform may apply various restrictions, classifications, shortcuts, and filters in response to user questions. These targeted requests to the LLMs will result in optimized performance. For example, prior to sending a request to the LLM, the platform may classify and filter the user questions and messages to change words based on the personalities of AI characters, emotional states of AI characters, emotional states of users, context of a conversation, scene and environment of the conversation, and so forth. Similarly, the platform may adjust the response formed by the LLM by changing words and adding fillers based on the personality, role, and emotional state of the AI character. The AI character model may change emotions based on the role of the AI character and in response to emotions of the user.

The platform may include integration interfaces, such as application programming interfaces (APIs), allowing external applications to use the AI character model. The AI character models generated by the platform can be used in game applications, virtual events and conversations, corporate training, and so on.

Some embodiments of the present disclosure relate to a system and a method for observation-based training of an AI character model. The system and the method may be integrated into the platform for generating AI character models. The AI character model may be presented to the user in the form of an AI character in a virtual environment provided to the user via a client-side computing device.

The observation-based training of an AI character model is referred to as a role-based training of the AI character model. The role-based training of the AI character model may result in learning by the AI character model to generate an AI character that has parameters of an actor that played a role of a character. The system may use a pre-trained AI character model implemented as a pre-trained neural network, receive log data, and adjust the parameters of the AI character model based on the log data. The neural network may have a plurality of nodes and connections. The adjusting of the parameters of the AI character model may include updating parameters associated with the nodes and the connections based on the log data to predict with higher probability the instances of behavioral characteristics that are desirable or that mimic the log data.

The adjustment of the parameters may include learning by the AI character model by observing the log data. For example, the system may read a log of conversations between a first user and a second user and the description of a scene in a virtual environment. In the interactions between the first user and the second user, the second user may play a specific role (for example, a barista). Upon reading the log data, the system may generate, based on the log data and the description of the scene, the parameters of an AI character that is a virtual barista.

Thus, the system may provide a fine-tuned AI character model that is more specific to the log data provided to the AI character model. Accordingly, the AI character model trained by the system may provide AI characters that mimic behavioral characteristics observed by the AI character model based on the log data.

Referring now to the drawings, FIG. **1** illustrates an environment **100** within which systems and methods for observation-based training of an AI character model can be implemented. The environment **100** may include a client-side computing device **102** associated with a user **104**, a computing platform **106** for providing an AI character model (also referred to herein as a computing platform **106**), and a data network shown as a network **108**. The computing platform **106** and client-side computing device **102** (also referred to herein as a client) may communicate via the network **108**.

The client-side computing device **102** may include, but is not limited to, a smartphone, a laptop, a personal computer, a desktop computer, a tablet computer, a phablet, a personal digital assistant, a mobile telephone, a smart television set, a personal computing device, and the like. The computing platform **106** may include a processor **110** and a memory **112** storing instructions to be executed by the processor **110**.

The network **108** can refer to any wired, wireless, or optical networks including, for example, the Internet, intranet, a Local Area Network (LAN), a Personal Area Network, Wide Area Network (WAN), a Virtual Private Network, a Wi-Fi® network, cellular phone networks (e.g., a Global System for Mobile (GSM) communications network, a packet switching communications network, a circuit switching communications network), Bluetooth™ radio, an Ethernet network, an IEEE 802.11-based radio frequency network, a Frame Relay network, an Internet Protocol (IP) communications network, or any other data communication network utilizing physical layers, link layer capability, or network layers to carry data packets, or any combinations of the above-listed data networks. In some embodiments, the network **108** may include a corporate network, a data center network, a service provider network, a mobile operator network, or any combinations thereof.

The computing platform **106** may be associated with an AI character model (shown in detail in FIG. **2**). The AI character model may be configured to generate AI-based characters, also referred herein to as AI characters. The user **104** may use the computing platform **106** to create the AI character models and interact with the AI character models via the client-side computing device **102** in a virtual environment associated with the AI character. The virtual environment can be generated by the client-side computing device **102** for presenting to the user **104**. The computing platform **106** is shown in detail in FIG. **2** as a platform **200**.

FIG. **2** illustrates a platform **200** for generating AI character models, according to an example embodiment. The platform **200** may include a studio **204**, an integration interface **206**, and an AI character model **202**. AI character models are also referred to herein as AI-based character models. The studio **204** and the integration interface **206** may be in communication with data sources **226**. The data sources **226** may include online search services. The data sources **226** may include a set of clusters each associated with a type of a feature of an AI character.

In one example embodiment, the studio **204** may receive, via a user interface, a character description **208** of an AI character. The studio **204** may generate, based on the character description **208**, an AI character model **202** corresponding to the AI character. An AI character is also referred to herein as an AI-based character.

The character description **208** can be provided using a natural human language. The character description may include a description of an AI character similar to a description of a character to be played that can be provided to a real actor. The user interface of the studio **204** may include input fields allowing a developer to enter different aspects (i.e., parameters) of the AI character. Each input field may define a part of the brain of the AI character.

The input fields may include a text field for entering a core description of the AI character. An example core description can include "Buddy is a kind young man from Argentina." The input fields may include a text field for entering a motivation of the AI character. An example motivation may include "Buddy likes to dance."

The input fields may also include a text field for entering common knowledge and facts that the AI character may possess. For example, the field for common knowledge may include "orcs from Mordor; orcs like to eat hobbits."

The input fields may include fields for selecting an avatar and voice of the AI character. The input fields may include fields for defining memory and personality features of the AI character. The input fields may also include a text field describing the scene and environment in which the AI character is placed. For example, the text field for the scene may include "savanna," "city," "forest," "bar," and so forth.

The integration interface **206** may receive a user input **210**, environment parameters **212**, and events **214** and generate, based on the AI character model **202**, a model output **216**.

The user input **210** may include voice messages of a user. The voice messages may include phrases commonly used in conversations. The integration interface **206** may generate, based on the voice messages, requests and provide the request to the AI character model **202** to generate the model output **216**. In an example embodiment, the requests may include text messages verbalized by the user and an emotional state of the user.

The model output **216** may include verbal messages **218**, gestures **220**, emotions **222**, and movements **224**. The verbal messages **218** may include responses to the voice messages of the user. The gestures **220** may include specific hand and facial movements of the AI character, either accompanying the verbal messages **218** or occurring without the verbal messages **218**. Gestures **220** may include, for example, waving goodbye, nodding to indicate agreement, or pointing to indicate a direction. Gestures **220** are typically intentional and have a specific meaning that is understood by those familiar with the culture or context in which they are used. Emotions **222** may include intonations of the voice of the AI character while uttering the verbal messages **218** or facial expressions of the AI character. Movements **224** may refer to the overall movements and postures of the body of the AI character, including the position of the arms, legs, and torso. The movements **224** can be used to convey a range of emotions and attitudes, such as confidence, relaxation, or nervousness. Movements **224** can be both intentional and unintentional.

FIG. **3** provides additional details of an AI character model **300**, in accordance with an example embodiment. The AI character model **300** may include a set of models including an avatar **302**, a language model **304**, a gesture model **306**, an emotional model **308**, a behavioral model **310**, and the like. The models may include machine learning models. In some embodiments, the models can be implemented as artificial neural networks. The AI character model **300** can include runtime parameters **312** and design parameters **314**.

The design parameters **314** may correspond to settings for personality and general emotions of an AI character. The design parameters **314** can be generated based on character description **208** received via the studio **204** shown in FIG. **2**.

The runtime parameters **312** may correspond to an emotional state of an AI character. The emotional state can be changed based on conversations with the user, elements in the scene, the surrounding environment in which the AI character is currently present, and so forth.

The avatar **302** may include a three-dimensional body model rendering the AI character. In some embodiments, the avatar **302** can be created using applications currently available on the market.

The language model **304** can be based on a LLM. The LLM is a machine learning algorithm that can recognize, predict, and generate human languages on the basis of very large text-based data sets. The language model **304** may form a request for the LLM, receive a response from the LLM, and process the response from the LLM to form a response to voice messages of the user. The request for the LLM can include classification and adjustment of the text requests from the integration interface **206**, according to the current scene, environmental parameters, an emotional state of the AI character, an emotional state of the user, and current context of the conversation with the user. Processing of the response from the LLM may include filtering of the response to exclude unwanted words, verifying relevancy of the response, changing the words in the response, and adding fillers to phrases according to the personality of AI characters. In other embodiments, the language model **304** may also retrieve data from available sources, such as Wikipedia® or Game Wikipedia®, to generate the response.

The gesture model **306** may generate a movement of the body of the AI character based on the response to the user, an emotional state of the AI character, and current scene parameters. For example, the AI character may turn to the user and raise a hand in response to a greeting from the user. The greeting gestures can differ based on scenes and environments.

The emotional model **308** may track the emotional state of the AI character based on the context of the conversation with the user, an emotional state of the user, a scene and environmental parameters, and so forth.

The behavioral model **310** may track and change behavioral characteristics of the AI character as a result of conversations with users or changes in the environment and scenes during a predetermined time period.

In general, the LLM can statistically suggest a continuation to any input provided to the LLM. If a conversation is started by using the LLM, the LLM may propose the next step for the conversation. For example, if a conversation includes a story related to some topic, the LLM may propose the next line for the story.

One of the key characteristics of LLMs is the fact that LLMs are large. In particular, the LLMs are trained on vast amounts of data. When used in conversations, the LLMs can statistically suggest some text determined by the LLMs to be meaningful in the next step of the conversation. Therefore, the LLMs conventionally build the conversation based on the text itself.

FIG. **4** is an architecture diagram **400** that shows using a surrounding architecture of an AI character model to control an output and behavior generated by LLMs, according to an example embodiment. The main steps implemented to control the output and behavior of AI characters using the AI character model include an input step **402** (step A), a transformation step **404** (step B), an orchestration step **406** (step C), and a generation step **408** (step D). The input step **402** includes providing a connection with a client and performing input streaming. The transformation step **404** includes pre-processing and transforming an incoming data stream. The orchestration step **406** and the generation step **408** include processing and transforming an incoming data stream. Steps A-D are shown in detail in FIG. **5**, FIG. **6**A, and FIG. **6**B.

FIG. **5** is a detailed architecture diagram **500** showing a surrounding architecture of an AI character model, according to an example embodiment. The input step (step A) may include establishing a connection between a client and a server, as shown in block **502**. In an example embodiment, the client may include a user device associated with a user. The user may use the client device to interact with AI characters in a virtual environment using an application running on the user device. To establish the connection between the system of the present disclosure and the client, a server (e.g., a web server), a game client, and an application running on the user device may be provided. The server, the game client, and the application may be set up based on predetermined rules to enable streaming multimodal inputs from the client to the server, as shown in block **504**. The inputs are shown in detail in FIG. **6**A.

FIG. **6**A and FIG. **6**B show a detailed architecture diagram **600** that illustrates a surrounding architecture of an AI character model, according to an example embodiment. The connection established between the client and the server via predetermined protocols enables collecting a plurality of streams of inputs from the client. Each stream may be associated with one of multiple modalities. In an example embodiment, the modality may include a type of data. As shown in FIG. **6**A, the inputs collected from the client may include text **602**, audio **604**, visuals **606**, events **608**, actions **610**, gestures (not shown), and so forth.

Referring again to FIG. **5**, the transformation step (step B) may include pre-processing the incoming streams of data in block **506**. The streams of inputs may be pre-processed differentially based on the specific modality. The pre-processing may include converting the received inputs into a singular format. The pre-processing is shown in detail in FIG. **6**A.

As shown in FIG. **6**A, the text **602** is in the form of a natural language and may need no pre-processing. The audio **604** may be pre-processed using a speech to text conversion **612**, in the course of which the audio input may be transformed into text. The visuals **606** may be pre-processed using a machine vision **614** based on object classification, environment understanding, and so forth.

The events **608** may include any event received from the client. An example event may include a button click in a game, an AI character moving a sword in a game, a button click in a web application, and so forth. The actions **610** may be received from an environment of AI characters with which the user interacts. An example action may include reacting to a horse riding by in an application, calling a web hook to retrieve information, and so forth. The events **608** and the actions **610** may be processed into client triggers **616**. Based on the pre-processing, all inputs may be transformed into text and/or embeddings **618**. The embeddings (also referred to as word embeddings) are word representations, in which words with similar meaning have a similar representation. Thus, a pre-processed data stream in the form of text and/or embeddings **618** may be obtained upon pre-processing of the received inputs.

Referring again to FIG. **5**, the transformation step (step B) may further include running the pre-processed data through a series of machine learning models that represent different elements of cognition and producing intermediate outputs, as shown in block **508**. Processing the data using the series of machine learning models is shown in detail in FIG. **6**A.

As shown in FIG. **6**A, the text and/or embeddings **618** may be passed through a plurality of machine learning models shown as heuristics models **620**. The processing of the text and/or embeddings **618** using the heuristics models **620** may include passing the text and/or embeddings **618** through a goals model **622**, a safety model **624**, an intent recognition model **626**, an emotion model **628**, an events model **630**, and a plurality of further heuristics models **632**.

The goals model **622** may be configured to process the text and/or embeddings **618** and recognize, based on what was said by the user or the AI character, what goals need to be activated. The safety model **624** may be configured to process the text and/or embeddings **618** and filter out unsafe responses. The intent recognition model **626** may be configured to process the text and/or embeddings **618** and determine what a player (i.e., a user) intends to do and use an intent to trigger one or more events at a later point of interaction of the player with AI characters in the game.

The emotion model **628** may be configured to process the text and/or embeddings **618** and update, based on what the player said, the emotions of the AI character. The events model **630** may be configured to process the text and/or embeddings **618** and determine the events. The events may act as triggers for performing an action based on predetermined rules. For example, a predetermined rule may include a rule according to which when the player steps into a specific location (the event) near the AI character, the AI character takes a predetermined action.

Upon the processing of the data, the heuristics models **620** may provide intermediate outputs. Each of the intermediate outputs provided by the heuristics models **620** may be a differential element. Specifically, the goals model **622**, the safety model **624**, the intent recognition model **626**, the emotion model **628**, and the events model **630** may each provide a specific sort of a separate element. The separate elements need to be orchestrated by composing together into a specific templated format.

Referring again to FIG. **5**, the orchestration step (step C) may include composing the intermediate outputs received from the heuristics models into templated formats for ingestion by LLMs and animation, gesture, and action models in block **510**. Upon composing the intermediate outputs into a template, the composed outputs may be fed into primary models representing elements of multimodal expression, as shown in block **512**. The orchestration step (step C) is further shown in detail in FIG. **6**B.

As shown in FIG. **6**B, the orchestration step (step C) may include formatting and representation **634** of the intermediate outputs received from the heuristics models. Upon being formatted, the composed data may be sent to another series of AI models. Specifically, the composed data received in block **510** shown in FIG. **5** may include dialogue prompts **636**, active goals and actions **638** (i.e., what goals and actions need to be active based on what was said or done by the user or the AI character), animation and gesture state **640** (i.e., what gestures or animations need to be active depending on the emotional state and the goal), narrative triggers **642**, voice parameters **644**, and so forth. The dialogue prompts **636** may be provided to a LLM **646**. The active goals and actions **638** may be provided to a goals and actions model **648**, the narrative controller **650**, and the animation and gesture model **652**. The animation and gesture state **640** may be provided to the goals and actions model **648**, the narrative controller **650**, and the animation and gesture model **652**.

The narrative triggers **642** may be provided to the goals and actions model **648**, the narrative controller **650**, and the animation and gesture model **652**. An example of the narrative triggers **642** may include words "I want to be in the investigation" said by the player. The goals and actions model **648**, the narrative controller **650**, and/or the animation and gesture model **652** may receive this narrative trigger and change the storyline and progress forward in the game.

The voice parameters **644** may be used for enacting the voice in the virtual environment. For example, if the AI character is angry, the voice parameter "angry" may be used to change the voice of the AI character in the game. If the state of the AI character changes to very forceful, the state can be shown by changing the voice of the AI character.

Referring again to FIG. **5**, the generation step (step D) may include using primary models and systems to generate final behavior-aligned data outputs in block **514**. The generation step (step D) may further include streaming outputs through predetermined protocols to the client and applying final transformations in block **516**. The generation step (step D) is further shown in detail in FIG. **6**B.

As shown in FIG. **6**B, the LLM **646** is a model used to generate a dialogue output **654**. The goals and actions model **648** and the narrative controller **650** both decide what needs to be sent to the client side. The client side may be represented by a client engine, a game engine, a web application running on a client-side computing device, and the like. The goals and actions model **648** and the narrative controller **650** may decide what needs to be enacted on the client side. The animation and gesture model **652** may decide what animations or gestures need to be activated on the client side to enact the behavior of AI characters. Therefore, the goals and actions model **648**, the narrative controller **650**, and the animation and gesture model **652** provide client-side narrative triggers **656** and animation controls **658**. The dialogue output **654**, the client-side narrative triggers **656**, and the animation controls **658** provide the dialogue, the events, the client-side triggers, and the animations that need to be enacted on the client side.

The dialogue output **654**, the client-side narrative triggers **656**, the animation controls **658**, and the voice parameters **644** may be processed using text to speech conversion **660**. The output data obtained upon applying the text to speech conversion **660** are sent as a stream to the client **662**. The game engine animates the AI character based on the received data to provide the generative behavior of the AI character. The animating may include, for example, instructing the AI character on what to say, how to move, what to enact, and the like.

FIG. **7**A and FIG. **7**B show an architecture diagram **700** illustrating AI character models with goal-oriented behavior, according to an example embodiment. The AI character models may include generative models configured to follow sequential instructions for dialog and actions that are driven by a specific purpose or intent for AI-driven characters. FIG. **7**A shows possible user inputs **702** and input impact for goals model **704**. The possible user inputs **702** include fields that are exposed to the user and can be changed by the user in the studio. The input impact for goals model **704** includes impacts of each user input on the goals model.

Compared to general language models that provide general goals for AI characters, the goals model enables providing specific goals. FIG. **7**A shows that each type of configuration caused by the possible user inputs **702** may influence the goals and actions of the AI character. More specifically, the AI character personality and background description **706** selected by the user has an impact on the constitution of AI character personality and style, which biases the reason for which, and manner in which, the AI character pursues goals, as shown in block **708**. Therefore, the AI character personality and background description **706** may influence how the AI character enacts its goals. For example, if the AI characters are Alice in Wonderland versus Jack Sparrow, the AI characters may have the exact same goal (e.g., to show their house to a player). However, the AI characters may show their houses in completely different ways because the AI characters represent two different people.

The motivations **710** received from the user may structure top-level motivations that underlie the reasoning for all AI character behavior and directions, as shown in block **712**. Therefore, the motivations **710** may effectively determine why this AI character is pursuing this goal, i.e., determine the top-level motivation of the AI character. For example, the motivation of Alice in Wonderland is to get home. The goals of Alice are to ask the Mad Hatter what he knows about Wonderland. These goals may be determined and provided to the top-level motivation.

Flaws and challenges **714** selected by the user allow establishment of flaws and challenges for the AI character, which may influence, motivate, or hinder goal enactment by the AI character, as shown in block **716**.

An identity profile **718** selected by the user may specify elements of an AI character (e.g., role, interests) which may have an influence on how the AI character pursues goals (e.g., a policeman trying to uncover information differently from a salesperson), as shown in block **720**. The flaws and challenges **714** and the identity profile **718** are ways of enacting so as to influence the goal more contextually. For example, the AI character is Indiana Jones and his flaw is that he is scared of snakes. The goal of the AI character is to cross a cavern covered in snakes. Therefore, based on the flaw, the AI character may say, "Oh, I'm so scared of snakes," and then achieve the goal. Therefore, the flaws and challenges **714** are used to add a context to the goal-oriented behavior of the AI character. The identity profile **718** is used similarly to further contextualize the goal-oriented behavior of the AI character. For example, the AI characters may include a police person (a first identity) and a salesperson (a second identity) both trying to uncover information, but the salesperson may do it very differently than the police person.

An emotional profile **722** received from the user may be used to establish an emotional profile of an AI character, such that the emotional profile may influence expression of goals, as shown in block **724**. The emotional profile **722** may include the expression. For example, the introvertedness of the AI character may be turned up to make the AI character introverted, in which case if the AI character had to sell something or the AI character had to say something to someone, the AI character may be more nervous than if the AI character was extroverted.

Various parts of memories, such as a personal memory **726**, world knowledge **730**, and contextual knowledge **734** provide information that may be relevant to the pursuit of a goal. Specifically, the personal memory **726** may be used to provide an AI character with personal memories that may be brought up during the pursuit of a goal, as shown in block **728**. For example, if the AI character remembers that the AI character recently was bitten by a dog and the goal is to go in and tie up a dog, the AI character may express fear or angst and say, "Oh, I can do that, but I'm really scared, I had this bad experience." Therefore, changing the behavior of the AI character based on the personal memory **726** makes the behavior more realistic.

The world knowledge **730** may be used to integrate information about the world to contextualize pursuit of the goal, as shown in block **732**. The world knowledge **730** may be used to further contextualize the behavior of the AI character. For example, in a specific science fiction world, the AI character knows that all the police are corrupt in an area and working for an evil overlord. Therefore, the AI character may be scared or show more cautious when pursuing an investigation.

The contextual knowledge **734** may be processed to include information about an environment or context to contextualize pursuit of the goal, as shown in block **736**. For example, if a volcano has just exploded and the AI character is asked to carry a girl to safety, the AI character may show more hurriedness, and may be forceful to the girl, versus if that was not true, the AI character might pursue the goal differently.

Voice configuration **738** may be used to determine the configuration of voice in real-time, which can allow AI characters to show different expressions when pursuing a goal, as shown in block **740**. For example, if the AI character is a fireman who is saving someone, it may be extremely loud in a burning building; therefore, the voice of the AI character may be made loud and forceful. The AI character may pursue the goal differently as compared, for example, the case when the AI character was doing the same actions in a courtroom.

Dialogue style controls **742** may be used to control a dialogue style of an AI character. The dialogue style may influence the manner and style of speech of the AI character, as shown in block **744**. For example, the user may set the dialog style to be a modern day New York dialogue style or a Wild West style. In each of the styles, the AI character may use different words. For example, a Wild West bartender may use slang when selling a drink.

Goals and actions **746** received from the user may be processed to specify the goals that an AI character has per scene, and then set up the actions that the AI character has available to pursue the goal, as shown in block **748**. Therefore, the goals and actions **746** specify the goals for the scene in which the AI character is currently present, the sequence of goals, and actions that the AI characters have to do to pursue the goals.

Animation triggers and controls **750** may include animations and gestures, which may determine which actual physical movements the AI character can take to pursue the goal, as shown in block **752**. For example, the AI character is selling an item and needs to take the item off the shelf and show it to the player when selling.

The input impact for goals model **704** are provided to a plurality of AI models to generate a consequent behavior **754** due to goal configurations, as shown in FIG. 7B. More specifically, the LLM may determine what the AI character needs to say to enact the goal, as shown in block **756**. The goals and actions model shown in block **758** is the controller for determining which goals need to be pursued and in which order, when is the goal confirmed as complete, and the like.

The narrative controller determines how the narrative progresses depending on how the AI character pursues the goal (the goal is successful or failed) and if the narrative shifts as a result of a success or a failure, as shown in block **760**. For example, in a game an AI character is supposed to save a girl, but the AI character fails, and the girl dies. This failure to complete the goal may change the narrative. The narrative controller may send a trigger to change the behavior of the AI character based on this failure to the game engine.

The text to speech conversion model determines how the AI character speaks his lines (audio) to pursue the goal, as shown in block **762**. The parameters to be changed may also include, for example, the dialogue style and voice configuration.

The animation and gesture model may determine what actual actions, animations, or gestures the AI character enacts to pursue the goal (e.g., smiling and taking an item off the shelf, picking up a girl to save her from a burning building), as shown in block **764**.

The outputs obtained in blocks **756-764** may include a dialogue output (audio or text) **766**, client side narrative triggers **768**, and animation controls **770**. The dialogue output (audio or text) **766**, the client side narrative triggers **768**, and the animation controls **770** may be provided to a client **772** (e.g., a client engine, a game engine, a web application, and the like).

FIG. **8** is a block diagram **800** illustrating a narrative structure that shows a context of scenes used to distinguish context for goals, according to an example embodiment. The narrative structure may include world/narrative settings **802** and world knowledge **804** (world knowledge for all AI characters in all scenes). The world/narrative settings **802** and the world knowledge **804** may be used to transition from one scene to another in a story. Therefore, a story or an experience associated with an AI character may happen as a series of scenes and transitions.

In an example embodiment, an AI character may exist in a scene **806**. Based on the world/narrative settings **802** and the world knowledge **804**, the scene **806** may be transitioned in block **808** into a scene **810** and a scene **812**. The scene **810** may be transitioned in block **814** and the scene **812** may be transitioned in block **816** into a scene **818**, a scene **820**, and a scene **822**.

FIG. **9** is a block diagram **900** illustrating a structure of goals within scenes, according to an example embodiment. Within each scene, for each specific AI character, there is a goal that the AI character has to pursue. A scene **902** may be driven by a plurality of parameters. The parameters may include scene and location knowledge **904**, which may include world knowledge for all AI characters. The parameters may further include historical knowledge **906**, which may include knowledge from previous scenes and from transition between the previous scene and the current scene **902**. The parameters may further include relationships **908**, which determine relations between AI characters **910**, **920**, and **922**. Each of the AI characters **910**, **920**, and **922** may have contextual knowledge **912**, i.e., scene-specific knowledge. Each of the AI characters **910**, **920**, and **922** may further have a goal set **914**. The goal set **914** may include a plurality of goals **916**. Each of the goals **916** may be associated with a plurality of actions **918** to be taken by the AI character to pursue the goals **916**.

In an example embodiment, scene **902** is a scene in which the AI character **910** is Indiana Jones who enters a cave (scene and location knowledge **904**). The context is as follows: the AI character **910** knows that he is scared of snakes (contextual knowledge **912**), but he is running away from enemies (contextual knowledge **912**) and the AI character **910** now has the first goal **916** to run through the cave and escape the snakes. Therefore, the AI character **910** has actions **918** available to pursue the goal **916**. The actions **918** may include running, asking for help, and the like. The next goal **916** of the AI character **910** may be to find the buried treasure. The last goal **916** may be to escape. For each of those goals **916**, the AI character **910** has specific actions **918** that are available for the AI character **910** to pursue.

FIG. **10** is a flow chart of a method **1000** for observation-based training of an AI character model, according to an example embodiment. In some embodiments, the operations may be combined, performed in parallel, or performed in a different order. The method **1000** may also include additional or fewer operations than those illustrated. The method **1000** may be performed by processing logic that may comprise hardware (e.g., decision making logic, dedicated logic, programmable logic, and microcode), software (such as software run on a general-purpose computer system or a dedicated machine), or a combination of both. The method **1000** may be implemented with a processor of a computing platform for observation-based training of an AI character model.

The method **1000** may commence in block **1002** with receiving, by the processor, log data. The log data may include interactions of a first user and a second user (i.e., user-to-user interactions), interactions of the first user and an AI character (i.e., character-to-user interactions), and so forth. The interactions may be performed in a virtual environment, also referred to as a computer-based environment. The interactions may include movements of users or AI characters, gestures of users or AI characters, actions taken by users or AI characters, emotions shown by users or AI characters, conversations of users or AI characters in the virtual environment, and so forth.

In some example embodiments, the log data may include a recording of a verbal conversation between the first user and the second user. In an example embodiment, the log data may include a description of a scene in the computer-based environment. The computer-based environment may include, for example, a computer game.

The user may include a developer of the AI character model, a player that interacts with an AI character in a virtual environment, and so forth. In some example embodiments, the log data to be used by the AI character model for learning may be preselected by a developer of an AI character, by a user that interacts with an AI character and wants to set the parameters of the AI character, and so forth.

In block **1004**, the method **1000** may include adjusting, by the processor and based on the log data, parameters of the AI character model to cause the AI character model to mimic behavioral characteristics of the first user in follow-up conversations with further users. The AI character model may include an LLM or a generative model and may be configured to learn to mimic any behavior (e.g., behavior of a user or an AI character in a virtual environment) observed by the AI character model. The AI character model may determine the behavioral characteristics of the first user based on the log data. Accordingly, the log data may be used to teach the AI character model to modify the parameters of the AI character to make the AI character to have the behavioral characteristics observed by the AI character model. As the AI character model observes multiple behavioral characteristics of the first user, the AI character model may learn to adjust multiple parameters of the AI character at once. For example, the parameters of the AI character model to be modified may include one or more of the following: a role, an intent, knowledge, an emotional state of an AI character (e.g., friendly, unfriendly, neutral, and the like), a type of personality (sanguine, choleric, melancholic, and phlegmatic), responses in conversations in which the AI character participates, and so forth.

In an example embodiment, the adjustment of the parameters of the AI character model may include modifying internal parameters corresponding to a role of the AI character model to cause the role to match a further role of the first user in the interactions.

In some example embodiments, the adjustment of the parameters of the AI character model may include modifying internal parameters corresponding to an intent of the AI character model to cause the intent to match a further intent of the first user in the interactions.

In an example embodiment, the adjustment of the parameters of the AI character model may include modifying internal parameters corresponding to an emotional state of the AI character model to cause the emotional state to match a further emotional state of the first user in the interactions.

In some example embodiments, the adjustment of the parameters of the AI character model may include modifying internal parameters for generating a response of the AI character model to a specific message of the second user to cause the response to match a further response of the first user to the specific message of the second user in the interactions.

In an example embodiment, the adjustment of the parameters of the AI character model may include modifying internal parameters for generating an action of the AI character model in response to a specific message or a user action of the second user to cause the action to match a further action of the first user in a further response to the specific message or the user action of the second user in the interactions. The action may include one of the following: a gesture, a movement of the AI character model, and so forth.

In the embodiment in which the log data includes the recording of the verbal conversation between the first user and the second user, the adjustment of the parameters of the AI character model may include modifying internal parameters corresponding to voice characteristics of the AI character model, thereby causing the voice characteristics to match further voice characteristics of the first user in the interactions.

The method **1000** may optionally include generating, by the processor, further log data including further interactions between the AI character model and the second user. The further interactions may include messages of the second user in the log data and responses to the messages. The responses may be generated by the AI character model. Upon generating the further log data, method **1000** may proceed with comparing, by the processor, the log data and the further log data to obtain discrepancies between the responses generated by the AI character model and corresponding responses of the first user in the log data. The method **1000** may proceed with performing, by the processor and based on the discrepancies, further adjustments of parameters of the AI character model.

In an example embodiment, the AI character model may generate AI characters that are representatives of different professions. As an example, a user may build an AI character that is a virtual Starbucks® barista. A real human actor may be involved in the environment to play the role of a barista. The interactions of the real human actor can be recorded in log data. The log data can be used to train the AI character model. Thus, the learning of the AI character model may be performed by the AI character model "observing the actor," thereby trying to mimic the whole experience of "the actor." The learning of the AI character model may include a feedback loop that receives the results showing whether the AI character model works. Based on the results, the behavior of the AI character generated by the AI character model may be adjusted.

The log data may be taken from any existing information sources, such as movies, books, comics, and so forth. In an example embodiment, a user may provide a transcript of a movie (e.g., Alice in Wonderland) to a computing platform for training an AI character model and instruct the computing platform to adjust the AI character model to behave more like characters of the movie. The computing platform may use the transcript as the log data, determine the behavioral characteristics (emotions, vocabulary, gestures, knowledge of facts and skills, etc.) of the characters of the movie based on the transcript, and adjust the parameters of the AI character model to behave in the virtual environment similarly to the characters of the movie.

In an example embodiment, a user may have an interaction with an AI character (e.g., Alice in Wonderland) in a virtual world environment and select the interaction as a desired interaction. The user may provide the log data that represent the desired interactions and feed the log data to a computing platform for training an AI character model. The computing platform may use the log data to adjust the parameters of the AI character model to have the behavior similar to the behavior of the user or the AI character in the log data.

In an example embodiment, the log data may be provided to the computing platform for training the AI character model in a form of an example dialog between characters. For example, the user may be creating an AI character that is Captain Jack Sparrow and may upload a transcript from the Pirates of the Caribbean® movie. The computing platform may use the transcript as the log data and bias the AI character model towards behaving like Captain Jack Sparrow.

In another example embodiment, the user may be creating an AI character that is Buzz Lightyear. The AI character model may include a generic model. The user may use every transcript that Buzz Lightyear has ever said across every movie and any other source to teach the AI character model to modify the parameters of the AI character model so as to create an AI character that replicates behavioral characteristics of Buzz Lightyear.

FIG. **11** is a high-level block diagram illustrating an example computer system **1100**, within which a set of instructions for causing the machine to perform any one or more of the methodologies discussed herein can be executed. The computer system **1100** may include, refer to, or be an integral part of, one or more of a variety of types of devices, such as a general-purpose computer, a desktop computer, a laptop computer, a tablet computer, a netbook, a mobile phone, a smartphone, a personal digital computer, a smart television device, and a server, among others. Notably, FIG. **11** illustrates just one example of the computer system **1100** and, in some embodiments, the computer system **1100** may have fewer elements/modules than shown in FIG. **11** or more elements/modules than shown in FIG. **11**.

The computer system **1100** may include one or more processor(s) **1102**, a memory **1104**, one or more mass storage devices **1106**, one or more input devices **1108**, one or more output devices **1110**, and a network interface **1112**. The processor(s) **1102** are, in some examples, configured to implement functionality and/or process instructions for execution within the computer system **1100**. For example, the processor(s) **1102** may process instructions stored in the memory **1104** and/or instructions stored on the mass storage devices **1106**. Such instructions may include components of an operating system **1114** or software applications **1116**. The software applications may include the studio **204**, the integration interface **206**, and the AI character model **202**. The computer system **1100** may also include one or more additional components not shown in FIG. **11**, such as a housing, a power supply, a battery, a global positioning system (GPS) receiver, and so forth.

The memory **1104**, according to one example, is configured to store information within the computer system **1100** during operation. The memory **1104**, in some example embodiments, may refer to a non-transitory computer-readable storage medium or a computer-readable storage device. In some examples, the memory **1104** is a temporary memory, meaning that a primary purpose of the memory **1104** may not be long-term storage. The memory **1104** may also refer to a volatile memory, meaning that the memory **1104** does not maintain stored contents when the memory **1104** is not receiving power. Examples of volatile memories include random access memories (RAM), dynamic random access memories (DRAM), static random access memories (SRAM), and other forms of volatile memories known in the art. In some examples, the memory **1104** is used to store program instructions for execution by the processor(s) **1102**. The memory **1104**, in one example, is used by software (e.g., the operating system **1114** or the software applications **1116**). Generally, the software applications **1116** refer to software applications suitable for implementing at least some operations of the methods for observation-based training of an AI character model as described herein.

The mass storage devices **1106** may include one or more transitory or non-transitory computer-readable storage media and/or computer-readable storage devices. In some embodiments, the mass storage devices **1106** may be configured to store greater amounts of information than the memory **1104**. The mass storage devices **1106** may further be configured for long-term storage of information. In some examples, the mass storage devices **1106** include non-volatile storage elements. Examples of such non-volatile storage elements include magnetic hard disks, optical discs, solid-state discs, flash memories, forms of electrically programmable memories (EPROM) or electrically erasable and programmable memories, and other forms of non-volatile memories known in the art.

The input devices **1108**, in some examples, may be configured to receive input from a user through tactile, audio, video, or biometric channels. Examples of the input devices **1108** may include a keyboard, a keypad, a mouse, a trackball, a touchscreen, a touchpad, a microphone, one or more video cameras, image sensors, fingerprint sensors, or any other device capable of detecting an input from a user or other source, and relaying the input to the computer system **1100**, or components thereof.

The output devices **1110**, in some examples, may be configured to provide output to a user through visual or auditory channels. The output devices **1110** may include a video graphics adapter card, a liquid crystal display (LCD) monitor, a light emitting diode (LED) monitor, an organic LED monitor, a sound card, a speaker, a lighting device, a LED, a projector, or any other device capable of generating output that may be intelligible to a user. The output devices **1110** may also include a touchscreen, a presence-sensitive display, or other input/output capable displays known in the art.

The network interface **1112** of the computer system **1100**, in some example embodiments, can be utilized to communicate with external devices via one or more data networks such as one or more wired, wireless, or optical networks including, for example, the Internet, intranet, LAN, WAN, cellular phone networks, Bluetooth radio, and an IEEE 902.11-based radio frequency network, Wi-Fi networks®, among others. The network interface **1112** may be a network interface card, such as an Ethernet card, an optical transceiver, a radio frequency transceiver, or any other type of device that can send and receive information.

The operating system **1114** may control one or more functionalities of the computer system **1100** and/or components thereof. For example, the operating system **1114** may interact with the software applications **1116** and may facilitate one or more interactions between the software applications **1116** and components of the computer system **1100**. As shown in FIG. **11**, the operating system **1114** may interact with or be otherwise coupled to the software applications **1116** and components thereof. In some embodiments, the software applications **1116** may be included in the operating system **1114**. In these and other examples, virtual modules, firmware, or software may be part of the software applications **1116**.

Thus, systems and methods for observation-based training of an AI character model have been described. Although embodiments have been described with reference to specific example embodiments, it will be evident that various modifications and changes can be made to these example embodiments without departing from the broader spirit and scope of

the present application. Accordingly, the specification and drawings are to be regarded in an illustrative rather than a restrictive sense.

What is claimed is:

1. A method for observation-based training of an Artificial Intelligence (AI) character model, the method being implemented with a processor of a computing platform providing the AI character model, the method comprising:

receiving, by the processor, log data including interactions of a first user and a second user; and

adjusting, by the processor and based on the log data, parameters of the AI character model to cause the AI character model to mimic behavioral characteristics of the first user in follow-up conversations with further users, wherein:

the AI character model includes a first plurality of heuristic machine learning models and a second plurality of primary machine learning models, the first plurality of heuristic machine learning models including an events model, an intent recognition model, and an emotion model, and the second plurality of primary machine learning models including a large language model, a goals and actions model, and an animation and gesture model; and

the adjusting the parameters of the AI character model includes:

pre-processing the log data to obtain a plurality of streams, the plurality of streams including a first stream of text pronounced by the first user during the interactions, a second stream of actions performed by the first user during the interactions, and a third stream of events occurring during the interactions;

running the plurality of streams through the first plurality of heuristic machine learning models to produce intermediate outputs;

composing the intermediate outputs into templated formats for the second plurality of primary machine learning models; and

feeding the templated formats to the second plurality of primary machine learning models.

2. The method of claim **1**, wherein the adjusting the parameters of the AI character model includes modifying internal parameters corresponding to a role of the AI character model to cause the role to match a further role of the first user in the interactions.

3. The method of claim **1**, wherein the adjusting the parameters of the AI character model includes modifying internal parameters corresponding to an intent of the AI character model to cause the intent to match a further intent of the first user in the interactions.

4. The method of claim **1**, wherein the adjusting the parameters of the AI character model includes modifying internal parameters corresponding to an emotional state of the AI character model to cause the emotional state to match a further emotional state of the first user in the interactions.

5. The method of claim **1**, wherein the adjusting the parameters of the AI character model includes modifying internal parameters for generating a response of the AI character model to a specific message of the second user to cause the response to match a further response of the first user to the specific message of the second user in the interactions.

6. The method of claim **1**, wherein the adjusting the parameters of the AI character model includes modifying internal parameters for generating an action of the AI character model in response to a specific message or a user action of the second user to cause the action to match a further action of the first user in a further response to the specific message or the user action of the second user in the interactions.

7. The method of claim **6**, wherein the action includes one of the following: a gesture and a movement of the AI character model.

8. The method of claim **1**, wherein:

the log data includes a recording of a verbal conversation between the first user and the second user; and

adjusting the parameters of the AI character model includes modifying internal parameters corresponding to voice characteristics of the AI character model, thereby causing the voice characteristics to match further voice characteristics of the first user in the interactions.

9. The method of claim **1**, further comprising:

generating, by the processor, further log data including further interactions between the AI character model and the second user, the further interactions including messages of the second user in the log data and responses to the messages, the responses being generated by the AI character model;

comparing, by the processor, the log data and the further log data to obtain discrepancies between the responses generated by the AI character model and corresponding responses of the first user in the log data; and

performing, by the processor and based on the discrepancies, further adjustments of parameters of the AI character model.

10. The method of claim **1**, wherein the log data includes a description of a scene in a computer-based environment.

11. A computing platform for observation-based training of an Artificial Intelligence (AI) character model, the computing platform comprising:

a processor; and

a memory storing instructions that, when executed by the processor, configure the computing platform to:

receive log data including interactions of a first user and a second user; and

adjust, based on the log data, parameters of the AI character model to cause the AI character model to mimic behavioral characteristics of the first user in follow-up conversations with further users, wherein:

the AI character model includes a first plurality of heuristic machine learning models and a second plurality of primary machine learning models, the first plurality of heuristic machine learning models including an events model, an intent recognition model, and an emotion model, and the second plurality of primary machine learning models including a large language model, a goals and actions model, and an animation and gesture model; and

the adjusting the parameters of the AI character model includes:

pre-processing the log data to obtain a plurality of streams, the plurality of streams including a first stream of text pronounced by the first user during the interactions, a second stream of actions performed by the first user during the interactions, and a third stream of events occurring during the interactions;

running the plurality of streams through the first plurality of heuristic machine learning models to produce intermediate outputs;

composing the intermediate outputs into templated formats for the second plurality of primary machine learning models; and

feeding the templated formats to the second plurality of primary machine learning models.

12. The computing platform of claim **11**, wherein the adjusting the parameters of the AI character model includes modifying internal parameters corresponding to a role of the AI character model to cause the role to match a further role of the first user in the interactions.

13. The computing platform of claim **11**, wherein the adjusting the parameters of the AI character model includes modifying internal parameters corresponding to an intent of the AI character model to cause the intent to match a further intent of the first user in the interactions.

14. The computing platform of claim **11**, wherein the adjusting the parameters of the AI character model includes modifying internal parameters corresponding to an emotional state of the AI character model to cause the emotional state to match a further emotional state of the first user in the interactions.

15. The computing platform of claim **11**, wherein the adjusting the parameters of the AI character model includes modifying internal parameters for generating a response of the AI character model to a specific message of the second user to cause the response to match a further response of the first user to the specific message of the second user in the interactions.

16. The computing platform of claim **11**, wherein the adjusting the parameters of the AI character model includes modifying internal parameters for generating an action of the AI character model in a response to a specific message or a user action of the second user to cause the action to match a further action of the first user in a further response to the specific message or the user action of the second user in the interactions.

17. The computing platform of claim **16**, wherein the action includes one of the following: a gesture and a movement of the AI character model.

18. The computing platform of claim **11**, wherein:

the log data includes a recording of a verbal conversation between the first user and the second user; and

the adjusting the parameters of the AI character model includes modifying internal parameters corresponding to voice characteristics of the AI character model, thereby causing the voice characteristics to match further voice characteristics of the first user in the interactions.

19. The computing platform of claim **11**, wherein the instructions further configure the computing platform to:

generate further log data including further interactions between the AI character model and the second user, the further interactions including messages of the second user in the log data and responses to the messages, the responses being generated by the AI character model;

compare the log data and the further log data to obtain discrepancies between the responses generated by the AI character model and corresponding responses of the first user in the log data; and

perform, based on the discrepancies, further adjustments of parameters of the AI character model.

20. A non-transitory computer-readable storage medium, the computer-readable storage medium including instructions that, when executed by a processor of a computing platform for observation-based training of an Artificial Intelligence (AI) character model, cause the computing platform to:

receive log data including interactions of a first user and a second user; and

adjust, based on the log data, parameters of the AI character model to cause the AI character model to mimic behavioral characteristics of the first user in follow-up conversations with further users, wherein:

the AI character model includes a first plurality of heuristic machine learning models and a second plurality of primary machine learning models, the first plurality of heuristic machine learning models including an events model, an intent recognition model, and an emotion model, and the second plurality of primary machine learning models including a large language model, a goals and actions model, and an animation and gesture model; and

the adjusting the parameters of the AI character model includes:

pre-processing the log data to obtain a plurality of streams, the plurality of streams including a first stream of text pronounced by the first user during the interactions, a second stream of actions performed by the first user during the interactions, and a third stream of events occurring during the interactions;

running the plurality of streams through the first plurality of heuristic machine learning models to produce intermediate outputs;

composing the intermediate outputs into templated formats for the second plurality of primary machine learning models; and

feeding the templated formats to the second plurality of primary machine learning models.

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