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CONTEXT-BASED SELECTION AND PRESENTATION OF CONTENT FOR PRESENTATION TO A USER

ABSTRACT

An interactive assistant, referred to herein as “an interactive assistant,” “a virtual assistant,” or simply “an assistant,” may be configured to select content based on various contextual information and to output such content to a user. For example, a user may engage in various different interactions with a computing system and/or with an interactive assistant over time (e.g., by performing certain actions, providing instructions, requesting select information, performing searches, or the like). Based on these interactions, the interactive assistant may identify and store contextual information associated with these interactions, such as, for instance, one or more of user behavior information, assistant behavior information, interaction information, user information, preference information, search history information, time information, location information, news information, or the like. The interactive assistant may utilize this historical contextual information to select, based on current context, particular content that may be relevant or of interest, and may present such content to the user (e.g., visually, audibly). In some cases, the interactive assistant may present such content to the user at appropriate times and/or locations based on the historical contextual information.

DESCRIPTION

An interactive assistant, such as shown in the example of Figure 1 below, may be included in a computing system that is configured to interact with one or more users. The computing system may be, include, or otherwise be included in a mobile device (e.g., smartphone, tablet computer, laptop computer, computerized watch, computerized eyewear,
computerized gloves), a personal computer, a smart television, a personal digital assistant, a portable gaming system, a media player, a mobile television platform, an automobile navigation and/or entertainment system, a vehicle (e.g., automobile, aircraft) and/or cockpit display, a home or other smart appliance and/or related device (e.g., interconnectable appliance/device via Internet of Things), or any other type of wearable, non-wearable, mobile, or non-mobile computing device, and the computing system may or may not include a display device. In some cases, the interactive assistant may be a voice-assistant that receives audible user commands, processes the commands based on speech recognition operations, and performs corresponding actions, such as providing audible responses to user queries and/or performing certain actions. The interactive assistant may provide or utilize a user interface with which a user can communicate to cause the assistant to output useful information, respond to a user’s queries, or otherwise perform certain operations to help the user complete a variety of real-world or virtual tasks. The interactive assistant may also be configured to monitor operations of the computing system as well as the user’s interactions with the computing system, and may further be configured to track contextual information associated with these operations or interactions.

Figure 1 below illustrates an example of an interactive assistant that may be configured to select content based on certain contextual information and to output such content to a user. The interactive assistant may be executed by or otherwise included in the computing system shown in Figure 1. For example, a user may engage in various different interactions with the computing system and/or an interactive assistant over time, such as, for example, by performing certain actions, providing instructions, requesting select information, performing searches, or the like. Based on these interactions, the interactive assistant may identify and store contextual information associated with these interactions. Such contextual information may include, for
instance, user behavior information, assistant behavior information, interaction information, user information, preference information, search history information, time information, location information, news information, or the like, to list a few non-limiting examples. The interactive assistant may then make use of this historical contextual information to select particular content that may be of interest to the user. In some cases, the interactive assistant may present such content to the user at appropriate times and/or locations based on such contextual information.

As shown in Figure 1 below, the computing system that includes the interactive assistant may have or otherwise be communicatively coupled to one or more input devices and one or more output devices. For instance, the input devices may include one or more microphones, a presence-sensitive input device and/or touch-sensitive screen, a mouse, a keyboard, a voice responsive system, a camera, or any other type of device for detecting input from a human or machine. In some cases, the input device may one or more location sensors (GPS components, Wi-Fi components, cellular components), one or more temperature sensors, one or more movement sensors (e.g., accelerometers, gyroscopes), one or more pressure sensors (e.g., barometer), one or more ambient light sensors, and/or one or more other sensors (e.g., camera, infrared proximity sensor, hygrometer, and the like). Other sensors may include a heart rate sensor, magnetometer, glucose sensor, hygrometer sensor, olfactory sensor, compass sensor, step counter sensor, to name a few other non-limiting examples.
The computing system may also include or be communicatively coupled to one or more output devices, such as one or more speakers or display screens, including a presence-sensitive screen and/or a touchscreen, or any other type of device for generating output to a human or machine. In some cases, the input devices and/or output devices may include one or more other type of wearable, non-wearable, mobile, or non-mobile computing devices that are also used by
the user. One or more of the input and/or output devices may be external to and
communicatively coupled (e.g., via a wired or wireless connection) with the computing system.

The computing system may also include a user interface module that is configured to
manage inputs received by the interactive assistant as users interact with the computing system,
and the user interface module may be configured to receive additional instructions from
applications, services, platforms, or other modules of the interactive assistant that process user
input. The user interface module may also be configured to process output that is provided to
users, and may be coupled to the input device(s) and output device(s) of the interactive assistant.
The computing system may also include a speech recognition module, which may interface with
the user interface module and/or the interactive assistant. When a user provides audible input to
the interactive assistant (e.g., via commands, questions, queries), the interactive assistant may
use the speech recognition module to process such audible input.

As described herein, the speech recognition module, user interface module, and
interactive assistant are configured to utilize and/or process information received from the input
devices only after receiving explicit authorization from the user to do so. The computing system
may provide the user (e.g., via the user interface module and/or the interactive assistant) with
detailed information about the requested use of data collected by input devices for use by the
interactive assistant, in conjunction with the use of specified functions or applications (e.g., one
or more of the search application, content delivery applications, or other applications). The
speech recognition module, user interface module, and/or interactive assistant only use such data
collected by input devices after receiving explicit authorization from user to do so. After
receiving such authorization, these modules are configured only to use the data gathered by the
input devices for the use or uses authorized by the user.
Further to the descriptions below, a user may be provided with controls allowing the user to make an election as to if and when the interactive assistant, the computing system, and/or the external computing systems described herein can collect or make use of supplemental data (e.g., user information or contextual information about a user’s social network, social actions or activities, profession, a user’s preferences, or a user’s current location), and if and when the user is sent content or communications from a computing system. In addition, certain data may be treated in one or more ways before it is stored or used, so that personally identifiable information is removed. For example, a user’s identity may be treated so that no personally identifiable information can be determined for the user, or a user’s geographic location may be generalized where location information is obtained (such as to a city, ZIP code, or state level), so that a particular location of a user cannot be determined. Thus, the user may have control over what supplemental data is collected about the user, how that supplemental data is used, and what supplemental data is provided to the user.

As shown in Figure 1, the computing system and/or external computing systems may include various applications, including one or more content delivery applications, a search application, and/or other applications. Over time, the user may engage in one or more interactions with the computing system, including any interactions with the interactive assistant. Based on such interactions, the interactive assistant may store user and/or interaction history information in one or more datastores. As shown in Figure 1, such user and/or history information, which may include contextual information associated with prior interactions, may be stored locally on the computing system and/or on the one or more external computing systems, and may include any information or metadata associated with the user’s interactions. In some instances, the user’s interaction with the local computing system may cause one or more
content delivery applications, executing locally and/or on external computing systems, to obtain content from one or more content repositories (e.g., content providers) and provide such content for output to the user. In some instances, the user may submit a command or search request to the interactive assistant. The interactive assistant and/or search application may search for content in the one or more of the content repositories local to the computing system and/or stored on one or more external computing systems, such as shown in Figure 1. Upon identifying content that is responsive to the user’s queries (e.g., content that satisfies one or more criteria specified in the queries), the search application may output the identified content to the user, such as via audible and/or visual output.

The interactive assistant, content delivery applications, search application, and/or other applications may store user and/or interaction history information, and this history information may be part of or otherwise included in contextual information that is used by one or more content delivery applications to select and output content to a user. For instance, based on such contextual information of prior interactions with the user, the content delivery applications may identify content that may be of interest to the user based on current contextual information (e.g., when the current contextual information is the same or similar the historical contextual information). The applications shown in Figure 1 may be executed locally on the computing system. In some cases, however, any of the applications may be executed on the one or more external computing systems and may be invoked by the interactive assistant.

As one example, if the user has submitted various different search queries over time that are each associated with the city of Mountain View, as indicated in the history information, the content delivery applications may attempt to identify news items or other information associated with the city of Mountain View, and output such information to the user (e.g., visually, audibly)
via the interactive assistant and/or user interface module. The content delivery applications may also utilize other contextual information in selecting such content, such as the location of the user (e.g., based on feedback from the user and/or location-based sensor input from the computing system), information about the user, time of day, other applications or programs operating on the user’s device(s), recent or current external events (such as a sporting event), or even user preference information (e.g., preference data specifying interest in certain topics or the like).

As another example, the user may routinely use the computing system to obtain and view television content for a particular television show (e.g., an evening talkshow) at 10pm on most weekday evenings. The content delivery applications may obtain such television content from one or more of the content repositories and output such content to the user. This historical contextual information may be stored in the user and/or history information either locally on the computing system and/or on the external computing systems (e.g., by the content delivery applications and/or the interactive assistant). On a subsequent weekday evening at 10pm, and without necessarily even receiving a user request, the interactive assistant and/or content delivery applications may automatically provide the user with an offer or a recommendation to output television content associated with this particular television show, particularly if the interactive assistant determines that the user is at home (e.g., based on the determined location of the computing system or other devices used by the user).

In some cases, the interactive assistant and/or content delivery applications may provide the user with an offer or a recommendation to output television content that is associated with a similar television show at the time of 10pm. For example, if it is 10pm on a Wednesday evening, but the interactive assistant determines that the particular television show previously viewed by the user is not airing on that given day (e.g., due to a conflicting sporting event taking place on
the given channel), the interactive assistant may provide the user with an offer to view television content of a similar show (e.g., a similar evening talkshow). If it is 10pm on a Saturday (e.g., non-weekday) evening, the interactive assistant may provide a similar offer to view related television content. The interactive assistant and content delivery applications may also utilize other related contextual information to identify content and/or perform other actions. For example, if the interactive assistant determines that the user is not located at the user’s home residence on a given weekday evening at 10pm, the interactive assistant may use such current contextual information, along with the historical contextual information, to provide the user with a recommendation to (1) record the television content for a particular television show, as opposed to outputting the content to the user’s home television, and/or (2) output the television content for the particular show to the user’s mobile device or hotel television, rather than to the user’s home television. In such fashion, the interactive assistant and/or content delivery applications are capable of using various types of contextual information, including time information and/or user location information, to proactively provide recommendations, perform actions, and output particular content from the various different content repositories based on prior user interactions and historical context information.

The content delivery applications may include one or more applications that are configured to use such contextual information and deliver different types of content to the user. For instance, the content delivery applications may include one or more applications to deliver news content, video content, image content, map content, audiobook content, and the like. The content delivery applications may even utilize user preference data to determine which types of content may be of most interest to the user.
In some examples, the content delivery applications may utilize other forms of time information or even calendar information to select content for a user. For example, over the course of time, the user may periodically submit queries or search requests for stock information. This interaction information may be stored in the user/history information locally on the computing system or on the external computing systems. The interactive assistant and/or content delivery applications may access the contextual information associated with these prior requests to determine that the user often asks for stock information at the time the stock market opens. As a result, the content delivery applications may determine to automatically provide the user with select stock market information at the time when the stock market opens (e.g., 6:30am Pacific time).

As another example, the interactive assistant and/or content delivery applications may access the calendar information for a user in determining what content to select and deliver to the user. For example, the user’s calendar may indicate that the user has an offsite meeting at 3pm Pacific time for a location that is 60 miles away from the user’s normal work location. The interactive assistant and/or content delivery applications may access the contextual information associated with this calendar information to proactively select current weather, traffic, and/or map information at or around 3pm Pacific time for delivery to the user, which may be useful as the user prepares to travel to the offsite meeting (e.g., based on the determined location of the user or devices/systems associated with the user).

As yet another non-limiting example, the interactive assistant and/or content delivery applications may access the user and/or history information to determine that, based on past interactions with the interactive assistant, the user has submitted various requests or queries associated with children’s books. Based on such contextual information, the interactive assistant
may determine that the user has an interest in these types of books, and the content delivery applications may select and deliver content to the user associated with any new children’s books that have just been published, or with a list of children’s audiobooks that may be of interest to the user. Such content, including audiobook content, may be stored locally in the content repository of the computing system or on the external computing systems.

In some instances, the user may issue a direct query or request for news information associated with a particular area. For example, the user may issue an audible request to “get news” or “get local news.” In these cases, the interactive assistant may process a request (e.g., using the speech recognition module and/or user interface module) and invoke the content delivery applications to identify and retrieve news information satisfying the user’s request. If the user has submitted a request to “get local news” or even just to “get news,” the assistant may assume that the user has requested news information local to the user’s current location, and may determine the location corresponding to “local” (i.e., of the user) based upon the current location of the computing system. In some cases, the computing system may determine its location based on input from one or more sensors (e.g., GPS sensors). In some cases, the computing system may determine its location based upon feedback from the user. For example, the user may, in these cases, provide input data specifying the location of the user. The computing system may also determine its location based upon one or more contextual signals and/or history information associated with user interactions with the interactive assistant.

Upon determining the location of the computing system, the content delivery applications may search one or more content repositories stored locally on the computing system and/or on the one or more external computing systems to identify news information associated with this particular location. Such news information may include matters associated with local politics,
local sports, local restaurants, local recent events, and the like. In such fashion, and as noted above, the interactive assistant and/or content delivery applications are capable of using various types of contextual information to proactively provide recommendations, perform actions, and output particular content from the various different content repositories based on prior user interactions.

In various cases, the interactive assistant is capable of using different types of contextual information, including time and/or location information as well as prior user behavior, to recommend certain actions or content. For instance, if the user typically listens to a particular radio station when driving home from work, the assistant may provide a recommendation to tune into that station, or even automatically tune into that station, when the assistant determines that the user leaves work based, e.g., on the time of day and location of the user. (Based on prior history, the assistant is capable of determining the user’s home and work locations, and may also identify a common time at which the user typically leaves work to drive back home, such as at 6pm.)

When the content is included in the content repositories local to the computing system, the content delivery applications and/or the interactive assistant may output the content directly via the output devices. When the content is included in content repositories stored on the one or more external computing systems, the external computing systems may stream the content to the computing system, and the computing system may then output the received content via the output devices. In such fashion, the computing system is capable of delivering received content even if the computing system is, at a certain point in time, in an offline mode or otherwise disconnected from the external computing systems.
In some cases, prior to outputting any content to the user, the content delivery applications may sort or filter the content based on one or more criteria. For example, a news content delivery application may sort news information on a time-ordered basis, with the most recent news items being output first. In some cases, the content delivery applications may sort or filter the content based on the type content (e.g., sports information, weather information, politics, and the like).

Users of the computing system may also provide one or more user preferences with respect to the content provided by the interactive assistant. One or more datastores that are local to the computing system and/or stored on the one or more external computing systems may include these user preferences as user information, as shown in Figure 1. For example, the user information may indicate that the particular user shown in Figure 1 is very interested in football. This user information may be based on explicit feedback received from the user and/or based on prior interactions with the interactive assistant. For instance, if the user has previously initiated various search requests associated with football or a particular football team, the interactive assistant may determine that the user is interested in football (and perhaps even a particular football team), and may store such user information associated with this particular user. If the user and/or history information indicates that the user is very interested in football, the content delivery applications may sort or filter any content (e.g., news information, video/image information) and output content to the user that is related to football or even to a particular football team.

Thus, as described herein, the interactive assistant and/or content delivery applications are capable of identifying and storing contextual information associated with prior user interactions, such as, for instance, one or more of user behavior information, assistant behavior
information, interaction information, user information, preference information, search history information, time information, location information, news information, or the like. The interactive assistant may utilize this contextual information to provide certain recommended actions and select particular content that may be relevant or of interest, and may present such content to the user (e.g., at appropriate times and/or locations) based on contextual information.