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APPLICATION USER-INTERFACE SPECIFIC EMOTIONAL RESPONSE COLLECTION

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ABSTRACT

A computing device is described that is configured to determine an emotional response of a user to an application being used by the user. For instance, when an application developer wishes to improve an application, the computing device may collect emotional data by utilizing sensors (e.g., cameras, microphone, touch panel, motion sensors, accelerometer, gyroscope, etc.) embedded within the computing device running the application. The computing device may correlate the collected emotional data to specific portions of the application so that the computing device may locate within the application where the emotional data appears to suggest the user is confused. For instance, the computing device may capture a screenshot of what is being displayed at the computing device at a particular time and associate the screenshot with the user's emotional state at the particular time. The computing device may then display both the collected emotional data and associated tracked portions of the application (e.g., within a dashboard presentable to the application developer). This way, the application developer could optimize the specific portions of the application based on the confusion expressed by the user.

DESCRIPTION

A computing device may execute on counter-top devices, mobile phones, automobiles, and many other types of computing devices. The computing device may output useful information, respond to users' needs, or otherwise perform certain operations to help users complete real-world and/or virtual tasks. Some computing devices may perform operations involving assistance to an application developer to identify areas for improvement of an

application. Further, the computing device may help understand the quality of an application by acquiring feedback from users utilizing features of the application.

The example system shown in FIG. 1 provides a computing device that automatically collects (upon a user's express authorization) a user's emotional data (e.g., by collecting image data, audio data, biometric data, etc.) through one or more emotional data sensors (e.g., camera, microphone, touchscreen, etc.). The computing device may, by utilizing an emotional data analysis module (e.g., located on a computing device or on an external server), combine the emotional data to form a more complete picture of the user's emotional state along with a corresponding confidence threshold of the emotional state. The computing device may track corresponding locations within an application for each of the associated collected emotional data. A dashboard generation module may display the tracked corresponding locations within the application, and the associated collected emotional data, within a dashboard so that a developer has an accurate picture of which locations within the application needs improvement, based on the user's emotional states.

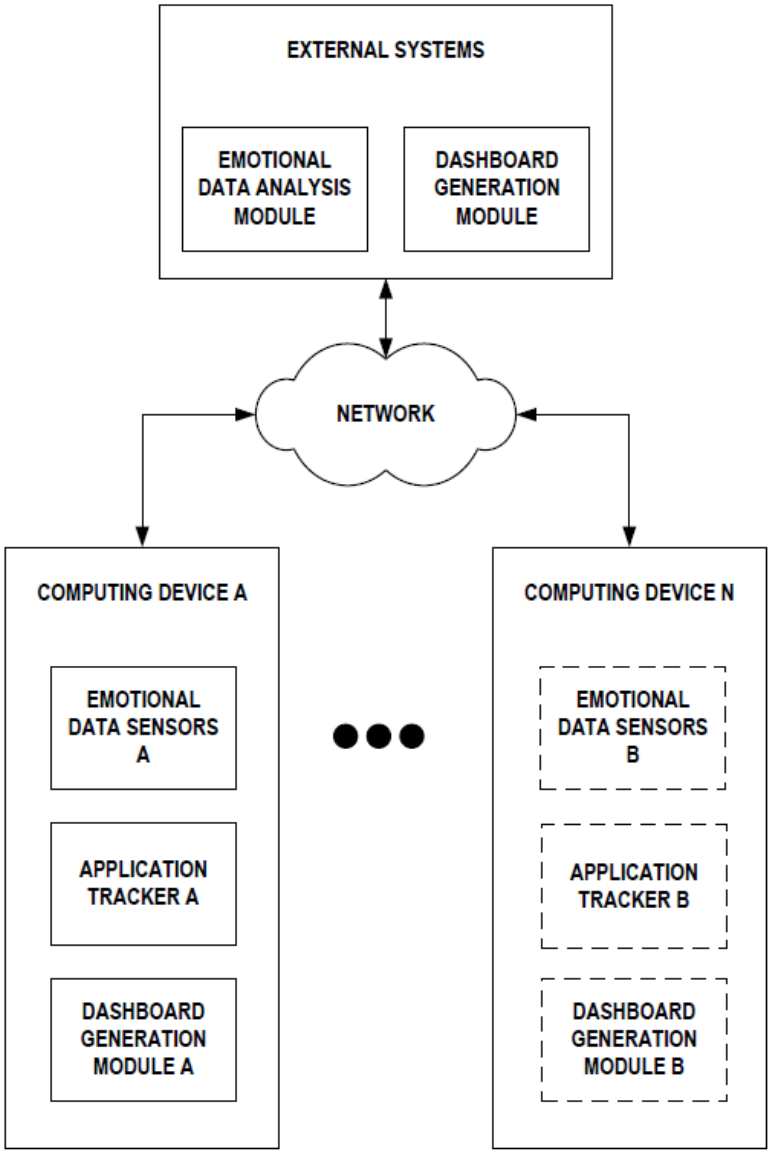

FIG. 1

The system of FIG. 1 includes one or more external systems and computing devices A–N communicating across a network with each of computing devices A–N executing emotional data sensors A–N, application trackers A–N, and dashboard generation modules A–N that perform operations involving determining a user's emotional state, tracking applications, and generating a dashboard. The network of FIG. 1 represents a combination of any one or more public or private

communication networks, for instance, television broadcast networks, cable or satellite networks, cellular networks, Wi-Fi networks, broadband networks, and/or other type of network for transmitting data (e.g., telecommunications and/or media data) between various computing devices, systems, and other communications and media equipment. Computing devices A–N represent any type of computing device, server, cloud computing system, mainframe, or other system that is configured to execute computer instructions and communicate on a network. In some cases, the external systems may not be included, and the computing system may be running entirely on a single computing device (e.g., a user's smart device).

The external systems and computing devices A–N can be personal computing devices. In some examples, the external systems and/or computing devices A–N may be shared assets of multiple users. Examples of computing devices A–N include mobile phones, tablet computers, wearable computing devices, countertop computing devices, home automation computing devices, laptop computers, desktop computers, televisions, stereos, automobiles, and any and all other type of mobile and non-mobile computing device. For example, computing device A may be a smart device and computing device N may be a mobile phone or automobile infotainment system.

Each of the computing devices A–N may also include one or more emotional data sensors A–N that may be in the form of, e.g., cameras (e.g., a selfie camera or other camera of a smart device), microphone, touch screen of a smart device, motion sensors (e.g., accelerometers, gyroscope, etc.), or a combination thereof. Data collected by the emotional data sensors A–N, e.g. a camera, emotions may be estimated from analyzing the digital images, which may include micro movements of the eye, skin color change, perspiration, blood vessel pattern changes, typing speed of a user, surrounding environment of the user (e.g., work, college, store, gym, home, etc.), touch pattern (e.g., strength or pressure of touch) of a touch screen, etc.

In addition to the emotional data sensors A–N collecting emotional data, application trackers A–N, embedded on any on computing devices A–N, may collect application-specific data for any application running on computing devices A–N. For example, the application-specific data may include screenshots of any application with a corresponding timestamp, and any output of the application, such as sounds, vibrations, screen pixel intensity, etc. Where a computing device of computing devices A–N is an augmented reality (AR) computing device, a screenshot may include both an image of an external environment along with graphics augmented to the environment. The timestamp may be useful for matching the emotional state with a particular portion of the application by matching a timestamp of any collected emotional data with a timestamp of a screenshot of the particular application.

The emotional data sensors A–N may begin collecting data upon a user consenting to the data collection. Once the user consents to the data collection, and only upon user authorization, the combination of emotional data sensors may collect the user data, and then combine the data to form a more complete picture of the user's emotional state. For example, a user's heartrate collected by the, e.g., touchscreen, may be combined with a pupil diameter width collected by the selfie camera and determined by image analysis software, and further with what the user is saying and how the user is saying it, to determine that a user is confused or irritated. This information may then be combined with a screen shot of a particular application, taken by the application tracker(s) A–N, to determine a corresponding portion of an application for the user's frustration.

In some examples, this combination may be transmitted to an emotional data analysis module for computing, e.g., complex data calculations. In some examples, for an emotional data analysis module to determine the user's emotional state, each of the collected emotional data may be weighted according to a criterion, based in part on historical information. For example,

the user may have a history of hesitating before pressing a portion of a screen when they are frustrated, so, in this case, time duration to touch the screen may be weighted more heavily. This may in turn result in a higher degree of confidence for a particular user's emotional state (as described in FIG. 2).

Upon the combination of determining the user's emotional state and the corresponding location within the application for the emotional state, the dashboard generation module(s) may generate the dashboard (shown in FIG. 2) for an application developer to better understand where the application can improve so that the user is not, e.g., frustrated or confused. In some examples, the emotional data analysis module may determine the emotional status of a particular user and then transmit that information to a dashboard generation module located on an external system for generation of a dashboard, which may then be transmitted to each or some of the computing devices A–N. In some cases, each of the computing devices A–N may include an emotional data analysis module. In some examples, each of the modules within the computing devices A–N and external systems may be located on an operating software layer, and may not be accessible to any application running on the computing device(s) A–N.

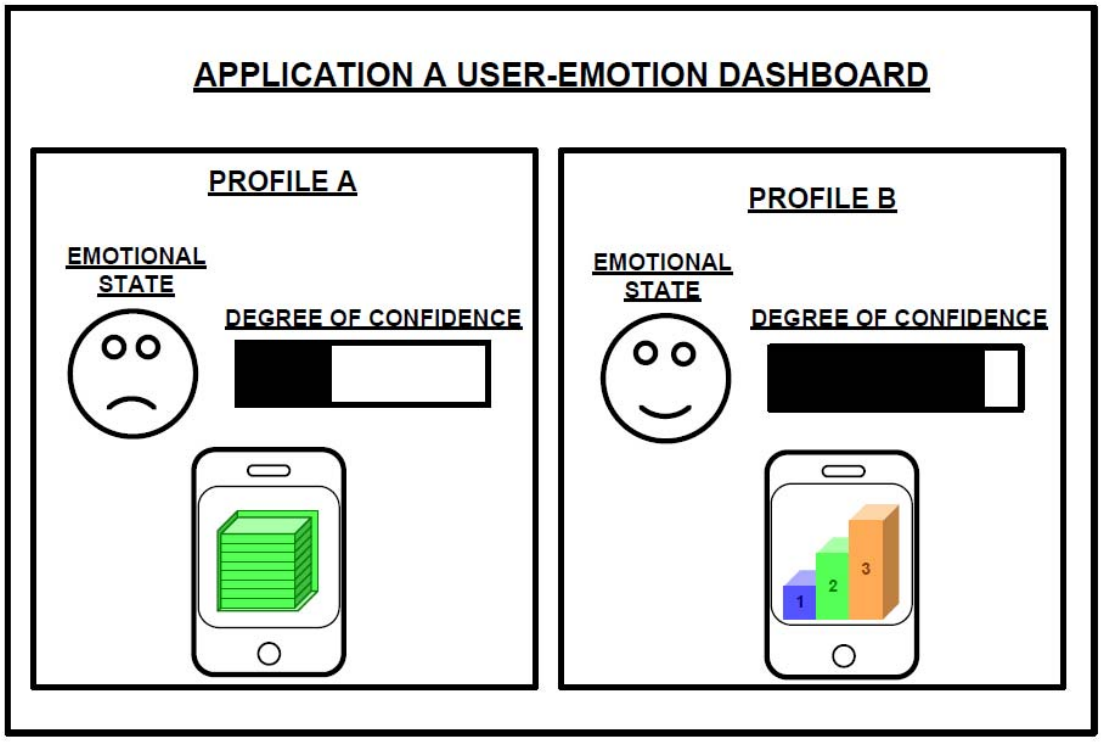

FIG. 2

An example dashboard generated in response to a combination of a user's emotional data and application-specific data is shown in FIG. 2. The environment shown in FIG. 2 includes an exemplary application A user-emotion dashboard. In some examples, two or more users (e.g., users A and B) may be included in the same application A user-emotion dashboard, with each having a particular profile (profile A and profile B). In other examples, there may be a plethora of profiles (e.g., a thousand users or however many users are using the application), each corresponding to a particular user.

Another example of a dashboard generated based on a combination of a user's emotional data and application-specific data may include a timeline of a user's application usage and the emotional state along said timeline. With such a dashboard (i.e., one that includes such a timeline), the developer can understand the change of emotional state of the user throughout the

application usage. The timeline could be a single user's or aggregated data of multiple users. A user's data may only be included in the timeline after consent is obtained.

In operation, the exemplary user-specific profiles may each include an emotional state of a user that corresponds to particular portions of the application. In some examples, the emotional state may be in the form of an icon as shown in FIG. 2, and in other examples may be in the form of a description indicating the user's emotional state, e.g., "frustrated," or a screenshot of the user expressing frustration. Each of the user-specific profiles may further include a degree of confidence for the particular emotional state, determined by the emotional data analysis module on the external system or on any of the computing devices A–N. The degree of confidence may be an estimation of the likelihood that the displayed emotional state of the user is accurate. This may be based on analyzing the collected emotional data, as well as any historical information about the particular user. For example, historical information may include determining that the user is frustrated whenever the user takes time to select a feature of an application or makes random selections.

The display of the degree of confidence may be colored or may include a numerical percentage of the estimate of the degree of confidence. In some examples, the degree of confidence may include a link for the developer to click that includes the basis for the determined degree of confidence. For example, the basis may include each input (e.g., collected emotional data) and a corresponding weight that was included in an analysis to determine the degree of confidence.

In addition, an aggregation (not shown) of all users' emotional states may be displayed within the dashboard so that the developer may determine which portions of an application need improvement. The aggregation may more accurately assist in determining an overall improvement to the application, rather than a user-specific improvement. The aggregation may

be modified by the developer in that the developer may determine which users to include in the aggregation. In some examples, the user-specific profiles may further include a screenshot of the corresponding location within the application where the user is, e.g., expressing frustration.

In some examples, the user profiles may be editable or modifiable. For example, each of the user profiles may include additional features that the application developer may wish to add to each of the profiles. For example, profile A may include only the emotional state and the degree of confidence, whereas profile B may only include the emotional state and a screenshot of the application. Once the dashboard is generated, the emotional data used as inputs to generate the dashboard may be deleted from the system. In some examples, the data may be stored on any of the computing devices A–N or the external system, and any screenshot of the user may be deleted.

In some examples, the developer may take action (e.g., modify the application) based on the generated dashboard display, or the application may be programmed to automatically adjust the application when the user is frustrated. For example, if a degree of confidence is over 90% that a user is frustrated with a particular portion of a gaming application, the application may automatically adjust the particular level from an “advanced” level to an “easy” level to decrease the user’s frustration, and then return the level back to an “advanced” mode once the user is less frustrated. In some examples, the developer may manually adjust portions of the application to coincide with the user’s emotional state to reduce any frustration of the user.

An example scenario may include a user playing a video game application. The computing devices capable of collecting the user’s emotional data may include the user’s smart device and a virtual reality (VR) headset. The user may say, “this level is hard,” and may be scowling. The computing devices, including the VR headset, may follow the user’s facial expressions by collecting images and audio of the surrounding environment with emotional data

sensors. The user's emotional state may then be determined along with the application tracking information, which may then be used to generate a dashboard presentable to a developer. The developer may then use this information to adjust the level of difficulty of the video game application. In some examples, the application may automatically adjust the level of difficulty upon an emotional state score being above a predetermined threshold.

As another example, to automatically adjust the content of an application, a developer of the application can include multiple screens or functions in the application, and an algorithm can automatically choose which screen or function to present to the user, based on optimization goal settings such as "Maximize happiness" or "Minimize frustration." In this case, the developer may only need to provide enough options in the application and an optimizing algorithm may select which option to show to the user based on the optimization settings.

In some examples, computing device A–N and the external systems may be part of an entire system utilized for a particular purpose, such as a shopping center ecosystem. In some examples, any of the computing devices A–N may be cameras strategically stationed throughout a facility (e.g., grocery store, shopping center, etc.) to determine a shopper's emotional state, and/or may also be linked to a shopper's computing device. For example, cameras may be stationed on shelves and other areas within the grocery store and may track a user's facial expressions (e.g., to determine if a user is confused when looking at ingredients of a grocery item) and the user's other emotional states. The emotional states may then be used, e.g., to determine where to place grocery items or which grocery items to place on shelves.

In some examples, the collected emotional data may be entirely removed from the computing devices A–N or from the external system, or the only data that has images or other identifying features specific to the user may be removed. The above examples are just some use

cases for the computing device architecture shown in FIG. 1, and both the computing device and external system architecture have many other applications and use cases.

It is noted that the techniques of this disclosure may be combined with any other suitable technique or combination of techniques. As one example, the techniques of this disclosure may be combined with the techniques described in US Patent Publication US20140112556A1. As another example, the techniques of this disclosure may be combined with the techniques described in US Patent Publication US20140280529A1.