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MOOD ADVISOR BASED ON A USER'S ONLINE AND DEVICE ACTIVITY

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ABSTRACT

A system can determine correlations between user moods and user activities performed with devices, and can provide advice affecting user moods based on such correlations. For example, the system records moods of a user, such as by requesting that the user input his or her current moods periodically to devices. The system also determines and records activities and conditions that are engaged in by the user over time, based on the user's usage of devices for physical and online activity and based on detection of user activity using devices and device data. The system correlates moods of the user to activities based on which activities were performed by the user close in time (or otherwise connected) to particular moods, and/or by correlating and finding patterns of moods resulting from particular activities. The system can present the correlation information to the user as well as offer advice based on the correlations as to how to better attain more positive moods by changing the user's activities.

DESCRIPTION

The present disclosure describes features related to providing information and advice for users related to their moods or feelings and based on data collected by a system regarding user moods and user activities that have been manually input and/or detected through their use of devices.

There is now widespread use of applications by users through electronic devices (cell phones, tablet devices, wearable devices, laptop or desktop computers, game systems, vehicle systems, etc.), such that many user activities can be detected by or through those devices. For example, various online and device activities such as shopping, banking, interactions with friends, calendar appointments and events, and other activities can be performed largely through, with, or assisted by devices. Methods and systems described herein attempt to find correlations between these different user activities and user moods. The system can attempt to find patterns in activities and moods of a user, and use these patterns to advise the user on future activities in order to affect positive moods and negative moods. Since it may be difficult for a person to

normally know or understand what may be affecting their moods, such features can greatly assist users in becoming more self-aware of their moods and to achieve positive changes.

More specifically, the system can record users' input that describes their current or past moods, and correlate this user mood input with the users' activities as detected through device usage, sensors, and data. The system can determine patterns and advice information that can give the user an indication of how the user can affect his or her mood positively and negatively.

Features described herein can be enabled in some implementations only with permission from the user. For example, the system can ask user permission to gather information about the user, receive and use information from other users and from user accounts, network services (e.g., social networking services, messaging services, photo services, etc.), calendar information, mail, etc.

User Input describing Moods or Feelings

The system can obtain data describing the moods, emotions, and feelings (all referred to as "moods" herein) of users at particular times. Such mood data can be obtained in a variety of ways. For example, a user can directly input descriptive data about his or her moods. Since a user is likely to be more accurate in describing a current mood rather than remembering a previous mood, the user can be requested by the system to input descriptions of a mood at the time the mood is present, or within a short time of experiencing the mood.

In some implementations, a device can be instructed by the user to output a notification, reminder, or prompt to the user, e.g., audio, visual, vibration or other forces output from the device, etc. The notifications can be output as a prompt for the user to input his or her current mood to the device. The user can set a variety of parameters for the notifications, such as whether the notifications are periodic, the time interval between notifications, and/or other conditions which cause notifications to be output. For example, the user can set conditions related to user activities that devices can monitor, and when such activities are detected, a notification is output. For example, if a device detects that the user is not walking or otherwise traveling (e.g., based on motion sensors and/or GPS sensors of a carried device of the user), then a notification can be output.

The device can also output a menu for the user that displays options from which the user can select to describe a current mood, e.g., as a quick way for the user to input mood data. Figure 1 shows one example of an interface that requests a user to input a current mood. A menu can offer mood options from which the user can select. In addition, a scale or rating menu for the selected mood can also be offered, e.g., where the user can input a value in a scale of 1-10 to indicate the degree (e.g., severity or intensity) of the mood. Mood data input by the user can be time stamped to indicate the time of occurrence of the mood. Options can also be provided for the user to input a past mood, and the time that the mood occurred.

Some implementations can receive more descriptive data about a user's mood. For example, the user can input how long the mood lasted (if it is over), or can input a mood while the user is feeling the mood and/or input when the mood started and/or ceased as estimated by the user. In this way, data can be obtained by the system that indicates if particular moods were short or long-term.

In some cases, the system can encourage the user to input mood data. For example, the system can output a message or request that the user be aware of particular moods at certain times in the future, and then follow up about the request at a later time by asking the user to input mood data. For example, the system can display a message to the user to "be more aware of your moods after the meetings today" and then at the end of the day can ask, "What were your moods during or after the meetings today?"

Mood data may also be available from some other web services or sites, communication services, applications, etc., at which the user has input and stored mood data. In some cases, this mood data can converted from different formats, such as emoticons (e.g., happy or sad faces), to a category and scale used by the features implemented by the system.

Some implementations can also receive mood data about a user from one or more third parties, such as other users (e.g., spouse, children, friends, etc.). For example, a person living with a user can readily observe the user at various times during a day, and can input mood data describing the current mood of the user as perceived by that person. Such data can be noted as being provided by the particular other person, and can be compared to the user's own mood data as another form of mood data. Such other persons' data can be used by the system if permissions are received from the user directed to the person.

Some implementations can have the system automatically determine, estimate, or infer a user's mood based on the actions, activities, or conditions of or around the user as detected through device usage or sensors, without any direct description of the mood being input by the user. For example, if the user inputs positive ratings or comments for viewed content (photos, movie, book, etc.), inputs more positive ratings or comments than on an average day, spends more-than-average time making such positive ratings and comments, etc., then a more upbeat mood may be inferred by the system in some cases. If, for example, the user also manually enters his or her mood close in time to inputting the ratings, the system can learn over time which types and actions within activities may indicate particular moods of the user. This can allow more accurate inferences of user mood in the future after such training. In some implementations, user physiological measurements (e.g., body temperature, heartbeat, and other signals or characteristics sensed by worn device sensors) may be correlated to certain moods of users in general, or correlated to moods of this particular user based on previous analyzed data (e.g., as described below), such that the system may be able to infer current user moods based on such measurements made at close to the same time.

In additional examples, the user's position is being tracked (e.g., using GPS sensors on a carried device) and the system senses that the user is at a particular location. If there is no entry on the user's calendar or any other known event, mail, etc. that indicates the reason or purpose of the user's visit, then the system can by default associate the location with a mood of the user and infer that the user is experiencing that mood. For example, a hospital can be associated with a bad mood, a park can be associated with a good mood (relaxation and exercise), a discotheque can be associated with a good mood (fun and excitement), a cinema can be associated with a happy or exciting mood (if the system consults online sources to find that a comedy or action film was playing) or a sad or serious mood (if the system finds that a drama or documentary film was playing), etc.

Mood data can be collected from various devices and stored locally on one or more client devices, or stored on a server, e.g., in a user account or other storage that is accessible to the user and/or the user's devices.

Determining User Activities

A variety of user activities and conditions can be automatically detected through the user's use of devices. Generally, the term "activity" or "activities" can refer to activities, conditions, and/or events as used herein. Some activities can be detected by particular types of portable devices carried by the user, and some activities can be detected by any device used by the user. Some activities can be detected or determined by examining user data, e.g., data from a user's calendar, contact list, and/or to-do list. Activities can include online activities performed via the Internet and/or other communications networks, other communication activities (via telephone, etc.), or other device activities (e.g., performed locally on a device, or performed while carrying a device). For example, the following list of activities and activity data is a sample of the types of activities and data which can be automatically detected and/or stored by a device.

--Telephone calls sent to and received from specific people

--Number of mails sent and received (e.g., work, personal)

--Mails sent to and received from a specific person (or system)

--Video conference calls, video events, SMS, chats, and persons involved

--Subjects or topics sent and received in messages, calls, content (e.g., using voice recognition for audio media, object/face recognition for visual media, text recognition for text, etc.)

--Content, entries, comments, and ratings on networking services, sites, web pages, etc.

--Entries, comments, ratings, notes stored locally and on network blogs that users follow

--Search queries and selected search results for searches on the internet with a search engine or application

--Web page and networked service browsing, reading, and receiving media output in a web browser or other application (time spent and selections made)

--Local browsing, selection, use, and display on a device of documents, images, applications, media (audio, video, etc.) (time spent and selections made)

--Physical meetings with other persons (e.g., detecting other persons' devices in proximity to the user)

--Calendar events and activities (meetings, birthdays, parties, vacations, holidays, etc. stored in calendars or other lists controlled by the user)

--Alarm clock settings (e.g., wake up time, reminders, etc.)

--Weather, season, month

--Travel and location activities (e.g., hiking, bicycling, airplane flights, trains, hotels booked, cars rented, places visited, entertainment experienced, etc.)

--Online shopping and sales (purchases, deliveries, offers, auction bids, etc.)

--Bank activities (receive paycheck, check bank account, charge to accounts, loans, etc.)

--Registrations and sign-ups for web sites and services, government services, etc.

--Sleep tracking information via wearable sensors, applications, etc.

--Physical and sports activity measurements via wearable sensors, applications, etc.

Many other types of activities can also be detected and associated activity data stored. Some activity data can be measured directly by the device or device sensors, such as user selections or input, user latitude and longitude, user physical conditions, etc., while some activity data can include information received from other sources such as web sites, online databases, etc., such as addresses or names of businesses or other places visited by a user, map data, weather information, etc. Some information about user activities may be obtained from services such as social networking services, travel information services, etc.

A device and system can record activity data describing these user activities and conditions. The activity data can be time stamped as to what times the described activities and conditions occurred and/or checked/received by a device. Activity data can be stored locally on one or more client devices, or stored on a server, e.g., in a user account or other storage that is accessible to the user and/or the user's devices.

A user can also manually input information describing his or her activities. For example, the user can input a summary or information related to particular actions of the user, content experienced, the reactions of other people in a meeting or conversation, etc.

Correlating Activities and Moods

The system can evaluate and compare the received mood data and determined activity data to look for patterns and correlations in these sets of data. For example, the system can compare the times of particular moods of the user with the times of activities of the user to try to find a match or correlation. In some implementations, the system can look within a window of time around (or before / after) a mood and a window of time around (or before / after) an activity. For example, if an activity occurred within a 1 hour window of time before a mood was reported by the user, then the system can correlate the activity with the mood if sufficient instances of this match occurred (e.g., based on a threshold). Some data can be given multiple windows of time. For example, mood data input at the end of a day can be given a short-term window of time before the entry time to find activities within that window that may have had a short-term effect on the user's input mood. In addition, the reported mood can have a longer time window of the prior 12 hours to find activities that may have occurred any time during that day and contributed to a mood at the end of the day. Other longer time windows in which to look for activities relative to a mood occurrence can include a week, two weeks, a month, etc.

The system can look at activities that occurred between the user's updates or inputs of his or her mood to try to find correlations or patterns. The system can also look at activities that occurred at longer time periods before a mood is recorded, and/or after a mood is recorded. For example, the system can also look for correlations of activities and moods within multiple different time periods or windows. In some examples, the system can look for activities that occurred within an hour of a recorded mood to try to find short-term correlations between activities and that mood. The system can also separately look for activities that occurred throughout the entire day before the mood (or alternatively, within the last three days before the mood), to find long-term correlations between activities and the mood.

The system can look for large changes in mood (.e.g., over a threshold) over multiple samples of mood data input by the user. For example, adaptive correlation techniques can be used, e.g. to take into account variable amounts of mood entries.

For example, the system can examine the mood and activity data to see how many times a particular activity has occurred within a particular time window of a particular mood, and can make a conclusion based on the number of times. For example, if the system finds that a particular mood has typically been exhibited by the user after a particular activity for many times

over weeks, month, or year, then the system can conclude that the activity may contribute to that mood. Various thresholds can be used for the number of times that an activity (or combination of activities) is matched with a mood and the conclusion of how correlated are activities and a mood.

In addition, the system can examine the mood data and activity data to find how often a particular mood was exhibited by the user over different particular periods of time, whether the frequency of the mood increased at particular times or in correlation with particular activities, how many times that particular moods were followed by particular activities (e.g., to find correlation between particular moods and later activities that may have been encouraged by those moods), and other similarities between times of moods and times of activities.

If the system has received mood data from third party persons that describe the user's moods, then the system can correlate and find patterns in different sets of data. For example, the system can correlate activity data to the user's own described mood data, and separately correlate the activity data to mood data input by third party persons. The system can also compare the third party mood data to the user's own of mood data input at similar times, such that similarities and/or discrepancies between these sets of mood data can be used. For example, if there are similarities in these sets of data for a mood at a particular time, then that mood occurrence can be given a higher confidence rating that it accurately reflects the user's mood at that time.

Providing Information and Advice to User

The system can use determined patterns and correlations between user moods and user activities based on the mood data and activity data to provide information and advice to the user. In one example, the system has examined the activity data and mood data and found correlations between wake-up times and moods of the user for many days. In addition, the system has found a correlation between moods of the user and particular persons that communicate with the user. The system may also have found a pattern that particular moods often occur for the user on certain days of the week. Such patterns and conclusions can be presented to the user, e.g., displayed on a display screen of a user device. The presentations can be made when requested by the user, or can be automatically presented based on a condition occurring such as a period of

time elapsing, etc. Some examples of presented correlations and conclusions to a user are shown below:

--On the days you wake up before 7 AM, your day seems to be better.
--On the days that Bob contacts you more than 3 times per day, your mood at the end of the day seems to be worse.
--You are generally happier on Wednesday and that could be related to your bike ride in the morning on that day.
--After you look at your bank balance, your mood tends to swing lower over the following hour or two; this mood change does not seem based on the current amount of money in your account.

General advice can also be presented by the system for the user as to how to improve or change moods, if the user expresses an interest in doing so. For example, the system can make suggestions for the user to do activities that have historically correlated with happier moods for the user, e.g., riding a bike more often, avoiding work on the weekend, etc. The system can also provide encouragement to the user, and/or anticipate the user's future moods based on the activity data and mood data from the past as well as other data, e.g., calendar data of the user. In one example, the system could output positive advice in the morning such as, "You have 3 hours of meetings today and you generally seem to be less happy on Wednesdays like today, so try to get through the meetings being positive about it." Or the system can provide more specific advice retrieved from a knowledge database, e.g., take 10 minute breaks, do short exercises, breathe deeply, etc. The system could then follow up at the end of the day, asking "How did you feel after the meetings?" and receive more mood data from the user and potentially, over time, correlate such mood data with system advice that was given. For example, the system can learn from the effects of previous presentations of information and advice to the user to determine whether the information and advice was effective in changing the usual or average moods of the users in relation to specific activities.

In some implementations, the system can provide suggestions to the user such as rescheduling activities and events of the user, skipping particular activities or events, adding

named activities, etc., which the system has estimated may improve the user's moods based on analysis of previous correlations between the user's moods and such activities.

The system can be instructed by the user to output such information or advice periodically (e.g., every 30 days or 60 days based on the data collected up to that time), and/or according to other user-specified conditions.

Such presented information and advice can also be influenced by such data characteristics as the strength of correlations between activity and mood data, and/or confidence ratings associated with the user's recorded moods and/or activities. For example, if the user's moods are known with high confidence due to alignment of the user's mood data and third party mood data, then the related advice can be more strongly worded. If a particular mood frequently and exclusively follows a particular activity for the user, then the advice concerning those circumstances can be more strongly worded.

The system can also provide graphical diagrams or illustrations of activity data, mood data, patterns/correlations, and conclusions for presentation to the user. For example, graphs, charts, and/or diagrams of this data can be displayed on a device of the user in response to the user requesting such displays via input to the device and/or to a user account of a server. In some examples, the system can display a graph showing various types of moods and how those moods have varied for the user over a user-specified period of time. The user could select a particular mood type to cause details to be displayed describing when that user's mood was affected based on a list of various activities. The user can configure the display for any desired parameters, e.g., the size of the time period in which received data is graphed, the types of activities or moods being correlated, etc.

Figure 2 is one example of a graphical display of a user's device which is presenting mood data for a particular mood selected by the user, which in this example is happiness. The graph shows a time scale selected by the user in the horizontal direction and a vertical scale showing the degree of happiness. In this example, the system also displays particular activity labels pointing to particular portions of the graph in which the user's mood changed or was extreme in some way. For example, these labels can describe an activity that the system has estimated is the most likely cause for the particular amount of happiness shown in the graph at the indicated portion. The system estimates these causal activities based on the activity data and

mood data in this time period and finding correlations with the happiness mood and the labeled activities.

In some implementations, the system can display symbols, icons, emoticons, or other graphic effects in displays, e.g., if some users react better to seeing graphical indicators such as a happy face, sad face, or other symbol rather than text. For example, the system can display graphical symbols or effects in a display of upcoming situations, events, or activities to indicate the predicted mood of the user in particular activities based on past correlations. In some cases, if the user sees a graphical happy/sad/other face icon next to listed events instead of seeing text, that can better communicate the notion that if the user does everything as he or she normally does for that event and does not try to change anything, potentially his or her mood will be the mood indicated by the icon. In some implementations, the system can request pictures with different faces of the user showing different moods, and display those face pictures to indicate past or predicted future moods of the user. For example, displaying the user's face may provide a strong signal for the user be aware of his or her mood for that day and try to change it.

A user can potentially use such presented information and advice to better realize what activities and conditions affect his or her mood, and to make changes in his or her routine and activities so that more desirable moods and emotions are more likely to occur. For example, the user can learn which activities to do more often to have more positive moods, and which activities to avoid more often to have fewer negative moods, which the user was not aware of previously. In this way, the features described herein can allow a user to examine his or her activities at a fine resolution with regards to how those activities are affecting the user and to make positive improvements in the user's life.

Device Examples

An example server device which can be used in a system implementing the features described above can be any suitable computer system, server, or other electronic or hardware device. For example, the server device can be a mainframe computer, desktop computer, workstation, portable computer, or electronic device (portable device, cell phone, smart phone, tablet computer, television, TV set top box, personal digital assistant (PDA), media player, game

device, etc.). In some implementations, server device includes a processor, memory, and an input/output (I/O) interface.

The processor can be one or more processors or processing circuits to execute program code and control basic operations of the server device. The processor includes any suitable hardware and/or software system, mechanism or component that processes data, signals or other information. A processor may include a system with a general-purpose central processing unit (CPU), multiple processing units, dedicated circuitry for achieving functionality, or other systems. Processing need not be limited to a particular geographic location, or have temporal limitations. For example, a processor may perform its functions in "real-time," "offline," in a "batch mode," etc. Portions of processing may be performed at different times and at different locations, by different (or the same) processing systems. A computer may be any processor in communication with a memory.

The memory is typically provided in the server device for access by the processor, and may be any suitable processor-readable storage medium, such as random access memory (RAM), read-only memory (ROM), Electrical Erasable Read-only Memory (EEPROM), Flash memory, etc., suitable for storing instructions for execution by the processor, and located separate from the processor and/or integrated therewith. The memory can store software operating on the server device by the processor, including an operating system and a browser. Any of software in the memory can additionally or alternatively be stored on any other suitable storage location or computer-readable medium. In addition, the memory (and/or other connected storage device(s)) can store privacy settings, images and other content, and other data used in the features described herein. The memory and any other type of storage (magnetic disk, optical disk, magnetic tape, or other tangible media) can be considered "storage devices."

An I/O interface can provide functions to enable interfacing the server device with other systems and devices. For example, network communication devices, storage devices such as memory and/or database, and input/output devices can communicate via the I/O interface. In some embodiments, the I/O interface can connect to interface devices such as input devices (keyboard, pointing device, touchscreen, microphone, camera, scanner, etc.) and output devices (display device, speaker devices, printer, motor, etc.).

Example client devices used with features described above can be desktop computers, laptop computers, tablet computers, phones, wearable devices, home entertainment devices, etc. Such devices include some similar components as the server device described above, such as processor(s), memory, and I/O interface. An operating system, software and applications suitable for the client device can be provided in memory and used by the processor, such as browser application software. The I/O interface for a client device can be connected to network communication devices, as well as to input and output devices such as the display screen. A display screen, for example, can be used to display the editing program and its features, and can be any suitable display device such as an LCD, LED, or plasma display screen, CRT, television, monitor, touchscreen, 3-D display screen, or other visual display device. Some embodiments can provide an audio output device, such as voice output or voice synthesis.

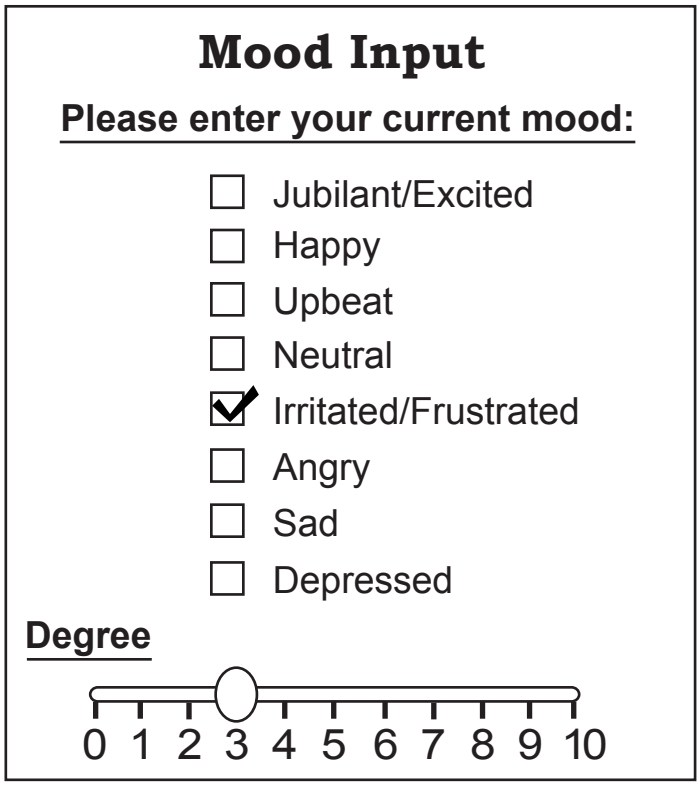
Mood Input
Please enter your current mood:
Jubilant/Excited
Happy
Upbeat
Neutral
Irritated/Frustrated
Angry
Sad
Depressed
Degree
0 1 2 3 4 5 6 7 8 9 10

FIG. 1

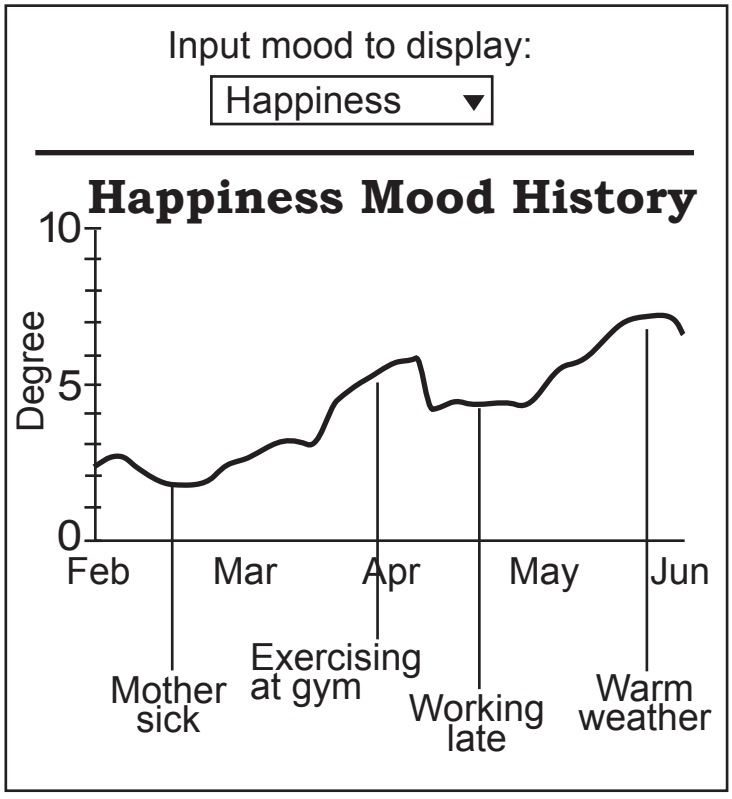
Input mood to display:
Happiness
Happiness Mood History
10
5
0
Degree
Feb
Mar
Apr
May
Jun
Mother sick
Exercising at gym
Working late
Warm weather

FIG. 2