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INTELLIGENT MEMO HIGHLIGHTING SERVICE

A cloud-based content management platform provides a variety of online applications to users for a comprehensive online service. The cloud-based content management platform can offer, for each user account, a memo application (for making short notes), an email application, a messaging application, a calling application, and a cloud-storage application among other things. When the cloud-based content management platform receives a request from users to access content associated with each online application, the cloud-based content management platform presents the content in a linear manner. For example, when a user requests to open a memo application, the cloud-based content management platform provides a list of memos (a list of short notes) generated in a chronological manner. In order to locate a memo of interest, the user needs to scroll through a long list of memos until the memo of interest can be found. Accordingly, processing resources for both a user device and a service supporting the cloud-based content management platform can be excessively consumed depending on a location of the memo of interest.

Therefore, a technique is proposed for incorporating context a user is in at a given time of requesting content (e.g., a memo) of an online application (e.g., a memo application). The technique can be implemented by a memo highlighting service as a plug-in software to an applicable online application (e.g., a memo application). The memo highlighting service can determine context of a user for requesting access to online memos by collecting data that represents user activities (e.g., web browsing activity, time and location, schedule) associated with a user device. The memo highlighting service can utilize a machine learning model to determine a relevant memo from memos associated with the user. It should be understood that the memo highlighting service can similarly be implemented in other online applications (e.g., an email

application, a messaging application, a calling application, a cloud-storage application) to highlight a relevant content.

Figure 1 illustrates a flow diagram of a method for intelligently highlighting memos that are most relevant to users at the time of requesting the memos. First, at block 100, the memo highlighting service can receive, from a user device, a request to access memos associated with a user account. The user device can be any computing device that can access the cloud-based content management platform. The memo highlighting service, as a part of the memo application provided by the cloud-based content management platform, can receive the request from the user device. The request can include a request to open or access the memo application. The memo application can enable a user to create, store and view a memo in a form of a text document. The memo highlighting service can store various memos such as a work to-do list, grocery shopping list, movie watch list, and reading list.

Subsequently, at block 110, the memo highlighting service can determine one or more keywords based on user activities associated with the user device and performed before the request is received (e.g., within a particular time duration preceding the request). A keyword would represent a user activity that has led to the user's access of a memo. The memo highlighting service can use a keyword to predict context or a reason for the opening of the memo application, in order to determine a relevant memo for the user shortly prior to or at the time of the request. To determine such a keyword, the memo highlighting service can monitor user activities associated with the user device based on various data collected from, for example, a web browser application of the user device, sensors (e.g., Global Position System (GPS) sensor) in the user device, online calendar application of the user device (provided by the cloud-

based content management platform), and time and date information from the user device. The memo highlighting service can periodically collect the data.

As an example of a user activity, the user can search a book on a mountain climbing at an online shopping website on the user device. After finding a book of interest, the user can open the memo application to make a note on a title and an author of the book. In such an instance, the memo highlighting service can collect web browsing data from the user device (logged within a predetermined time threshold before receiving the request to access memos) and analyze the web browsing data to determine a keyword appropriate for the user activity. The memo highlighting service can obtain an image (e.g., an image of a web site) displayed on a web browser of the user device. The image can contain a web site address, an image of a book cover, and text description about a book. Then the memo highlighting service can perform text analysis (e.g., natural language processing) or image recognition on the image to determine the nature of the user activity (e.g., browsing a book on mountain climbing). Based on the analysis, the memo highlighting service can determine that a keyword for the user activity as “shopping”, “book”, and/or “mountain climbing.” In some examples, the user device (instead of the memo highlighting service) can perform the text analysis and image recognition on images displayed on the web browser of the user device and transmit a keyword extracted from the analysis to the memo highlighting service.

As another example of a user activity, the user can be shopping at a local grocery store with the user device. When the user turns on the user device and requests to open the memo application, the memo highlighting service can determine a keyword representing current context of the user activity. The memo highlighting service can determine the keyword based on a GPS location collected from the user device within a predetermined time threshold. In this example,

the memo highlighting service can determine that the user is at a local grocery store based on the GPS location of the user device. Thus, the memo highlighting service can determine that the keyword for the user activity is “grocery shopping.”

As still another example of a user activity, the user can be attending a business meeting. When the user requests to access memos from the user device, the memo highlighting service can determine a keyword for the user activity based on date and time information provided by the user device and a meeting event from the online calendar application. The memo highlighting service can determine whether the user activity is associated with any particular meeting event by comparing a schedule from the online calendar application with the time (as provided by the user device) the user requested access to memos. In this example, the user may have two meetings scheduled for the day – business meeting in the afternoon and a date at a movie theatre at night. In response to determining that the request to access memo application is received in the afternoon, the memo highlighting service can determine the keyword to be “business meeting.” On the other hand, if the request was received at night, the memo highlighting service can determine the keyword to be “movie.” In addition to the meeting event from the online calendar application, the memo highlighting service can also incorporate a GPS location of the user device in determining the keyword.

Once the memo highlighting service determines a keyword describing a user activity that leads the user to access memos, the memo highlighting service, at block 120, can rank memos associated with the user account based on the keyword. The memo highlighting service can determine attributes of each memo associated with the user account. Some examples of the attributes can include a title of a memo and salient term(s) in the text of a memo. The memo highlighting service can extract a salient term in the text of each memo by performing natural

language processing on the text of the respective memo. In another example, the memo highlighting service can determine as a salient term a word that is repeatedly included in the text. For example, the memo highlighting service can determine a “business” as a salient term for a work to-do list memo, a “shopping” as a salient term for a grocery list memo, a “movie” for a movie watch list memo, and a “book” for a reading list memo.

The memo highlighting service can provide the keyword and attributes (e.g., title and salient terms) of each memo as input to a machine learning model. Specifically, the memo highlighting service can utilize a recurrent neural network model to predict a note the user is likely to select. A recurrent neural network model uses an internal memory to process a sequence of inputs. Because of the internal memory, the recurrent neural network model can remember and incorporate input received after the previous output for predicting the next output. Thus, the recurrent neural network model can improve upon the input remembered. Accordingly, the recurrent neural network model can be useful in processing sequential data such as time series, speech, text, audio, and video. The memo highlighting service can also provide to the internal memory of the recurrent neural network model memos selected by the user over the time so that the machine learning model remembers the user’s preference (or a pattern) and refines its prediction.

After providing the keyword and attributes of each memo, the memo highlighting service can obtain from the machine learning model as an output a ranking for each memo. The ranking can indicate how relevant the respective memo is to the keyword. That is, the ranking can represent a likelihood the user will click on the respective memo given the predicted context for requesting access to the memos. For example, with respect to the keyword, “book,” a ranking for a reading list memo can be higher than a ranking of a grocery shopping list memo. However, for

the keyword, “business meeting,” a ranking for a work to-do list memo can be higher than a ranking of a reading list memo. The ranking can be a numerical value between zero and one.

Lastly, at block 130, the memo highlighting service can provide the memos associated with the user account while highlighting a subset of the memos based on rankings. The memo highlighting service can launch the memo application on the user device and provide a list of memos associated with the user account. The memo highlighting service can select a subset of memos having a ranking higher than a predetermined threshold (e.g., 0.5). Then, the memo highlighting service can visually highlight the subset of memos by ordering them first in the list. In another example, the memo highlighting service can highlight the highly ranked memos by different colors. In this way, the memo highlighting service can save the user a time in locating a memo predicted to be relevant to the user.

It should be appreciated that the memo highlighting service can be applicable to other applications such as an email application, a messaging application, a call application, a cloud storage application provided by the cloud-based content management platform. The memo highlighting service can log similar data associated with the user device (e.g., a web browser application of the user device, sensors (GPS sensor), online calendar application of the user device, time information of the user device). In response to receiving a request to launch the respective application, the memo highlighting service can determine a keyword describing predicted reason for the user to access the respective application. The memo highlighting service can then rank emails, messages, contact information, or documents based on the keyword. Finally, the memo highlighting service can visually highlight highly ranked set of emails, messages, contact information, or documents for faster access.

Further to the description above, a user may be provided with controls allowing the user to make an election as to both if and when systems, programs or features described herein may enable collection of user information (e.g., information about user activities on the cloud-based content management platform, information about the content of documents stored in the cloud storage, information about user's schedule, a user's preferences, or a user's current location), and if the user has sent content or communications from a server. 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. Thus, the user may have control over what information is collected about the user, how that information is used, and what information is provided to the user.

ABSTRACT

A technique is proposed for intelligently highlighting memos that are most relevant to users at the time of requesting memos. The method includes receiving, from a user device, a request to access memos associated with a user account. The method also includes determining a keyword based on user activities associated with the user device and performed before the request is received. The method further includes ranking memos associated with the user account based on the keyword. The method finally includes providing the memos associated with the user account while highlighting a subset of the memos based on rankings.

Keywords: self-highlighting notes, intelligent memo, recurrent neural network model, machine learning.

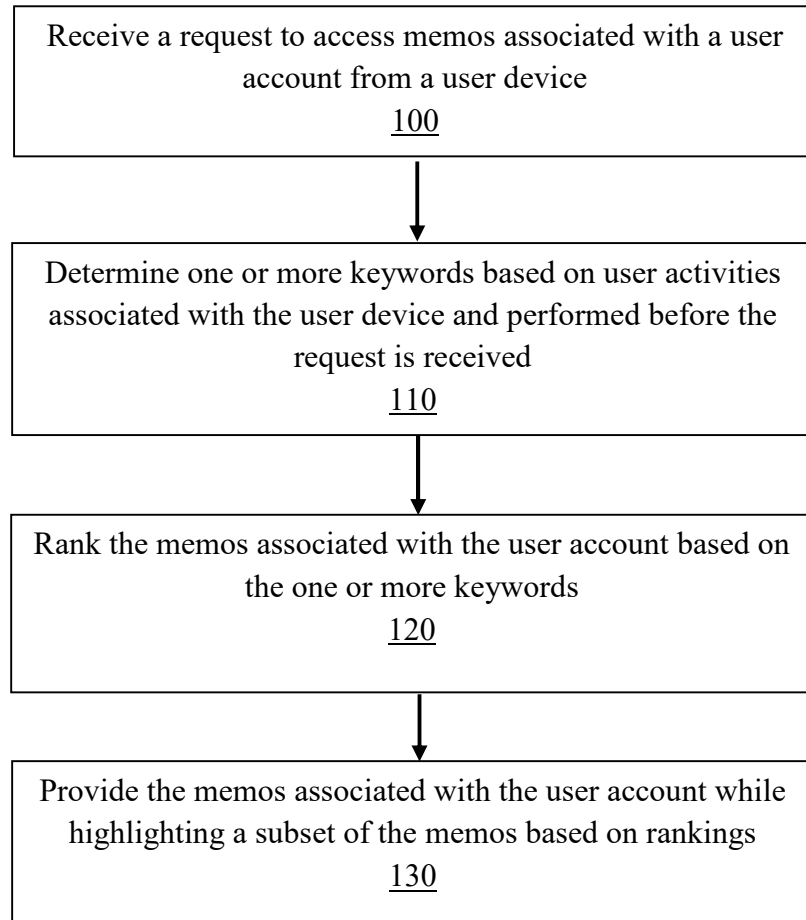


FIG. 1