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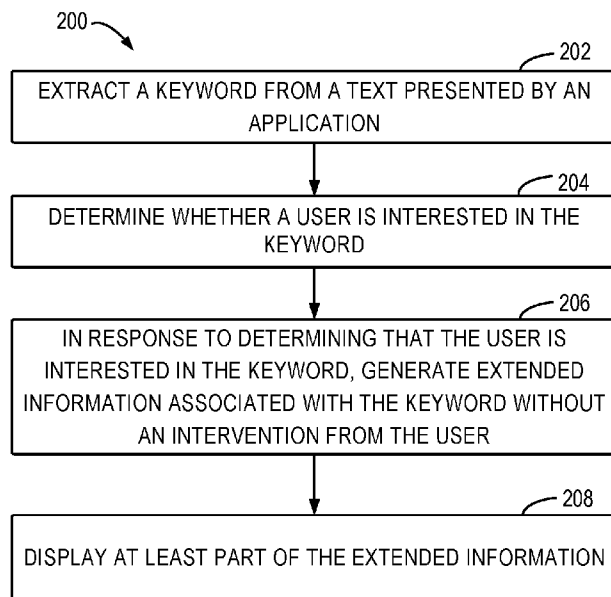
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FIG. 2



(57) Abstract: Embodiments of the subject matter described herein provide a solution for automatically providing information in an application. During operation, a keyword is extracted from a text presented by the application. It is then determined whether a user is interested in the extracted keyword. In response to determining that the user is interested in the keyword, extended information associated with the keyword is generated without an intervention from the user, and at least part of the extended information is displayed. This solution provides the user directly with information that the user expects or needs to know without requiring the user to search for the information over the Internet, which thereby saves the user's search time and improves the user experience.

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AUTOMATICALLY PROVIDING INFORMATION IN AN APPLICATION

FIELD

[0001] Embodiments of the subject matter described herein generally relate to
5 information technology, and more specifically, relate to a computer-implemented method,
a device and a computer program product for providing information.

BACKGROUND

[0002] Nowadays, people browse and edit a text with an application for presenting the
text, so as to obtain a variety of kinds of information. When browsing or editing the text,
10 people probably want to learn detailed information related to some content in the text.
As an example of the application for presenting the text, emails are one of the most
important tools for communication between people. People, in particular professionals,
probably spend a certain amount of time to edit, review, and reply emails. It has been
discovered from studies that many email senders would request email receivers to provide
15 certain information, for example, market environment information, investment interest,
and the like. Although people may obtain such information through Internet search or
from other databases, it is time consuming. For example, in order to understand content
of emails or to reply to emails, the email receivers probably have to gather, organize, and
analyze a large amount of information over the Internet to obtain useful information
20 therein. This process is tedious and time consuming.

SUMMARY

[0003] In the embodiments of the subject matter described herein, there is provided a
solution for automatically providing information in an application. After obtaining a text
presented by an application, a keyword can be extracted from the text, and it is determined
25 whether a user of the application is interested in the extracted keyword. If it is
determined that the user is probably interested in the extracted keyword, extended
information associated with the extracted keyword is generated without requiring the user
to perform any act on the keyword. Then, at least part of the extended information is
displayed. In this way, information that the user expects or needs to know may be
30 provided directly to the user without requiring him/her to search for the information over
the Internet, which thereby saves the user's search time and improves the user experience.

[0004] The Summary is provided to introduce a selection of concepts in a simplified
form that are further described below in the Detailed Description. This Summary is not
intended to identify key features or essential features of the subject matter described herein,

nor is it intended to be used to limit the scope of the subject matter described herein.

BRIEF DESCRIPTION OF THE DRAWINGS

[0005] With reference to the drawings, the above and other objectives, advantages, and features of the subject matter described herein will become apparent through the detailed description of embodiments of the subject matter described herein. Throughout the drawings, the same or similar reference symbols generally refer to the same or similar elements, wherein:

[0006] Fig. 1 illustrates a block diagram of a computing device in which one or more embodiments of the subject matter described herein can be implemented;

[0007] Fig. 2 illustrates a flowchart of a method of providing information according to embodiments of the subject matter described herein;

[0008] Fig. 3 illustrates a graphical user interface (GUI) of an email application presenting a received email according to embodiments of the subject matter described herein;

[0009] Fig. 4 illustrates a GUI presented by an email application when replying to the email shown in Fig. 3 according to embodiments of the subject matter described herein; and

[0010] Fig. 5 illustrates a GUI presented by an email application when replying to the email shown in Fig. 3 according to embodiments of the subject matter described herein.

DETAILED DESCRIPTION OF EMBODIMENTS

[0011] Embodiments of the subject matter described herein will be described below in detail with reference to drawings. Although the drawings illustrate some embodiments of the subject matter described herein, it would be appreciated that the subject matter described herein may be implemented in various forms, and should not be construed as being limited to the embodiments described herein. Rather, these embodiments are provided for thorough and complete understanding of the subject matter described herein. It is to be understood that the drawings and embodiments of the subject matter described herein are provided merely for purpose of illustration and is not intended for limiting the protection scope described herein.

[0012] As used herein, the term “includes” and its variants are to be read as open terms that mean “includes, but is not limited to.” The term “based on” is to be read as “based at least in part on.” The term “one embodiment” and “an embodiment” are to be read as “at least one embodiment;” the term “another embodiment” is to be read as “at least one other embodiment;” and the term “some embodiments” is to be read as “at least some

embodiments.” Other definitions, either explicit or implicit, may be included below.

[0013] As mentioned above, when reading or editing a text using an application for presenting the text, a user may be interested in some content items in the text or needs to learn further information related to these content items. For example, having little
5 knowledge about a certain term mentioned in the text, a user probably needs to search for the definition of the term. As another example, if the text mentioned a hot event occurring recently, a user may want to know more details related to this hot event or the progress thereof. To this end, in a conventional way, a user is required to input the word mentioned in the text manually into a website with a search function, to obtain information
10 associated with the word from various network resources. When there are massive content items in which the user is interested in the text, such manual search would take massive user time. If these content items relate to different fields, the user probably has to perform the search through different professional websites and thus may need to frequently switch among the different websites, thereby causing poor user experience.

[0014] In view of the above, the embodiments of the subject matter described herein provide a solution of providing desired information to a user automatically. In the embodiments of the subject matter described herein, for a text presented by an application, information that a user may be interested in is predicted, and the predicted information is displayed automatically to the user without requiring the user to perform any act with
20 respect to the content items in the text. This can not only save user time in obtaining extended information, but also further improve the user experience in using the application.

[0015] Basic principles and several example embodiments of the subject matter described herein will be described with reference to Figs. 1 to 5. Fig. 1 illustrates a block
25 diagram of a computing device 100 in which one or more embodiments of the subject matter described herein can be implemented. It would be appreciated that the computing device 100 as shown in Fig. 1 is merely provided as an example, without suggesting any limitation to the functionality and scope of the embodiments as described herein.

[0016] As shown in Fig. 1, the computing device 100 includes a computing device 100
30 in form of general-purpose computing device. Components of the computing device 100 may include, but are not limited to, one or more processors or processing units 110, a memory 120, a storage device 130, one or more communication units 140, one or more input devices 150, and one or more output devices 160.

[0017] In some embodiments, the computing device 100 may be implemented as various

user terminals or service terminals. The service terminal may be any server, large-scale computing device, and the like that is provided by various service providers. The user terminal may for example be any type of mobile terminal, fixed terminal or portable terminal, including a mobile telephone, station, unit, device, multimedia computer, multimedia tablet, Internet node, communicator, desktop computer, laptop computer, 5 notebook computer, netbook computer, tablet computer, personal communication system (PCS) device, personal navigation device, personal digital assistant (PDA), audio/video player, digital camera/video camera, positioning device, television receiver, radio broadcast receiver, E-book device, gaming device, or any combinations thereof, including the accessories and peripherals of these devices, or any combinations thereof. It would be appreciated that the computing device 100 can support any type of interface for a user (such as a “wearable” circuitry and the like).

[0018] The processing unit 110 may be any physical or virtual processor and can perform various processing based on programs stored in the memory 120. In a 15 multi-processor system, multiple processing units execute computer-executable instructions in parallel to as to improve the parallel processing capacity of the computing device 100. The processing unit 110 may also be referred to as a central processing unit (CPU), a microprocessor, controller or a microcontroller.

[0019] The computing device 100 typically includes a plurality of computer storage 20 medium, which may be any available medium accessible by the computing device 100, including, but not limited to, volatile and non-volatile medium, and detachable and non-detachable medium. The memory 120 may be a volatile memory (for example, a register, cache, random access memory (RAM)), non-volatile memory (for example, a read-only memory (ROM), electrically erasable programmable read-only memory (EEPROM), flash memory), or any combination thereof.

[0020] The memory 120 may include an information provision module 125 which is configured to perform functionality of various embodiments described herein. It would be appreciated that “information provision method” and “information provision module” are used exchangeably herein. The information provision module 125 may be accessed 30 and operated by the processing unit 110 to implement respective functions.

[0021] The storage device 130 may be any detachable or non-detachable may include machine-readable medium, such as flash drive, disk or any other medium, which can be used for storing information and/or data and accessed in the computing device 100.

[0022] The input device 140 may be one or more input devices, such as a mouse,

keyboard, touch screen, tracking ball, voice-input device, and the like. The output device 150 may be one or more output devices, such as a display, a loudspeaker, a printer and the like.

[0023] The communication unit 160 communicates with a further computing device via communication medium. In addition, functions of components in the computing device 100 can be implemented by a single computing cluster or multiple computing machines that can communicate via communication connections. Therefore, the computing device 100 can be operated in a networking environment using a logical connection with one or more other servers, network personal computers (PCs) or further general network nodes. The computing device 100 can further communicate, via the communication unit 160, with one or more external devices (not shown) such as a storage device, display device and the like, one or more devices that enable users to interact with the computing device 100, or any devices that enable the computing device 100 to communicate with one or more other computing devices (for example, a network card, modem and the like). Such communication can be performed via an input/output (I/O) interface (not shown).

[0024] The computing device 100 may receive a text 102, via the communication unit 160, from other devices or various network resources, such as news websites, blogs, self-media, and the like. Alternatively, the computing device 100 may also receive the text 102 input by the user via the input device 140. The text 102 is transferred to the information provision module 125 for processing. According to the embodiments of the subject matter described herein, the information provision module 125 extracts, from the text 102, one or more keywords 104-1, 104-2, 104-3, determines whether a user is probably interested in these keywords, and determines extended information 106-1, 106-2 (for example, definitions of the keywords, introduction of the keywords, and hot events associated with the keywords) associated with the keywords 104-1, 104-2 in which the user may be interested. Hereinafter, the keywords 104-1, 104-2, 104-3 are collectively referred to as keywords 104, and the extended information 106-1, 106-2 are collectively referred to as extended information 106. It would be appreciated that although only three keywords 104 and two pieces of extended information 106 are shown in Fig. 1, the respective numbers of keywords 104 and pieces of extended information 106 are not limited thereto but may be any number. The text 102 and the extended information 106 determined by the information provision module 125 may be displayed via the output device 150 (for example, a display) to the user.

[0025] It would be appreciated that the communication between the information

provision module 125 and the input device 140 and the output device 150 can be implemented via an interface provided by the operation system (OS) on the computer device 100. Examples of such interface include, but are not limited to, various application programming interfaces (APIs).

5 [0026] According to the information provision solution according to the embodiments of the subject matter described herein, information that a user probably desires or needs to know is predicted based on a keyword in a text, and the information is automatically provided to the user. In this way, the user can obtain contents that he/she may be interested in without actively search for any related content, thereby saving the user's
10 search time and improving the user experience.

[0027] Fig. 2 illustrates a flowchart of a method 200 of providing information according to embodiments of the subject matter described herein. It would be appreciated that the method 200 may be implemented by the computing device 100, in particular by the information provision module 125 in the computing device 100. For purpose of
15 explanation of the method 200 in Fig. 2, the method 200 will be described with reference to examples of a graphical user interface (GUI) in Figs 3, 4 and 5, where Figs. 3, 4 and 5 illustrate the GUI for a process of providing information according to an embodiment of the subject matter described herein, respectively.

[0028] At 202, the computing device 100 extracts a keyword 104 from a text 102 presented by an application. In some embodiments, the application may be any application capable of presenting content in a form of text, such as an email application, document editing application, browser, or the like. In the embodiments of the subject matter described herein, a keyword refers to such word in a text that can better reflect the subject of the text than other words in the text, which means that importance of this word
20 is higher than that of the other words. For purpose of description, reference is made to Fig. 3, which illustrates the extraction of the keyword in the example of an email application. It would be appreciated that the embodiments of the subject matter described herein are not limited to the email application, but may be applicable to any application capable of presenting a text, such as a document editing application, browser,
25 or the like.
30

[0029] Fig. 3 illustrates a GUI 300 of the email application installed on the computing device 100 and used for presenting a received email. The GUI 300 presents an email received by a user YuZheng from MingZhou, which contains a text 102 of "I suggest you read the article about Mei Tao's presentation on video analysis which mentions video

captioning, an interesting topic linking video and text.” It would be appreciated that although an English text is used as an example in the embodiment of the subject matter described herein, other languages, such as Chinese, Japanese, or the like, are possible, and the embodiments of the subject matter described herein are not limited by the language of the text.

[0030] In some embodiments, some natural language processing technologies may be utilized to process the text 102, so as to determine the keywords 104 therein. Specifically, the text 102 may be first segmented to obtain individual words in the text 102, such as “I,” “suggest,” “article,” and the like. Then, for each of these words, various methods may be employed to evaluate the importance of the word with respect to the text 102 (which may indicate the probability that this word is a keyword). The words in the text 102 are ranked according to the importance accordingly, and one or more words ranked top may act as the keywords 104 of the text 102. Of course, words having importance exceeding a threshold importance may be selected as the keywords 104 of the text 102.

[0031] In some embodiments, for each word in a text 102, a word frequency-inverse document frequency (TF-IDF) score of the word may be calculated as a measurement for evaluating the importance of the word with respect to the text 102. The basic idea of TF-IDF lies in that the importance of a word is increased proportionally to the number of times it appears in the text, and decreased inversely proportional to its frequency of appearance in a corpus. TF-IDF can efficiently measure importance of a certain word in a context of a particular text. In some embodiments, various developed algorithms may be used to calculate TF-IDF of each word. The scope of the embodiments of the subject matter described herein is not limited in this regard.

[0032] In some embodiments, for each word in a text 102, a TextRank score of the word may be calculated as a measure for evaluating the importance of the word with respect to the text 102. TextRank is an algorithm of extracting a keyword based on a graph, and the basic idea thereof is to regard a text as a network of words, links in which represent semantic relations between words. For a given word, the TextRank algorithm is used to calculate the importance of the given word based on the importance of other words being linked to the given word.

[0033] In some embodiments, for each word in a text 102, the TF-IDF score and the TextRank score of the word may be combined (for example, weight-combined) to obtain a combined score as a measure for evaluating the importance of the word with respect to the text 102. Such combined score takes not only the statistical characteristic of the word but

also the semantic relations between the words into account, which leads to more accurate keyword extraction based on the combined score.

[0034] In some embodiments, a keyword 104 may also be extracted from the text 102 based on a historical behavior of a user or other users. For example, given a historical behavior of a user or a further user on a predetermined word, a word can be selected from the text 102 as the keyword 104 if a semantic similarity between the word and the predetermined word exceeding a threshold. The historical behavior may include acts performed by the user or other users on the predetermined word in an email application or other applications, such as the user or other users clicking on a predetermined word with a mouse, copying a predetermined word in the email application, searching for the predetermined word in another application (for example, a browser), or the like.

[0035] For example, if a user searched for a certain predetermined word through a certain website in the past, it indicates that the user was interested in the predetermined word in the past, and thus it is likely that the user is interested in a synonym of the predetermined word in the text 102. As another example, if a search frequency of a certain predetermined word over the Internet bursts (i.e., exceeds a threshold number), it indicates that a lot of users are interested in this predetermined word, and thus it is very likely that the user in concern is also interested in a synonym of the predetermined word in the text 102. As such, in some embodiments, a target word synonymous with the predetermined word may be selected from the text 102 directly as a keyword 104, without requiring calculation of the importance of the target word with respect to the text 102. In this way, the keyword 104 that possibly draws the user's attention may be extracted from the text 102 based on the historical behavior of the user or other users, and thus it is possible to provide the user with more useful and well-directed information. In the embodiments of the subject matter described herein, a target word synonymous with the predetermined word may be selected from the text 102 by calculating a semantic similarity between the two words using a neural network.

[0036] For the text 102 as shown in Fig. 3, by applying the method of determining a combined score of a TF-IDF score and a TextRank score as described above, the keyword 104-1 "captioning," the keyword 104-2 "article," the keyword 104-3 "presentation," and the like may be extracted from the text 102. It would be appreciated that although only three keywords are shown, the number of keywords may be any integer.

[0037] Still referring to Fig. 2, at 204, the computing device 100 determines an interest of the user in the keyword(s) 104. The user's interest in a keyword 104 (i.e., whether

he/she is interested in the keyword 104 or not) involves prediction of a potential direction in which the user is interested. In some embodiments, the user's interest in the keyword 104 may be determined based on a type of the keyword 104 or presence of the keyword 104 in a set of hot documents. Some embodiments about how the user's interest in the keyword 104 is predicted will be described below.

[0038] In some embodiments, the user's interest in the keyword 104 may be determined by determining whether the keyword 104 is a named entity. In the field of natural language processing, an entity with a particular meaning is referred to as a named entity, which mainly includes a person name, an address, an institution name, a proper noun, or the like. In a text such as an email, people are often more interested in entities having particular meanings and more eager to learn or need to learn more information on these entities. Hence, a named entity identification technology may be employed to determine whether an extracted keyword 104 is a named entity. If the keyword 104 is a named entity, then it can be determined that the user is interested in the keyword 104.

[0039] In some embodiments, the user's interest in the keyword 104 may be determined by determining whether the keyword 104 is a special terminology in a specific field. The special terminology refers to a unitary definition of some specified things in a specific field, which typically has a specified meaning related to the concerned field. A layman in the specific field probably needs more information to accurately understand the specific meaning of the terminology. Therefore, if it is determined that a keyword 104 is a special terminology of a certain field, then it can be determined that the user is interested in the keyword 104. In the example of Fig. 3, it is likely that there is a special terminology that is unfamiliar to the user (for example, the keyword 104-1 "captioning") in the text 102 of the email. To reply to the email properly, the user probably needs to learn the meaning of this terminology. In some embodiments, a terminology identification technology may be employed to determine whether the extracted keyword 104 is a special terminology in the specific field.

[0040] In some embodiments, the user's interest in the keyword 104 may be determined by determining whether the keyword 104 is associated with a hot event. A hot event refers to an event drawing wide attention within a predetermined period of time (for example, a day or a week), and therefore, people often tend to follow the hot event and its progress. For example, the keyword 104 in the text is probably related to a hot event happened recent, and only after acquiring some knowledge about the hot event, the user can realize the context of the text or further process the text (for example, reply to the

email). Hence, a keyword related to a hot event is probably a keyword of the user's interest.

[0041] In some embodiments, whether a keyword 104 is related to a hot event be determined, by determining whether the extracted keyword 104 is present in a set of hot documents associated with the hot event or not, and the number of times it appears in the set of hot documents. If a keyword 104 is present in the set of hot documents, which indicates that the keyword 104 is associated with a hot event, then it can be further determined that the user is interested in the keyword 104. Example of the set of hot documents associated with a hot event may include, but are not limited to, a document of which the number of times as being searched by a search engine within a predetermined period of time exceeds a first predetermined threshold, a document of which the number of times as being clicked within a predetermined period of time exceeds a second predetermined threshold, and a document which is associated with an occurrence of a specific event within a predetermined period of time. For example, the set of hot documents may include one or more documents which are searched by massive users or of which the number of times as being clicked within a past hour exceeds a predetermined number of times, day or week, and one or more documents which are organized according to the development progress of the specific event. The set of hot documents may be obtained from specific network resources, for example, a news website.

[0042] Some embodiments about extracting a keyword 104 and determining whether a user is interested in the keyword 104 have been described above. It would be appreciated that the embodiments are provided merely for the purpose of illustration. In some embodiments, the method for extracting keywords in a text 102 and a method for determining whether a user is interested in keywords may be used interchangeably. For example, in one embodiment, when a keyword is extracted, the method of determining whether a user is interested in the keyword as described above may be employed. Specifically, it is determined whether the words in the text 102 are named entities and/or terms in specific fields, and/or present in a set of hot documents or not, and whether these words are keywords is determined based on the determining result. Further, the method of extracting keywords described above can be employed when whether a user is interested in the keywords is determined. It may be determined whether a user is interested in the keywords based on a historical behavior of a user or other users on the keywords (for example, clicking, copying, searching or the like).

[0043] In this way, the determined keywords of the user's interest are often consistent

with the user's focus when reading a text. As a result, information that is more useful to a user can be predicted based on the keywords of interest.

[0044] Still referring to Fig. 2, at 206, in response to the user being interested in the keywords 104, the computing device 100 generates extended information 106 associated with the keywords 104 without an intervention from the user. According to the embodiments of the subject matter described herein, generation of extended information occurs instantly by determining a keyword is of interest in the text presented by an application. If it is determined that a user is interested in a certain keyword(s) 104, extended information 106 associated with the keyword(s) 104 may be directly prepared for the user in the application without requiring the user to perform any additional act on the keywords 104 (for example, clicking on a hyperlink related to the keywords, selecting or copying the keywords, clicking on options in a drop-down menu, performing searching using search tools, and the like). In some embodiments, in response to determining that the user is interested in a keyword 104, the keyword 104 may be searched instantly on network resources such as encyclopedia websites, professional forums, news websites, blogs, self-media, and so on, to obtain the extended information 106 associated with the keyword 104.

[0045] As compared to the conventional method in which a text presented by an application includes hyperlinks to urge a user to direct to extended information related to keywords, or the conventional method in which a user manually searches the keywords, according to the embodiments of the subject matter described herein, it is unnecessary for a user to perform additional operations or spend additional time to obtain the extended information, the corresponding extended information is prepared instantly and automatically for the user based on the actual text presented and the individual user's interests on the keywords. For example, in the case of hyperlinks, a mapping between specific entries and related extended information should be established in advance, and thus the information cannot be provided according to customized requirements. In the case of performing search, a user also needs to copy a keyword via a tool such as a mouse, and the inputs the keyword into a search engine to perform the search, which requires too many steps. In contrast, by utilization of the technology according to the subject matter described herein, further information associated with a keyword is prepared instantly for the user without requiring the user to exit the application and perform any act on the keyword. It provides more convenience and better experience for the user.

[0046] In some embodiments, the generated extended information may be related to the

type of the keyword 104 or the hot document where the keyword 104 is present. If the keyword 104 is a named entity, the generated extended information associated with the keyword 104 may include, but is not limited to, an introduction to the keyword 104, a link to the introduction, and a summary of the introduction. In a case that the keyword 104 is a terminology in a specific field, the generated extended information 106 associated with the keyword 104 may include, but is not limited to, a definition of the keyword 104, a link to the definition and a summary of the definition. In a case that the keyword 104 is associated with a hot event, the generated extended information 106 associated with the keyword 104 may include, but is not limited to, a document (for example, news) associated with the hot event, a link to the document, and a summary of the document. It would be appreciated that the above extended information 106 may be sourced from various network resources, such as encyclopedia websites, professional forums, news websites, blogs, self-media, and the like. It would also be understood that the extended information 106 mentioned above are merely as examples, and other extended information associated with the keyword may be generated according to actual needs.

[0047] At 208, the computing device 100 displays at least part of the generated extended information 106. In some embodiments, in response to an indication from the user, the computing device 100 may display a part of or all of the extended information 106. For example, if it is determined that the user hovers the mouse over the keyword 104, or clicks on the keyword 104 with a finger or mouse, the computing device 100 may display part of or all of the extended information 106 associated with the keyword 104.

[0048] In some embodiments, after generating the extended information 106, the computing device 100 may display the extended information 106 automatically without an intervention from the user. As compared to the conventional method in which the presence of extended information is indicated in form of hyperlinks in the text presented by the application, or a user manually searches the keywords, or the like, in the embodiments of the subject matter described herein, extended information associated with the keywords of the user's interest can be generated automatically and presented to the user without an intervention from the user. By comparison, in the scenario of hyperlink, the user has to click on the hyperlink via a tool, such as a mouse or the like, to obtain the extended information; and in the case of manual search, the user has to perform more tedious steps to obtain the search results associated with certain words in the text. In contrast, using the technology of the subject matter described herein, a user can obtain the extended information more conveniently and directly.

[0049] The extended information 106 associated with the keyword 104 may be displayed in various manners. In some embodiments, for example, in the case of an email application, the extended information 106 may be displayed in association with the reply when a user creates a reply to the email. As such, the user may acquire possible helpful information while replying to the email. The manner of presenting the extended information will be described below with reference to Figs. 4 and 5.

[0050] Fig. 4 illustrates a GUI 400 presented by the email application when replying to the email as shown in Fig. 3. A user creates a replay email 410 for the original email shown in Fig. 3. In response to creating the replay email 410, extended information 106 associated with the keywords 104 of user interest in the text 102 is displayed in the form of page 420 at the right side of the reply email 410. In the page 420, there is provided extended information 106 associated with each keyword 104 of the user's interest, for example, the extended information 106-1 associated with the keyword 104-1 "captioning", and extended information 106-2 associated with the keyword 104-2 "article." The extended information 106-1 and the extended information 106-2 may include information related to "captioning" and "article" from different network resources, respectively. As shown in Fig. 4, the extended information 106-1 may include a part of the definition related to "captioning" from Wikipedia, the link "[Closed Captioning-Wikipedia](#)" of the definition, an introduction or a part thereof about how "captioning" is performed from YouTube, the link "[How to Caption YouTube Videos-YouTube](#)" of the introduction, and the like. The extended information 106-2 may include how the introduction of "article" is used, the link "[Purdue OWL: How to Use Article \(a/an/the\)](#)" of the introduction, and the like.

[0051] In some embodiments, if the extended information 106 related to the plurality of keywords 104 is to be presented, a display sequence of the extended information 106 associated with the respective keywords 104 may be determined based on the respective scores of the respective keywords 104 when determining the keywords. For example, in the example as shown in Fig. 4, since the score of the keyword 104-1 "captioning" is higher than the score of the keyword 104-2 "article", the extended information 106-1 associated with the keyword 104-1 "captioning" may be displayed preceding the extended information 106-2 associated with the keyword 104-2 "article."

[0052] In some embodiments, in order to enable a user to browse quickly and thus find the content of the most interest, summarized contents, instead of full contents, may be displayed as the extended information 106. The summarized content, for example, is a

part of a definition of a keyword or a part of an introduction, such as the preceding sentences (as shown in Fig. 4) of the definition or introduction, or the summary of the definition or introduction. The summarized content may for example be general description of a hot event, or the like.

5 **[0053]** In the case of providing summarized contents only, when a user has a mouse hovered or a hand over a summarized content, with an intention of obtaining full content corresponding thereto, the full content associated with the summarized content may be displayed. As shown in Fig. 5, for the definition related to “captioning” from Wikipedia,
10 the part 524, full content 526 associated therewith may be displayed. In this way, the user can browse quickly through information associated with each keyword from various network resources, and pay attention to the content of the interest thereof, thereby improving the user experience.

[0054] In some embodiments, the summarized content and the link for obtaining the full
15 content may be displayed at the same time, as the extended information (the example as shown in Fig. 4). When a user clicks on the link, the user is guided to the related network resource to review the full content. In the case of lengthy full content, it will facilitate the user to obtain comprehensive information.

[0055] It would be appreciated that according to the actual needs, the page 420 for
20 presenting the extended information 106 may be displayed in association with the reply email 410 in any layout, rather than limiting to the layout as shown in Figs. 4 and 5. For example, the page 420 may be displayed at the left, right or lower side of the reply email 410, or any location convenient to be viewed by the user. The extended information 106 may also be presented according to other sequences. It would be appreciated that the
25 extended information 106 may also be displayed in association with the original email in response to the original email being opened.

[0056] In other embodiments, for example, when the application for presenting a text is a document editing application, keywords may be extracted from the text of the document, and it is determined whether the user is interested in the keywords. In response to the
30 document being opened, extended information associated with the keywords of interest is displayed in association with the document, such that the user may obtain the required information when browsing the document, without leaving the document.

[0057] In other embodiments, for example, when the application for presenting the text is a browser, a keyword(s) may be extracted from a text on a web page presented by the

browser, and it is determined whether the user is interested in the keywords. Extended information associated with the keywords of interest may be displayed in association with the web page, such that the user can obtain the required information (for example, progress of a hot event) instantly, without exiting the web page and unnecessary manual search of the required information.

[0058] It would be appreciated that some examples about displaying extended information in cases of different presenting of a text have been described above. According to actual requirements, the presentation of the extended information may be designed in any other appropriate manner. The embodiments of the subject matter described herein are not limited in this regard.

[0059] Some example embodiments of the subject matter described herein will be listed below.

[0060] In an aspect, there is provided a computer implemented method, comprising: extracting a keyword from a text presented by an application; determining whether a user is interested in the keyword; in response to determining that the user is interested in the keyword, generating extended information associated with the keyword without an intervention from the user; and displaying at least part of the extended information.

[0061] In some embodiments, displaying the at least part of the extended information comprises: displaying the at least part of the extended information without an intervention from the user.

[0062] In some embodiments, generating the extended information associated with the keyword comprises: searching for the keyword to obtain the extended information associated with the keyword.

[0063] In some embodiments, determining whether the user is interested in the keyword comprises: determining whether the keyword is a named entity; and in response to the keyword being the named entity, determining that the user is interested in the keyword.

[0064] In some embodiments, determining whether the user is interested in the keyword comprises: determining whether the keyword is a terminology in a specific field; and in response to the keyword being the terminology in the specific field, determining that the user is interested in the keyword.

[0065] In some embodiments, determining whether the user is interested in the keyword comprises: determining whether the keyword is present in a set of hot documents; and in response to the keyword being present in the set of hot documents, determining that the user is interested in the keyword.

[0066] In some embodiments, the set of hot documents comprises at least one of the following: a document of which the number of times as being searched by a search engine within a predetermined period of time exceeds a first predetermined threshold, a document of which the number of times as being clicked within a predetermined period of time
5 exceeds a second predetermined threshold, and a document which is associated with an occurrence of a specific event within a predetermined period of time.

[0067] In some embodiments, the extended information comprises at least one of the following: an introduction to the keyword, a link to the introduction, a summary of the introduction, a definition of the keyword, a link to the definition, a summary of the
10 definition, a target document of a set of hot documents in which the keyword is present, a link to the target document and a summary of the target document.

[0068] In some embodiments, extracting the keyword from the text comprises: selecting a target word from the text as the keyword based on a historical behavior of the user or a further user on a predetermined word, a semantic similarity between the target word and
15 the predetermined word exceeding a threshold.

[0069] In some embodiments, the historical behavior comprises an act related to the predetermined word and performed the user or the further user in a further application different from the application.

[0070] In some embodiments, the application is an email application and the text is
20 contained in a received email, and wherein displaying the at least part of the extended information comprises: in response to the user creating a reply to the email, displaying the at least part of the extended information in association with the reply.

[0071] In one aspect, there is provided an electronic device, comprising: a processing unit; and a memory coupled to the processing unit and having instructions stored thereon
25 which, when executed by the processing unit, perform acts comprising: extracting a keyword from a text presented by an application; determining whether a user is interested in the keyword; in response to determining that the user is interested in the keyword, generating extended information associated with the keyword without an intervention from the user; and displaying at least part of the extended information.

[0072] In some embodiments, displaying the at least part of the extended information
30 comprises: displaying the at least part of the extended information without an intervention from the user.

[0073] In some embodiments, generating the extended information associated with the keyword comprises: searching for the keyword to obtain the extended information

associated with the keyword.

[0074] In some embodiments, determining whether the user is interested in the keyword comprises: determining whether the keyword is a named entity; and in response to the keyword being the named entity, determining that the user is interested in the keyword.

5 [0075] In some embodiments, determining whether the user is interested in the keyword comprises: determining whether the keyword is a terminology in a specific field; and in response to the keyword being the terminology in the specific field, determining that the user is interested in the keyword.

10 [0076] In some embodiments, determining whether the user is interested in the keyword comprises: determining whether the keyword is present in a set of hot documents; and in response to the keyword being present in the set of hot documents, determining that the user is interested in the keyword.

[0077] In some embodiments, the set of hot documents comprises at least one of the following: a document of which the number of times as being searched by a search engine
15 within a predetermined period of time exceeds a first predetermined threshold, a document of which the number of times as being clicked within a predetermined period of time exceeds a second predetermined threshold, and a document which is associated with an occurrence of a specific event within a predetermined period of time.

[0078] In some embodiments, the extended information comprises at least one of the
20 following: an introduction to the keyword, a link to the introduction, a summary of the introduction, a definition of the keyword, a link to the definition, a summary of the definition, a target document of a set of hot documents in which the keyword is present, a link to the target document and a summary of the target document.

[0079] In some embodiments, extracting the keyword from the text comprises: selecting
25 a target word from the text as the keyword based on a historical behavior of the user or a further user on a predetermined word, a semantic similarity between the target word and the predetermined word exceeding a threshold.

[0080] In some embodiments, the historical behavior comprises an act related to the predetermined word and performed by the user or the further user in a further application
30 different from the application.

[0081] In some embodiments, the application is an email application and the text is contained in a received email, and wherein displaying the at least part of the extended information comprises: in response to the user creating a reply to the email, displaying the at least part of the extended information in association with the reply.

[0082] In one aspect, there is provided a computer program product being tangibly stored in a non-transient computer storage medium and comprising machine-executable instructions which, when executed by a device, cause the device to perform operations comprising: extracting a keyword from a text presented by an application; determining
5 whether a user is interested in the keyword; in response to determining that the user is interested in the keyword, generating extended information associated with the keyword without an intervention from the user; and displaying at least part of the extended information.

[0083] In some embodiments, displaying the at least part of the extended information
10 comprises: displaying the at least part of the extended information without an intervention from the user.

[0084] In some embodiments, generating the extended information associated with the keyword comprises: searching for the keyword to obtain the extended information associated with the keyword.

[0085] In some embodiments, determining whether the user is interested in the keyword
15 comprises: determining whether the keyword is a named entity; and in response to the keyword being the named entity, determining that the user is interested in the keyword.

[0086] In some embodiments, determining whether the user is interested in the keyword
20 comprises: determining whether the keyword is a terminology in a specific field; and in response to the keyword being the terminology in the specific field, determining that the user is interested in the keyword.

[0087] In some embodiments, determining whether the user is interested in the keyword
25 comprises: determining whether the keyword is present in a set of hot documents; and in response to the keyword being present in the set of hot documents, determining that the user is interested in the keyword.

[0088] In some embodiments, the set of hot documents comprises at least one of the following: a document of which the number of times as being searched by a search engine within a predetermined period of time exceeds a first predetermined threshold, a document of which the number of times as being clicked within a predetermined period of time
30 exceeds a second predetermined threshold, and a document which is associated with an occurrence of a specific event within a predetermined period of time.

[0089] In some embodiments, the extended information comprises at least one of the following: an introduction to the keyword, a link to the introduction, a summary of the introduction, a definition of the keyword, a link to the definition, a summary of the

definition, a target document of a set of hot documents in which the keyword is present, a link to the target document and a summary of the target document.

5 [0090] In some embodiments, extracting the keyword from the text comprises: selecting a target word from the text as the keyword based on a historical behavior of the user or a further user on a predetermined word, a semantic similarity between the target word and the predetermined word exceeding a threshold.

[0091] In some embodiments, the historical behavior comprises an act related to the predetermined word and performed by the user or the further user in a further application different from the application.

10 [0092] In some embodiments, the application is an email application and the text is contained in a received email, and wherein displaying the at least part of the extended information comprises: in response to the user creating a reply to the email, displaying the at least part of the extended information in association with the reply.

15 [0093] The functionality described herein can be performed, at least in part, by one or more hardware logic components. For example, and without limitation, illustrative types of hardware logic components that can be used include field-programmable gate arrays (FPGAs), application-specific integrated circuits (ASICs), application-specific standard products (ASSPs), system-on-a-chip systems (SOCs), complex programmable logic devices (CPLDs), and the like.

20 [0094] Program code for carrying out the methods of the subject matter described herein may be written in any combination of one or more programming languages. The program code may be provided to a processor or controller of a general purpose computer, special purpose computer, or other programmable data processing apparatus such that the program code, when executed by the processor or controller, causes the
25 functions/operations specified in the flowcharts and/or block diagrams to be implemented. The program code may be executed entirely or partly on a machine, executed as a stand-alone software package partly on the machine, partly on a remote machine, or entirely on the remote machine or server.

30 [0095] In the context of this disclosure, a machine-readable medium may be any tangible medium that may contain or store a program for use by or in connection with instructions execution system, apparatus, or device. The machine-readable medium may be a machine-readable signal medium or a machine-readable storage medium. A machine-readable medium may include but not limited to an electronic, magnetic, optical, electromagnetic, infrared, or semiconductor system, apparatus, or device, or any suitable

combination of the foregoing. More specific examples of the machine-readable storage medium would include an electrical connection having one or more wires, a portable computer diskette, a hard disk, a random access memory (RAM), a read-only memory (ROM), an erasable programmable read-only memory (EPROM or Flash memory), an optical fiber, a portable compact disc read-only memory (CD-ROM), an optical storage device, a magnetic storage device, or any suitable combination of the foregoing.

[0096] Further, while operations are depicted in a particular order, this should not be understood as requiring that such operations be performed in the particular order shown or in sequential order. In certain circumstances, multitasking and parallel processing may be advantageous. Likewise, while several specific implementation details are contained in the above discussions, these should not be construed as limitations on the scope of the subject matter described herein, but rather as descriptions of features that may be specific to particular implementations. Certain features that are described in the context of separate implementations may also be implemented in combination in a single implementation. Rather, various features described in the context of a single implementation may also be implemented in multiple implementations separately or in any suitable sub-combination.

[0097] Although the subject matter has been described in language specific to structural features and/or methodological acts, it is to be understood that the subject matter specified in the appended claims is not necessarily limited to the specific features or acts described above. Rather, the specific features and acts described above are disclosed as example forms of implementing the claims.

CLAIMS

1. A computer-implemented method, comprising:
extracting a keyword from a text presented by an application;
determining whether a user is interested in the keyword;
in response to determining that the user is interested in the keyword, generating extended information associated with the keyword without an intervention from the user;
and
displaying at least part of the extended information.
2. The method of claim 1, wherein displaying the at least part of the extended information comprises:
displaying the at least part of the extended information without an intervention from the user.
3. The method of claim 1, wherein generating the extended information associated with the keyword comprises:
searching for the keyword to obtain the extended information associated with the keyword.
4. The method of claim 1, wherein determining whether the user is interested in the keyword comprises:
determining whether the keyword is a named entity; and
in response to the keyword being the named entity, determining that the user is interested in the keyword.
5. The method of claim 1, wherein determining whether the user is interested in the keyword comprises:
determining whether the keyword is a terminology in a specific field; and
in response to the keyword being the terminology in the specific field, determining that the user is interested in the keyword.
6. The method of claim 1, wherein determining whether the user is interested in the keyword comprises:
determining whether the keyword is present in a set of hot documents; and
in response to the keyword being present in the set of hot documents, determining that the user is interested in the keyword.
7. The method of claim 6, wherein the set of hot documents comprises at least one of the following:
a document of which the number of times as being searched by a search engine

within a predetermined period of time exceeds a first predetermined threshold,

a document of which the number of times as being clicked within a predetermined period of time exceeds a second predetermined threshold, and

a document which is associated with an occurrence of a specific event within a predetermined period of time.

8. The method of claim 1, wherein the extended information comprises at least one of the following: an introduction to the keyword, a link to the introduction, a summary of the introduction, a definition of the keyword, a link to the definition, a summary of the definition, a target document of a set of hot documents in which the keyword is present, a link to the target document, and a summary of the target document.

9. The method of claim 1, wherein extracting the keyword from the text comprises: selecting a target word from the text as the keyword based on a historical behavior of the user or a further user on a predetermined word, a semantic similarity between the target word and the predetermined word exceeding a threshold.

10. The method of claim 9, wherein the historical behavior comprises an act related to the predetermined word and performed by the user or the further user in a further application different from the application.

11. The method of claim 1, wherein the application is an email application and the text is contained in a received email, and wherein displaying the at least part of the extended information comprises:

in response to the user creating a reply to the email, displaying the at least part of the extended information in association with the reply.

12. An electronic device, comprising:

a processing unit; and

a memory coupled to the processing unit and having instructions stored thereon which, when executed by the processing unit, perform acts comprising:

extracting a keyword from a text presented by an application;

determining whether a user is interested in the keyword;

in response to determining that the user is interested in the keyword, generating extended information associated with the keyword without an intervention from the user; and

displaying at least part of the extended information.

13. The device of claim 12, wherein displaying the at least part of the extended information comprises:

displaying the at least part of the extended information without an intervention from the user.

14. The device of claim 12, wherein generating the extended information associated with the keyword comprises:

searching for the keyword to obtain the extended information associated with the keyword.

15. A computer program product being tangibly stored in a computer storage medium and comprising machine-executable instructions which, when executed by a device, cause the device to perform operations comprising:

extracting a keyword from a text presented by an application;
determining whether a user is interested in the keyword;
in response to determining that the user is interested in the keyword, generating extended information associated with the keyword without an intervention from the user;
and
displaying at least part of the extended information.

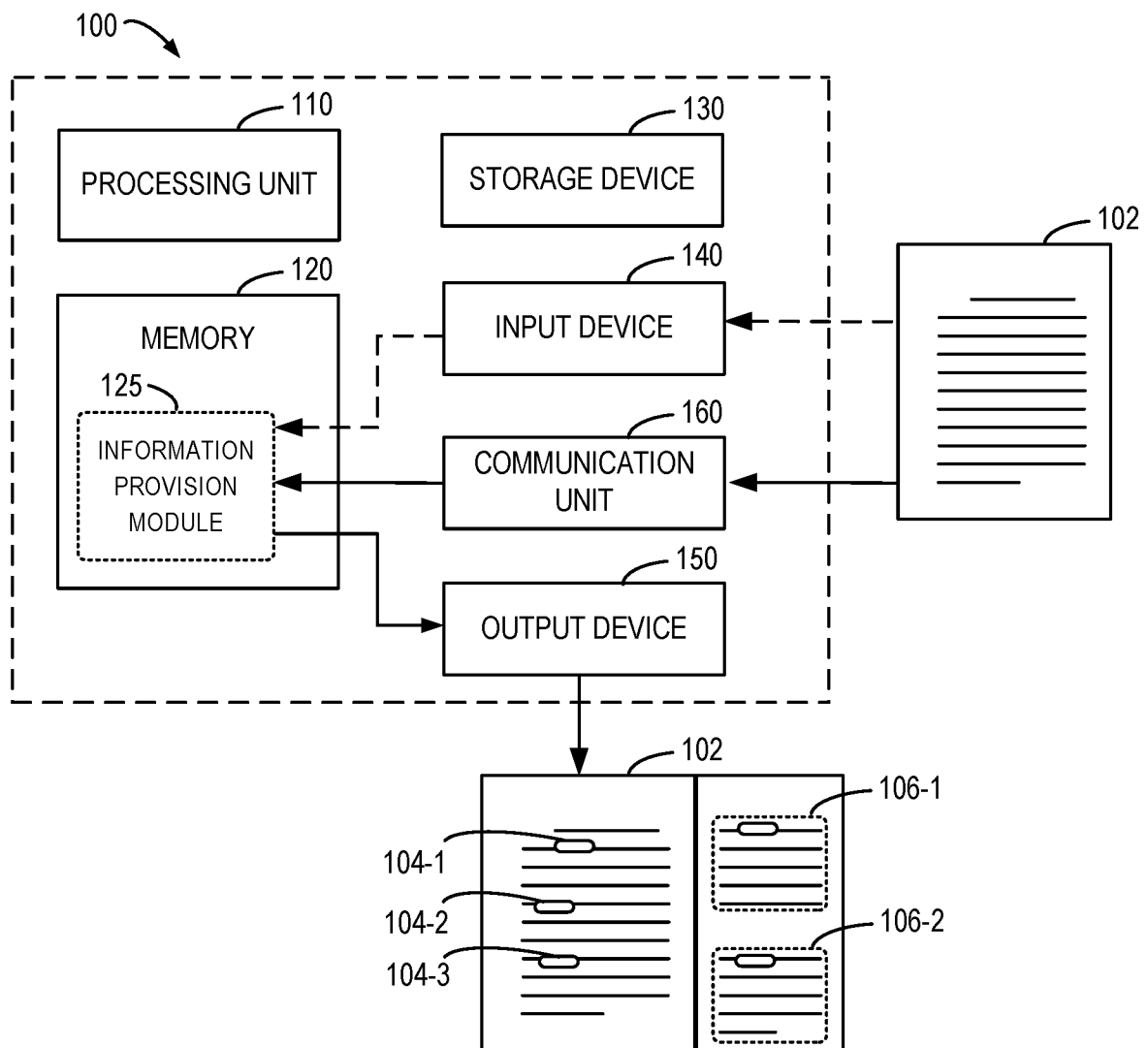


FIG. 1

2/5

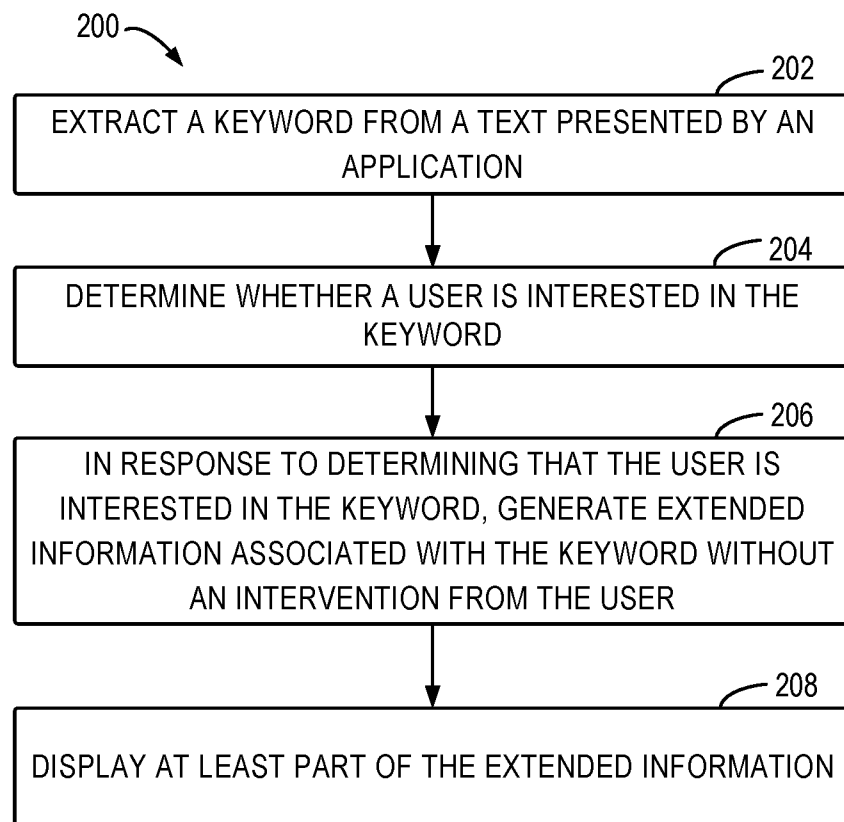


FIG. 2

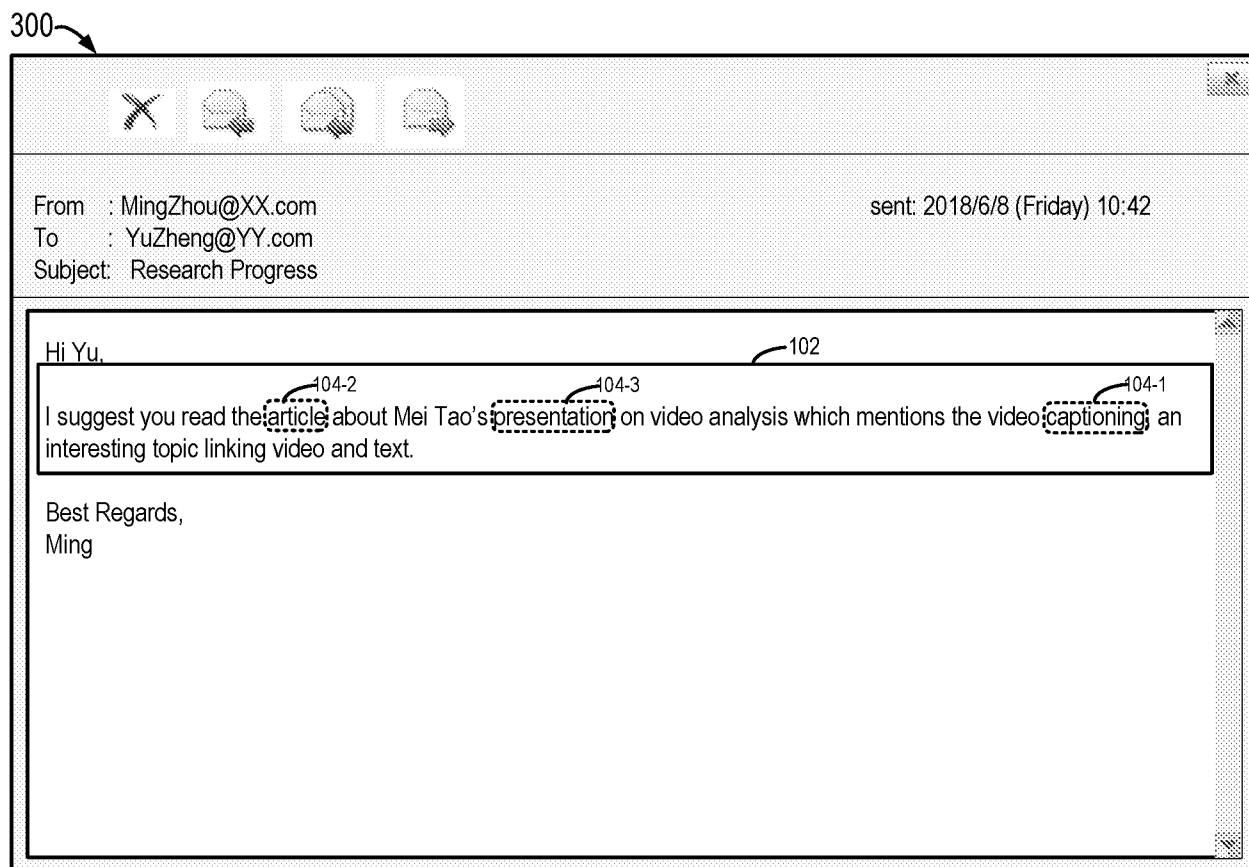


FIG. 3

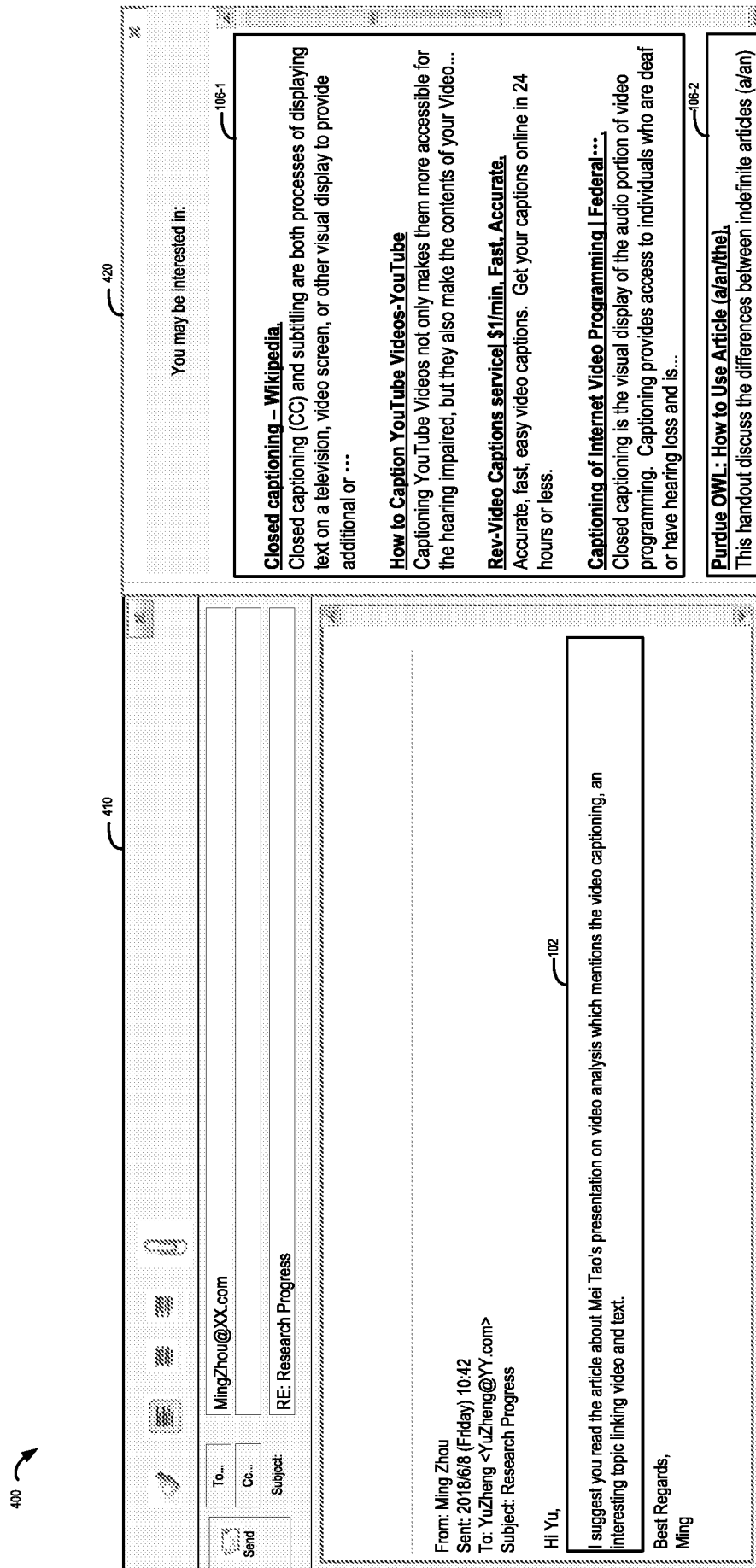


FIG. 4

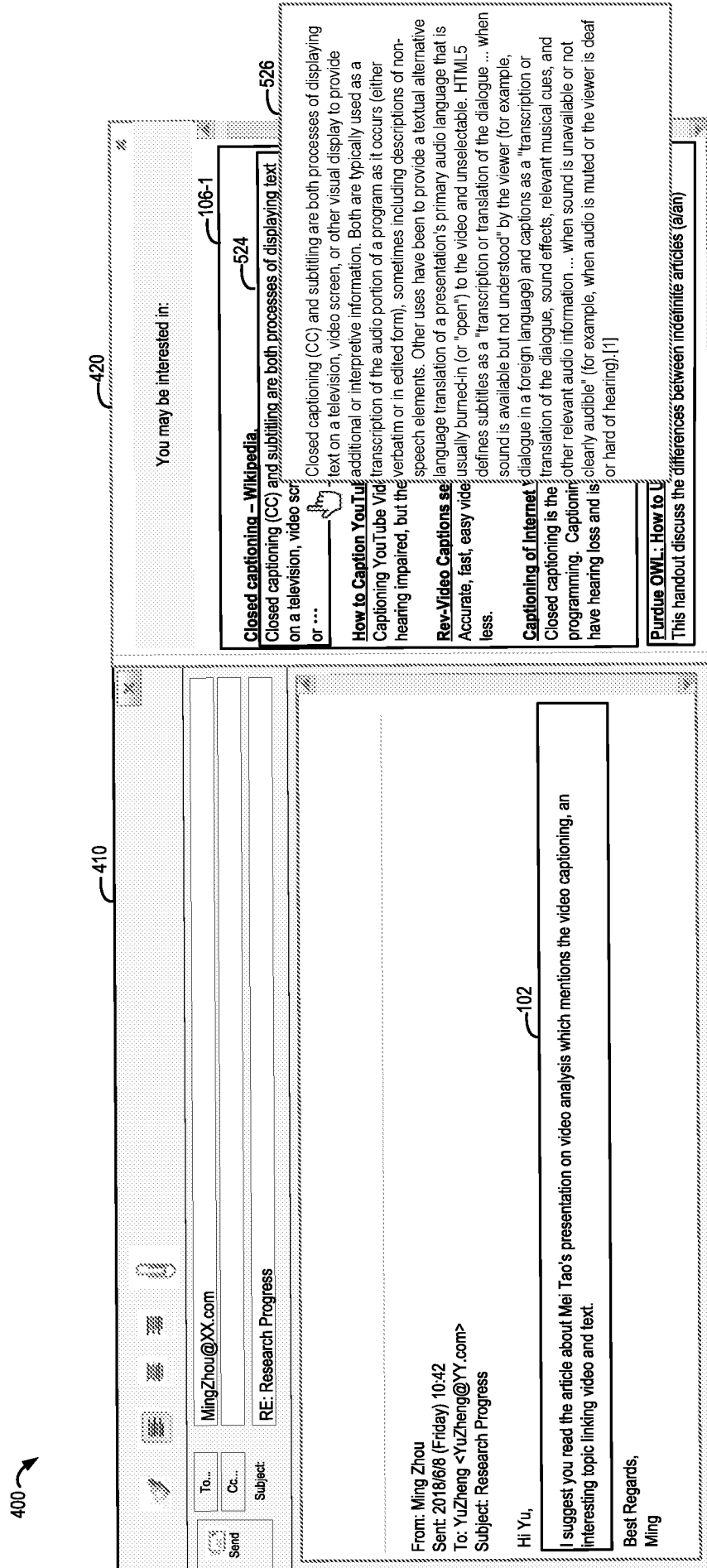


FIG. 5

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2019/037846

A. CLASSIFICATION OF SUBJECT MATTER
INV. G06F16/33
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EP0-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 7 664 740 B2 (MICROSOFT CORP [US]) 16 February 2010 (2010-02-16) abstract column 1, line 24 - line 37 column 1, line 60 - column 2, line 6 column 2, line 47 - column 5, line 62 -----	1-15
X	US 2016/350404 A1 (SMITH ELLIOT [GB] ET AL) 1 December 2016 (2016-12-01) abstract paragraph [0001] paragraph [0014] paragraph [0025] - paragraph [0034] -----	1-15
X	US 5 873 107 A (BOROVVOY RICHARD D [US] ET AL) 16 February 1999 (1999-02-16) abstract column 2, line 26 - line 40 column 3, line 13 - column 4, line 29 -----	1-15

☐

Further documents are listed in the continuation of Box C.

☒

See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

30 July 2019

Date of mailing of the international search report

06/08/2019

Name and mailing address of the ISA/

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Authorized officer

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2019/037846

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 7664740	B2	16-02-2010	NONE

US 2016350404	A1	01-12-2016	CN 107533563 A 02-01-2018
			EP 3304355 A1 11-04-2018
			JP 2018519561 A 19-07-2018
			US 2016350404 A1 01-12-2016
			WO 2016195871 A1 08-12-2016

US 5873107	A	16-02-1999	NONE
