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Browser with smart scrolling based on user context

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ABSTRACT

This disclosure describes smart scrolling functionality for a web browser such that the user experience for scrolling a web page is improved to aid the user in locating information within the page that is likely of interest for the task at hand. To infer the user's intent, the user's ongoing tasks and context are determined, with user permission. Content of web pages viewed by the user is examined to determine content within the page that is likely to be of relevance to the user's information need. Pieces of content likely to be of relevance to the user are highlighted via the smart scrolling feature. The smart scrolling user experience is achieved by making the scrolling sticky in regions of the page that are likely to contain information of interest to the user. Alternatively or in addition, information of interest within the page are indicated by highlighting the corresponding positions within the scroll bar, annotating them with relevant icons, etc.

KEYWORDS

- Web browser
- Mobile browser
- Smart scrolling
- Sticky scrolling
- Scroll bar highlighting
- Text understanding
- Entity extraction
- Intent inference
- Context determination

BACKGROUND

Users often browse web pages to look for certain pieces of information, such as telephone number of a business, a piece of text that answers their question, etc. Scrolling through long web pages to find such specific pieces of information can often be slow and frustrating. The issue is worse on mobile devices, such as smartphones, because of small display sizes of these devices. Neither the web browser nor the operating system provide easy and quick techniques to locate the information of interest within the web page.

DESCRIPTION

This disclosure describes smart scrolling functionality for a web browser such that the user experience for scrolling a web page is improved to aid the user in locating information within the page that is likely of interest for the task at hand. Such user experience can be achieved by making the scrolling "sticky" in regions of the page that are determined as likely to contain information of interest to the user. Alternatively or in addition, information of interest within the page can be indicated by highlighting the corresponding positions within the scroll bar, annotating such portions with relevant icons, such as a phone icon for phone numbers, etc.

With user permission, user intent is inferred by periodically examining and classifying the information on the user's device screen and the user's ongoing tasks and context. If the user permits, the contents of the user's device screen, such as messaging conversations, web search results, etc., are analyzed using on-device machine learning based text understanding models that extract entities. Inferences regarding the user's intent are made based on the extracted entities. If the user denies permission, or restricts permission to certain data sources, only such data sources as permitted by the user are utilized for entity extraction and inference. The techniques are turned

off if the user does not provide permission, or if the user specifically chooses to turn off smart scrolling features.

For example, if the user's conversation with a friend includes mention of a restaurant name, it can be inferred that the user intends to make a restaurant reservation. Similarly, if the user has recently performed a web search for a specific topic, it is predicted that the user is likely looking for information on that topic in web pages that are browsed subsequent to the web search.

Once the user's intent is derived, the content of web pages browsed by the user is examined to determine content within the page that is likely to be of relevance to the user's information need. Specifically, if the user permits, each section of the page, such as a paragraph, is compared with the extracted entities and/or the determined user intent to generate a score indicative of the relevance of the section for the user's inferred intent. Pieces of content for which the relevance score is above a threshold value of relevance are selected for highlighting to the user via the smart scrolling feature as described above. Alternatively, another machine learning model can be used to determine the piece of content that are relevant to the user's intent inferred with the user's permission.

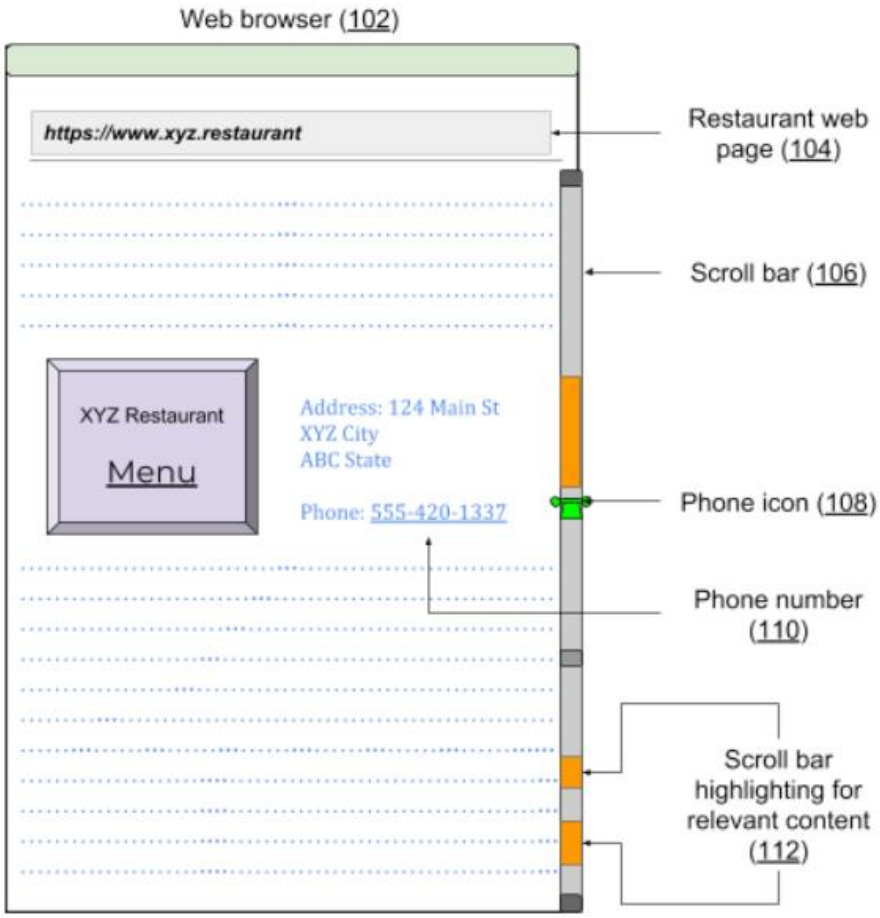

Fig. 1: Web browser with a scroll bar that highlights page areas with relevant content

Fig. 1 illustrates an operational example of the smart scrolling functionality described in this disclosure. The user navigates to a restaurant web page (104) using a web browser (102). With the user's permission, it is inferred that the user is looking for the restaurant's phone number, e.g., to make a reservation if the menu options are suitable. Additionally, the user is likely to need the restaurant's street address. Based on the inference, the content of the web page is analyzed to locate the piece of information of relevance to the user's task: phone number, address, and menu. The location of the phone number (110) within the page is indicated via phone icon (108) displayed at the corresponding place on the scroll bar (106). The regions of the web page that contain the menu and address information are indicated by an orange color on the

scroll bar. The location of other relevant information, e.g., recommended menu items, parking information, busy times, etc. is also indicated. When there are relevant pieces of information below the currently visible area of the page, their corresponding locations within the page are highlighted in orange color (112) on the scroll bar.

Once information about the user's current tasks and context, such as topics, entities, intent, etc., has been extracted, such information is stored in temporary working memory on the user device. As the user switches tasks or locks the device, the information is purged from the working memory and is no longer considered relevant.

The machine learning based models used for text understanding can be neural networks or any other suitable machine learning models. Such models allow entities that are present in a knowledge base to be detected locally on the device. In combination with these models, more general machine learning models that can extract arbitrary named entities can be used for better scalability without requiring a full list of known entities to be stored on the device.

The threshold value used to determine whether a piece of web page content is sufficiently relevant can be specified by the programmer, the user, the device manufacturer, or other stakeholder. Alternatively, the value can be determined dynamically as suited for the user's task and the content of the web page.

Further to the descriptions above, a user is provided with controls allowing the user to make an election as to both if and when systems, programs or features described herein enable collection of user information (e.g., information about a user's social network, social actions or activities, profession, a user's preferences, or a user's current location), and if the user is sent content or communications from a server. In addition, certain data is 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 is treated so that no personally identifiable information can be determined for the user, or a user's geographic location is generalized where location information is obtained (such as to a city, ZIP code, or state level), so that a particular location of a user cannot be determined. Thus, the user has control over what information is collected about the user, how that information is used, and what information is provided to the user.

CONCLUSION

This disclosure describes smart scrolling functionality for a web browser such that the user experience for scrolling a web page is improved to aid the user in locating information within the page that is likely of interest for the task at hand. To infer the user's intent, the user's ongoing tasks and context are determined, with user permission. Content of web pages viewed by the user is examined to determine content within the page that is likely to be of relevance to the user's information need. Pieces of content likely to be of relevance to the user are highlighted via the smart scrolling feature. The smart scrolling user experience is achieved by making the scrolling sticky in regions of the page that are likely to contain information of interest to the user. Alternatively or in addition, information of interest within the page are indicated by highlighting the corresponding positions within the scroll bar, annotating them with relevant icons, etc.