Technical Disclosure Commons

Defensive Publications Series

November 13, 2018

Content delivery adjusted based on user attention

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ABSTRACT

Online content delivery is often personalized based on a user's profile and characteristics or other relevant contextual factors. Such personalization is typically predetermined and not adjusted in real-time as a user interacts with the content. With user permission, the techniques of this disclosure utilize real-time signals regarding the user's engagement with content and adjust content delivery to fit the engagement patterns of the user, thus better matching user expectations.

KEYWORDS

- Content delivery
- Real-time personalization
- User interaction signals
- Browsing behavior
- User engagement
- User attention

BACKGROUND

Online content delivery is often personalized based on a user's profile, when users permit access to factors such as search history, and user characteristics, such as age and gender, or other relevant contextual factors, such as location, and device. Such personalization typically takes place in advance to determine the content to be served and the manner in which it is served. Once the content and the corresponding delivery mechanism has been determined, it is not adjusted in real-time as the user interacts with the content. Lack of such real-time adjustment can

result in suboptimal personalization since the opportunity for further personalization and adjustment based on the user's engagement with the content is lost.

DESCRIPTION

The techniques of this disclosure are implemented upon specific user permission to access real-time signals regarding a user's engagement with delivered content. For users that don't provide such permission, the techniques are not implemented, and personalization is limited to the extent possible based on user-permitted factors.

Examples of real-time signals that may be utilized with user permission include, for example: scrolling behavior, including current scroll position and time spent when scrolling through the different pieces within the content; type of content currently within the user's viewport, such as text, images, video, etc., including the relevant characteristics of such content, such as fonts for text or volume for videos; length of the content, such as size of an article or play time for a video, including the user's current position within the content; time spent interacting with the content or the various pieces within or related to the content, such as recommendations for similar content, etc. These real-time signals of user engagement serve as indicators of the user's attention. For instance, a measure of the user's overall attention could be derived based on appropriately combining the various measured real-time signals into a single number, e.g., between 0 and 1, reflecting a spectrum of user attention from completely non-attentive to fully attentive.

The measure of user attention derived from real-time signals of the user's engagement with the content is then utilized to make various adjustments to the content and corresponding delivery. Such adjustments can cover a variety of facets related to the content and content

delivery, such as the type, length, and size of the content, the position of content pieces within the larger unit, advertisements related to the content, etc.

For example, a user detected to be engrossed in reading a dense text article to the end is not shown advertisements in the middle of the content to avoid interrupting the user with content that is likely to be ignored owing to the user's focus on the article. In such cases, related content that is not part of the article, such as recommendations for other content or relevant advertisements, is placed below the article. Similarly, some content, such as advertisements, may not be shown at all when the user is scrolling fast and is therefore unlikely to notice it.

Moreover, user engagement with the current content may be utilized to determine recommendations for subsequent content of interest. For example, a user detected to spend more time on images within a given content may be shown image-based relevant advertising. In another example, a user who reads text articles till the end may be recommended longer articles for subsequent reading.

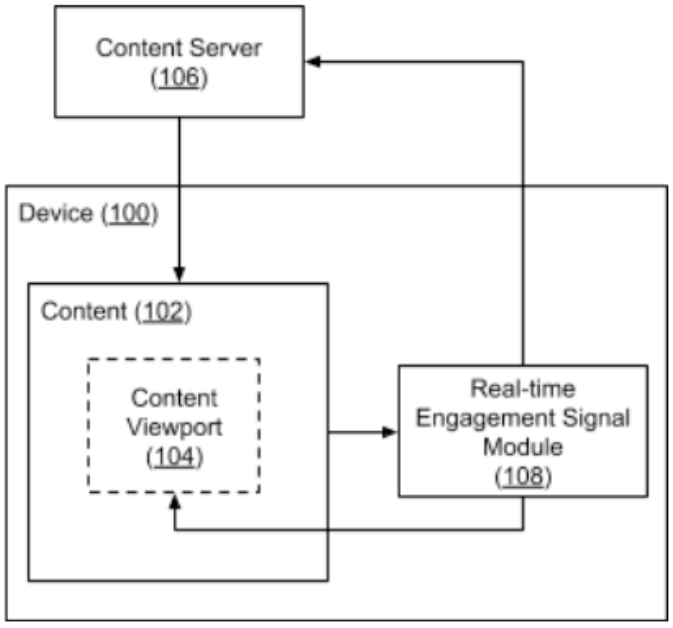

Fig. 1: Utilizing real-time signals of user engagement to adjust content delivery

Fig. 1 shows an implementation of the techniques of this disclosure. A user utilizes content viewport (104) to view personalized content (102) delivered to a user device (100) by a content server (106). With user permission, the content delivery is personalized to the user's profile, user characteristics, and contextual factors, such as location and device. If the user permits, the user's engagement and interaction with the content is collected and analyzed by a real-time engagement signal module (108) via permitted relevant real-time signals and associated timestamps related to the user's actions, such as scrolling, tapping, etc. and content properties, such type, length, size, visibility within the viewport, etc.

The real-time engagement signal module combines the signals to derive one or more numeric or categorical measures related to the user's engagement with the content. For instance, the real-time engagement signal module calculates a score between 0 and 1 to indicate the extent of the user's attention when interacting with the content. In another example, the real-time engagement signal module provides a label that indicates the category of content the user interacts with for the largest amount of time. The measures of user engagement are utilized by the server, the device, or other relevant parties to make real-time adjustments to the content served to the user. The measures are further used to adjust the type and delivery of subsequent content.

The real-time engagement signal module can be implemented on the user device or within the client software used for content viewing. The properties of the content may be obtained via examining the source code of the delivered content in real-time or by offline processing that identifies and tags various relevant sections within the content. Alternatively, the real-time engagement signal module can be implemented on a server external to the device. With user permission, the real-time engagement signals can be collected and analyzed separately for

each user. Alternatively, if the users permit, the real-time engagement signals collected from multiple users of a set of users are analyzed collectively to improve the user attention measures and to refine the models that generate the measures. Real-time adjustments to content delivery is turned off for users who do not permit the use of real-time engagement signals and no measurement or analysis of real-time engagement signals is performed.

Making dynamic adjustments to content delivery based on real-time signals of user engagement as described herein offers a number of benefits that optimize content delivery and improve user experience. User satisfaction is likely to improve due to recommendation of content that better fits the user's attention and interactive practices, and better matches the user's needs and expectations. Greater user satisfaction can consequently lead to longer engagement times, more interaction with recommended content, and greater attention to relevant advertisements that would otherwise have gone unnoticed. Content providers benefit via greater user engagement, higher user satisfaction, saved bandwidth by not delivering content that the user is likely to ignore, and saved costs of serving ineffective advertisements.

Further to the descriptions 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 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 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, or a user's geographic location may be 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 may have control over what information is collected about the user, how that information is used, and what information is provided to the user.

CONCLUSION

With user permission, the techniques of this disclosure utilize real-time signals regarding the user's engagement with content. These real-time signals of user engagement serve as indicators of the user's attention. The measure of user attention derived from the real-time signals of the user's engagement with the content is applied to make adjustments to the content and corresponding delivery to fit the engagement patterns of the user. Making dynamic adjustments to content delivery based on real-time signals of user engagement as described herein offers a number of benefits that optimize content delivery and improve user experience. Content providers benefit via greater user engagement, higher user satisfaction, saved bandwidth by not delivering content that the user might have ignored, and saved costs of serving ineffective advertisements.