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Updating Content Item Delivery Criteria Based On User Interaction

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ABSTRACT

Content items and associated criteria for delivery are received by a server from content provider. The server provides online services such as social networking, media hosting and sharing websites, news, etc. User interaction with the server and other data such as user profile information is analyzed using machine-learning models trained to detect emotion. Available content items are matched to the detected emotion based on criteria associated with the content items to select and deliver particular content items to deliver to the requesting user. User interactions with the delivered content are monitored. The criteria associated with content items are updated based on the monitored user interaction to control delivery rate and to improve selection of users to whom the content items are delivered. The described techniques for selection and delivery of content items based on detected emotion enable delivery of content items that have a high likelihood of providing a quality user experience. The described techniques improve engagement of the user with the online service.

KEYWORDS

user emotion; emotion detection; user profile; user targeting; target group; content delivery; content selection; machine learning; delivery criteria; widget; social network; media hosting; interaction data

BACKGROUND

Users access content via various online providers, e.g., social networking providers, media hosting and sharing websites, news websites, etc. Providers benefit from providing a positive user experience, e.g., by delivering content to each user that the user is likely to be interested in. Content can include content items that other users such as social network friends of

a current user had viewed or otherwise interacted with. Content owners often provide criteria to provide individual content items to particular groups of users, e.g., based on user attributes. Accurately determining what content that a user finds interesting is important for providers and content owners, because they benefit when a user views or interacts with the provided or sponsored content.
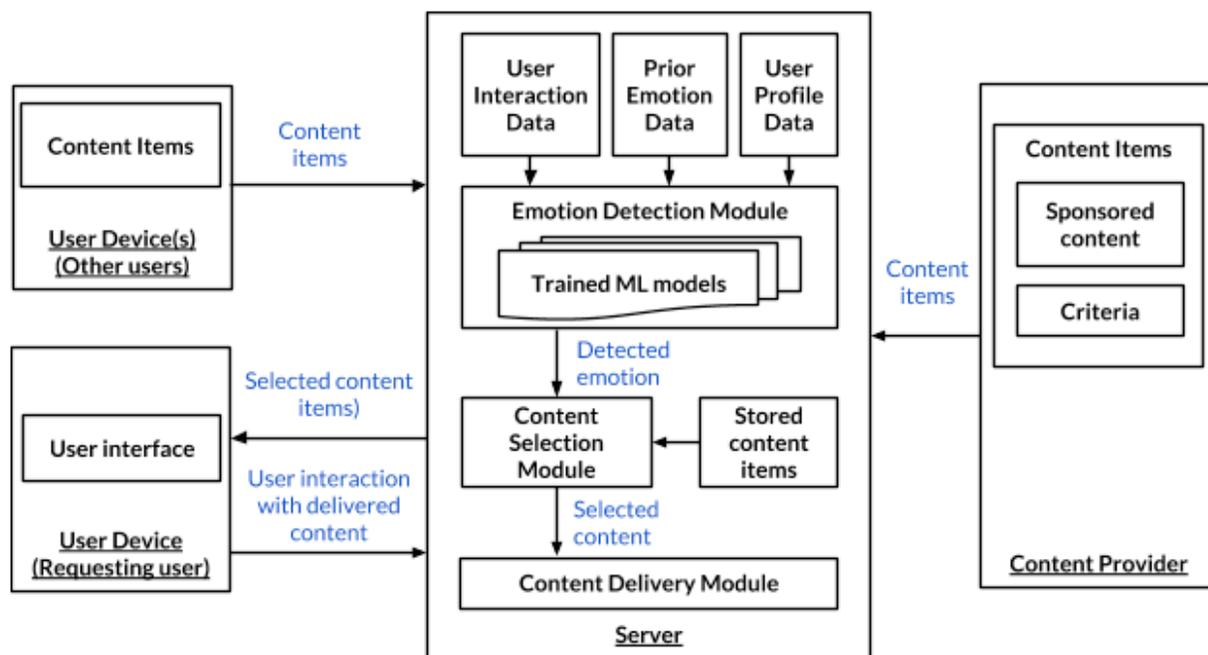
DESCRIPTION

Fig. 1: Delivering content based on user emotion and content-specific criteria

Fig. 1 is an illustration of an example environment for delivery of content items based on user emotion. Users access a server, e.g., a social networking provider, news website, media hosting website, etc., via a user device such as a computer, tablet, smartphone, wearable device, head mounted display, etc. In some instances, the access is two-way, users can receive content items from the server and also contribute content items such as images/videos, audio, text

content such as documents, comments or online posts, etc. Users can also interact with the server by reacting to content items, e.g., as text comments or other feedback indicative of user emotions (e.g., via use emojis, selections of icons that allows user to react to content, etc.)

Fig. 1 illustrates a user device associated with a requesting user that is requesting content items from the server and displays them on a user interface, and other user devices associated with other users, e.g., that contribute content items to the server. User interactions of the user device that consumes content with the server are stored by the server as user interaction data. While different user devices are shown in Fig. 1 as submitting content to and interacting with the server, the same user device can submit content to the server and receive content from the server.

Content items can also be provided by content providers such as commercial content providers, audio or video producers, news outlets, blogs, online advertisers etc. Some content items, e.g., advertisements, sponsored posts, etc. may be deemed sponsored content. Content providers can pay for delivery of such content by the server to various user devices. Content items from such providers can also be associated with criteria that specify the users to which the content items are to be delivered, e.g., user demographics, interests, etc. and other contextual factors for delivery of content. Criteria for content item delivery are explained further with reference to Fig. 2 below.

The server receives and stores content items ("stored content items") from user devices and content providers and can also fetch content items from providers as needed. The server also stores user interaction data, prior emotion data, and user profile data. The server includes an emotion detection module that includes machine-learning models that are trained to detect user emotion based on the user interaction data, prior emotion data, and user profile data.

The emotion detection module provides a detected emotion to a content selection module that accesses stored content items or retrieves content items and associated criteria from content providers. The content selection module matches the detected emotion with the associated criteria and selects content items for provision to the user device of the requesting user. The content delivery module delivers the selected content items to user devices.
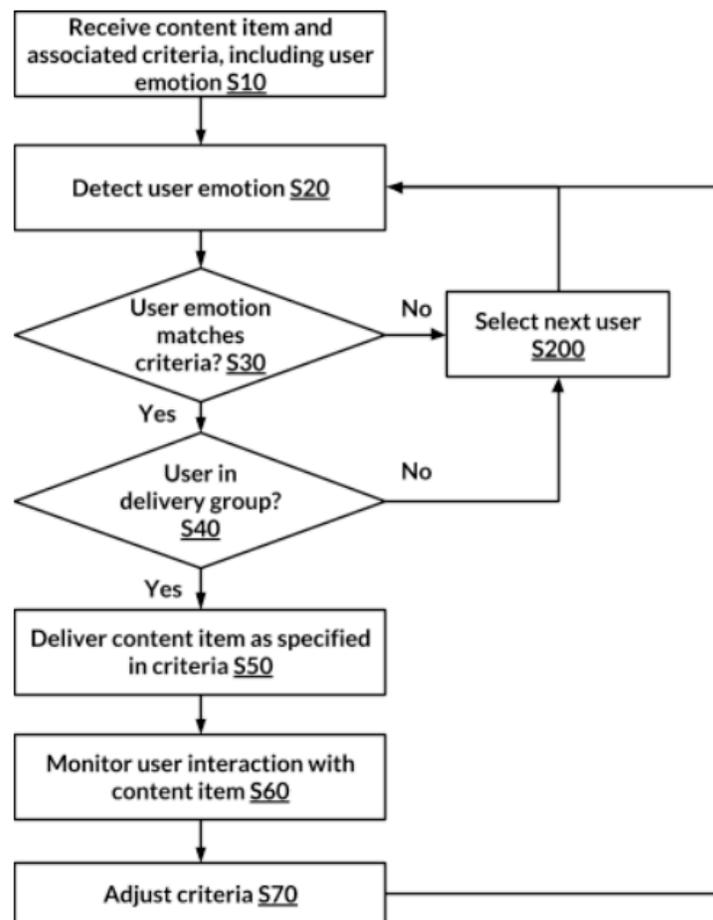

Fig. 2: Providing content to selected users and refining content delivery criteria

An example of a method to provide content to users and refining content delivery criteria is shown in Fig. 2. The method is performed for individual users, e.g., that request content items from the server illustrated in Fig. 1.

At Block S10, a content item, such as a document or other text content, audio/video, multimedia content, advertisement, etc. is received from a content provider. For example, content can be received from users and content providers, as illustrated in Fig. 1, and includes criteria that specify whether the content item is delivered to particular users. The criteria indicate a user emotion and a threshold score, or score range for the emotion, e.g., "deliver to users that have at least 80% likelihood of having the detected emotion happy," "do not deliver to users that are bored," etc. The criteria can also include logical relations such as AND, OR, etc., e.g., "deliver if the detected emotion is excited OR if the detected emotion is happy." The criteria further indicate how the content item is to be delivered to the users. In some examples, the criteria also indicate a delivery rate for the content item. For example, the delivery rate for a content item can be a zero or negative value, which indicates that such a content item is not to be delivered to users. The content item is delivered to users that match the criteria. Block S10 is followed by block S20.

At block S20, user emotion of a user is detected, e.g., using techniques as described in [1]. For example, the techniques include use of machine-learning (ML) models that are trained to detect emotion based on user interaction with the server. A single ML model can be used, or multiple ML models, each for a specific user group (e.g., based on user demographics) can be used to detect emotion. The detected emotion can include a state, e.g., "happy," "excited," "bored," etc. and an associated score. The score can indicate a likelihood that the user emotion is the detected state (e.g., 80% likely that the user happy, 60% likely that the user is happy, etc.), or can indicate the strength of the detected state (e.g., "5 - very excited," "2 - mildly excited," etc.). Other criteria such as user demographics, location, etc. can also be used in combination with the user emotion, e.g., emotion detection can be performed only for users that meet a demographic or location criteria associated with the content item. Block S20 is followed by block S30.

At block S30, the detected emotion is compared with the criteria. For example, it is determined whether the detected emotion matches the emotion specified in the criteria associated with a content item, and whether the associated score matches a threshold score, or is within a score range specified in the criteria. In some examples, multiple probabilities (or scores) of the detected emotion that match other criteria are also determined and the determination of match with the criteria is based on a weighted average. If the detected emotion matches the criteria, block S40 is performed; else, block S200 is performed to select the next user.

At block S40, the content item is delivered to the user based on the criteria. The criteria can specify a proportion of users that match the emotion criteria to whom the content is delivered. For example, the content item is delivered to a subset of users that match the criteria, e.g., 10%, 20%, or any other proportion of the users, or a particular number of users, e.g., 10,000 users. The proportion or number of users can be specified in relation to a time window, e.g., 10,000 users per minute, and is reset upon expiry of the time window. If the proportion is met (e.g., based on prior delivery of the content item to other users), block S50 is performed; else, block S200 is performed to select the next user. The subset of users to whom the content item is delivered is referred to as *delivery group*. In examples where the criteria for proportion of users is not specified or is specified as 100%, such that the delivery group includes all users that have detected emotion matching the criteria, block S40 is not performed, and block S40 is followed by block S50.

At block S50, the content item is delivered to the user device, e.g., for a browser of the user device to render as a web page, for an installed software application on the user device to display in the user interface, etc. In some examples, the criteria include a specification of how the content item is to be delivered. Such specification includes, e.g. a specified location within a

user interface where the content is placed during presentation to the user, a size of an area with the user interface for presentation of the content item (e.g. a size of a UI widget in which the content item is placed), etc. The specified location can be based on the detected emotion, e.g., different locations can be specified based on different detected emotions or scores associated with the same emotion. For example, a strong emotion ("very happy") can be associated with a prominent location for delivery of the content item, while other, non-prominent locations such as a sidebar can be specified if the strength of the emotion is lower ("happy"). The specification can also include a type of the UI widget/ content area, e.g., "advertisement slot," "sidebar," etc. To deliver the content item, the server formats a web page, or other container, or sends a specification that can be used by a client device to display the content item according to the criteria. Fig. 3 below illustrates some example user interfaces. Block S50 is followed by block S60.

At block S60, user interaction of the user with the content item is monitored. For example, a rate of user interaction with the content item is monitored. The rate includes the frequency of interaction with the content item of the users to whom it is delivered. Interaction can include, e.g., viewing a video content item, providing feedback on the content item, sharing the content item with other users, etc. Different interactions are assigned different weight values. Monitored user interactions are aggregated across users and based on the different weight values associated with different types of interaction. The monitored user interaction is indicative of a level of interest of the user in the delivered content item. Block S60 is followed by block S70.

At block S70, the criteria associated with the content item is adjusted. Such adjustment is based on the monitored user interaction. Adjusting the criteria can include, e.g., modifying the threshold score or the score range of the detected emotion for delivery of the content item. For

example, the score range is increased or decreased based on a comparison of the rate of monitored interaction with a threshold value. For example, if users in the range of "70-100% likelihood of detected emotion of happy" have a rate of interaction higher than the threshold, the score range can be increased, e.g., to "60-100% likelihood of detected emotion of happy." Similarly, the range can be narrowed, based on a lower rate of monitored interaction, e.g., to "90-100% likelihood of detected emotion of happy."

Adjusting the criteria can also include modifying the delivery rate for the content item. Adjustments of the criteria in this manner improves the effectiveness of the delivery of content items, e.g., by not delivering a content item to users that unlikely to find the content item of interest, by increasing the rate of delivery of content items that are popular in a target group of users, etc. Adjusting the criteria can also include modifying the specified location of the content item, size of the content area or content widget, etc.

After adjusting the criteria, the method returns to block S20 to detect emotion for the next user; alternatively, the method returns to block S10 to receive the next content item and associated criteria. For example, block S20 is performed when there are still users that have not been matched to the content item, when the proportion of users to whom the content item is delivered is less than that specified in the criteria, etc. Block S10 is performed when no further users are to be considered for delivery of the content item, when the proportion specified in the criteria is met, etc.

Adjusting the criteria over time based on monitored user interaction improves the efficacy of content delivery. For example, raising or lowering a score threshold, or adjusting the score range based on monitored user interaction can ensure that a higher proportion of users to

whom the content is delivered after such adjustment will find the content of interest. Adjustment of the criteria can be automatic, or can be a recommendation that can be approved or rejected by a user, e.g., the content owner, an entity that operates the server that delivers content, etc.

The foregoing description recites the blocks as being performed sequentially, but it is possible that different blocks are performed in parallel, are combined, or performed in a different sequence. For example, detection of user emotion can be performed prior to, or in parallel with receiving content items. Further, the method may be performed for multiple users in parallel.
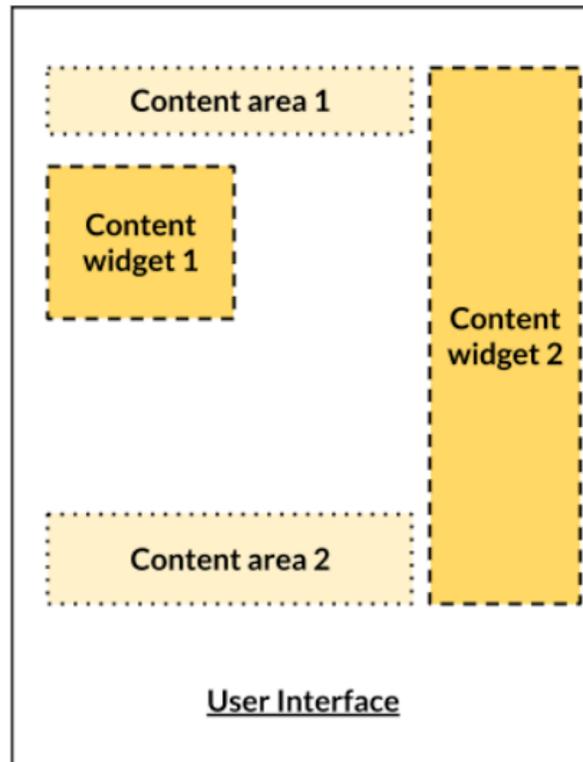

Fig. 3: Example user interface for content delivery

An example user interface for content delivery is illustrated in Fig. 3. The user interface includes content areas and content widgets. Each of the content areas/ widgets has an associated

location in the user interface, and a particular size. The content delivery module delivers the content in a particular content area or widget, based on the criteria, as described above with reference to Fig. 2.

CONCLUSION

Content items and associated criteria for delivery are received by a server from content provider. The server provides online services such as social networking, media hosting and sharing websites, news, etc. User interaction with the server and other data such as user profile information is analyzed using machine-learning models trained to detect emotion. Available content items are matched to the detected emotion based on criteria associated with the content items to select and deliver particular content items to deliver to the requesting user. User interactions with the delivered content are monitored. The criteria associated with content items are updated based on the monitored user interaction to control delivery rate and to improve selection of users to whom the content items are delivered. The described techniques for selection and delivery of content items based on detected emotion enable delivery of content items that have a high likelihood of providing a quality user experience. The described techniques improve engagement of the user with the online service.

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