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July 03, 2017

## Bidding Per Viewable Impression

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### Recommended Citation

Lanza, John D., "Bidding Per Viewable Impression", Technical Disclosure Commons, (July 03, 2017)  
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## **BIDDING PER VIEWABLE IMPRESSION**

### **DETAILED DESCRIPTION**

Performance of visual ads can be valuated based on number of impressions, click through rate (CTR), and/or conversion rate. For example, for a given ad, the respective performance can be defined based on the number of times that ad was displayed on information resources (e.g., webpages, social media platforms, gaming platforms, or mobile applications), the respective percentage of impressions that led to user interactions with the ad, or the respective percentage of impressions that led to online transactions related to the advertised product or service. For visual ads, a data processing system can collect performance parameters (e.g., clicks, landing page access, or conversions) via information resources on which the ads are displayed, landing pages associated with the ads, pages associated with conversion transactions, or a combination thereof.

In an audio-based interaction environment, audio ads pose technical challenges with respect to tracking and evaluating respective performances. For instance, when an audio ad is provided for presentation on a client device, the data processing system may not know whether the audio ad was played at all, partially played, or fully played on the client computing device. Lack of such presentation performance data as well as interaction performance data makes it difficult for the data processing system to accurately select the ads that are more likely to result in audio impressions or user interactions.

In the current disclosure, a data processing system can collect or receive audio presentation parameters such as whether or not an ad is presented, play time of each ad, and/or user audio interactions related to presented audio ads from client computing devices associated with a virtual personal assistant. The data processing system can use the collected data for generating a presentation probability predictive model that can be used to predict the likelihood

of presentation and/or likelihood of user interaction for audio ads. The data processing system can use the presentation probability predictive model to select ads for presentation in audio format on client computing devices. The use of the presentation probability predictive model allows for the selection of ads based on respective historical performances.

FIG. 1 is a flow diagram illustrating an example method 100 for audio advertisement valuation based on a listen duration probability model. The method 100 can be performed by a data processing system hosting a virtual personal assistant and/or serving client computing devices with online content. At step 105, the method 100 can include transmitting to a set of client computing devices an ad audio signal for presentation to corresponding users over time. For each client computing device, the data processing system can transmit the audio ad as part of a conversation between the virtual personal assistant and a user of that client computing device. The client computing device can receive a speech signal generated by the respective user, and forward the received speech signal to the data processing system. The data processing system can machine-translate the received speech signal to text and identify one or more keywords. The data processing system can identify a user request associated with the received speech signal. The user request can include a search query, a request for an online service, a command to execute an online action, or the like. For example, the user can request the virtual assistant to search for a product or service, purchase the product or service online, and/or access/download a document or an application related to the product or service.

The data processing system can select an ad (e.g., related to the product or service) for presenting to the user. The selected ad can include audio or text content. If the ad is a text ad, the data processing system can generate an audio signal corresponding to the text content of the ad. The ad may have multiple versions such as a text version, an audio version, a video version,

and an image version, in which case, the data processing can select the audio or text version for presenting to the user in the form of an audio signal. The data processing system can include the ad audio signal in an audio file, and transmit the audio file to the client computing device of the user. The audio file may include an audio response by the virtual personal assistant to the user (e.g., an audio signal corresponding to the expression “Got it”) followed by the ad audio signal. In response, the client computing device can play the received audio file. Alternatively, the audio file may include a question to the user regarding whether or not to play the ad audio signal. The data processing can transmit the ad speech signal to multiple client computing devices, for example, as part of two-way conversations between the client computing devices (or the virtual personal assistant) and the corresponding users.

At step 110, the method 100 can include monitoring presentation of the ad audio signal at each client computing device. The client computing device can monitor whether or not the ad audio signal was presented to the user. For instance, the user may instruct the client computing device not to play the ad audio signal (e.g., responsive to a question by the client computing device regarding whether or not to play the ad). In such instance, the client computing device would not play the ad and store a data record indicating that the ad was not presented. Alternatively, the client computing device may initiate presentation of the ad audio signal (e.g., with or without asking the user’s permission) can keep track of the amount of ad content presented. For example, the presentation of the ad audio signal may be interrupted by the user (e.g., the user reducing sound volume or commanding the virtual personal assistant to stop playing the ad) or an event such as a received call at the client computing device. The client computing device may record the amount of audio content (e.g., in terms of absolute or percentage presentation time or in terms audio data bytes) of the ad played before interruption.

In some implementations, the client computing device can determine that the ad audio signal if the amount of presented ad content is greater than or equal to a pre-defined threshold value (e.g., 5%, 10%, 25%, 50%, 75%, or 100%). The client computing device may also record whether or not the user interacted with the presented audio content (e.g., by asking for more information about the advertised product or service, initiating an online transaction via the virtual personal assistant related to the advertised product or service, or requesting a corresponding landing page to be displayed on the client computing device).

At step 115, the method 100 can include the data processing system obtaining one or more ad presentation parameter values. The client computing device can transmit to the data processing system values of a set of presentation parameters. The parameter values can be indicative of whether or not the ad audio signal was presented, the amount of ad content presented at the client computing device, and/or interactions, if any, by the user with the presented ad. The client computing device can also provide the data processing system with parameter values indicative of a context of the presentation device. Such parameter values can include the client computing device ID, a respective device type, the audio volume level at the time of presenting the ad audio signal, the user's request or corresponding keywords that led to the selection of the ad, a geographical location of the user, or a combination thereof.

At step 120, the method 100 can include generating a presentation probability predictive model based on the received parameter values. The data processing system can employ a machine learning algorithm to generate the presentation probability predictive model. The presentation probability predictive model can be configured to predict the likelihood (or probability) of presenting and/or interacting with audio ads if offered to a client device. For instance, the presentation probability predictive model can receive as input an ad ID, a device ID,

a device type, one or more keywords, a device location, or a combination thereof. Responsive to the received input, the presentation probability predictive model can provide a presentation probability value indicative of a probability of playing the audio ad corresponding to the ad ID and/or an interaction probability value indicative of a probability of user interaction with the audio ad if presented. Generating the presentation probability predictive model can include continually updating the presentation probability predictive model. For instance, the data processing system can update internal parameters or states of the presentation probability predictive model using newly received presentation data from client computing devices.

The presentation probability predictive model may be used by the data processing system or an advertiser device to determine a value of an ad presentation opportunity. For instance, the data processing system can use a likelihood or probability value provided by the presentation probability predictive model for a given ad to determine an appropriate bid value for that ad. The presentation probability predictive model may be used by the data processing system in selecting ads for transmitting to client computing devices. For example, the data processing system can use likelihood or probability values associated with multiple ads generated by the presentation probability predictive model to decide which ad to select.

At step 125, the method 100 can include the data processing system identifying an opportunity to provide an audio ad for presentation on a client computing device. The data processing system can receive, from a client computing device, a speech signal indicative of a request from a user. The data processing system can identify one or more keywords associated with the received speech signal, and determine a context associated with the request (e.g., a search query, a specific online service request, or a specific online action request). The data processing system can identify an opportunity for providing one or more audio ads to be

presented on the client computing device. For example, if the request is one for scheduling a ride with a given provider, the data processing system may decide that ads related to alternative provider could be presented to the user of the client computing device. Also, if the request relates to a live streaming of a sports game on a given platform, the data processing system may decide to provide related to other streaming platforms.

At step 130, the method 100 can include the data processing system selecting, using the presentation probability predictive model, an audio ad for transmitting to the client computing device. The data processing system can identify an initial set of ads, for example, based on keywords associated with the user's request, a location of the user, a device type of the user, a profile of the user, or a combination thereof. For each ad in the identified initial set, the data processing system can use the presentation probability predictive model to compute a respective presentation probability value and/or an interaction probability value. Based on the output probability values of the presentation probability predictive model, the data processing system may determine an appropriate bid value for each ad in the identified initial set. For example, if the presentation probability value and/or the user interaction probability value for a given ad is relatively high (e.g., higher than a threshold value), the data processing system may assign a relatively high bid value for that ad and vice versa. The data processing may also (or alternatively) eliminate ads in the initial set with relatively low presentation (and/or user interaction) probability values.

The data processing system may then run an auction using the assigned bid values and/or and filtered ads from identified initial set. In the auction, the data processing system may take into account the bid values of the ads as well as other criteria, such as user preferences, relevance to the user's request, user location, likelihood of user interaction, or a combination thereof. The

data processing system can select an ad for transmitting to the client computing device based on the auction results.

At step 135, the method 100 can include providing the selected ad for presentation on the client computing device. If the selected ad is a text ad or a visual ad with textual content, the data processing system can machine-translate the textual content into a corresponding ad audio signal. The data processing system may integrate the audio ad (or the ad audio signal) within an audio file including other audio content. The data processing system can then transmit the audio ad (or the audio file) to the client computing device. In response, the client computing device can play the audio file or the audio ad to the respective user.

While the presentation probability predictive model is described as generated mainly based on audio presentation parameters, the data processing system may account for visual presentation performance of the ad in the presentation probability predictive model. For instance, if an ad can is associated with a visual format and an audio format, the data processing system may generate the presentation probability predictive model based on historic presentation performance of both formats. The historic presentation (and/or user interaction) performances for both performances may be assigned different weights when used to create or update the presentation probability predictive model.

100

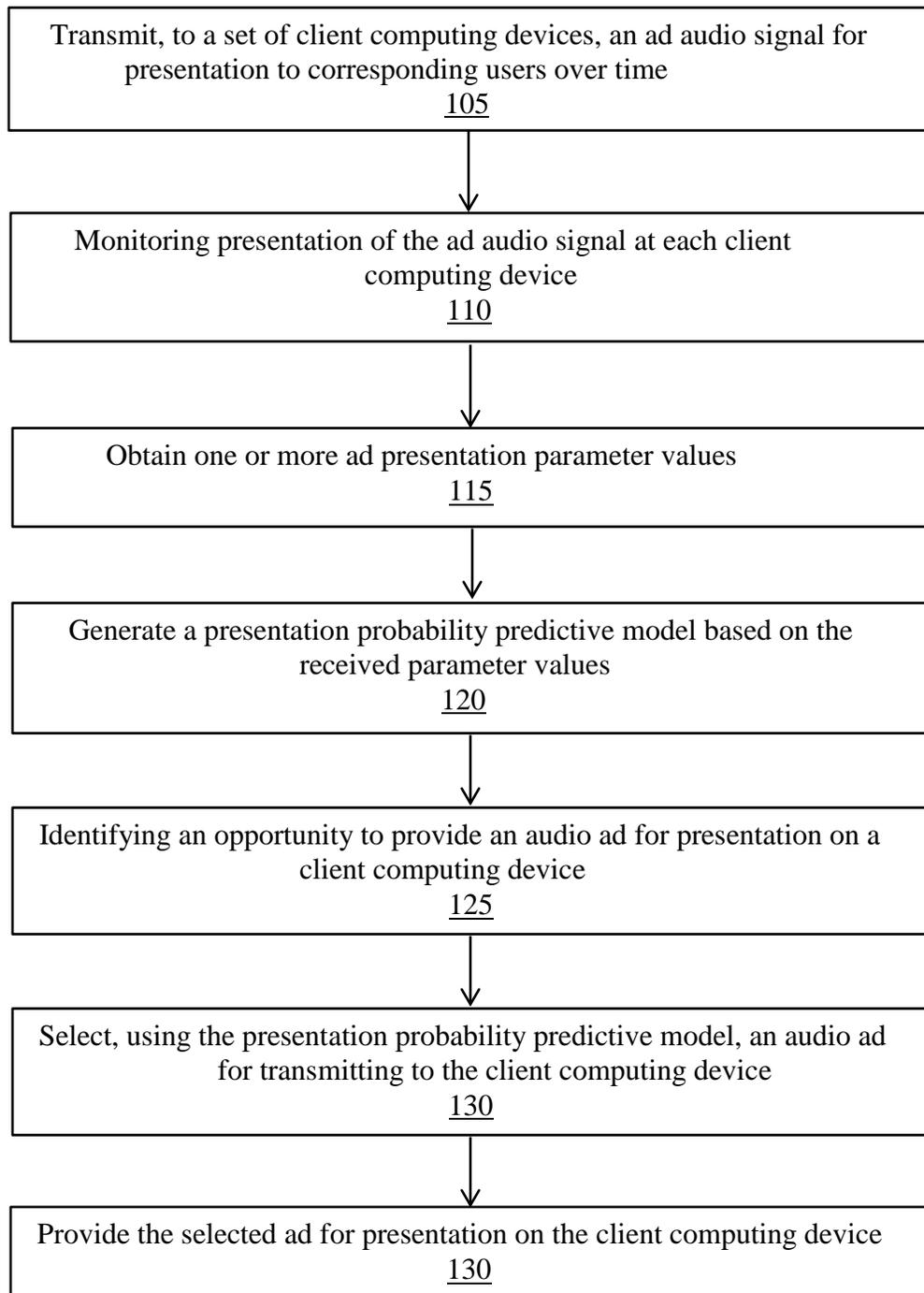


FIG. 1

## ABSTRACT

Systems and methods described herein allow for audio ad valuation based on respective historic presentation performance on client computing devices. The client computing devices can monitor presentation of audio ads to determine whether an audio ad was played and for how long. The client computing devices can report historic presentation performance values of ads to a data processing system. The data processing system can use the received audio ad presentation performance values to create and continually update a presentation probability predictive model. The presentation probability predictive model can be configured to predict probabilities of audio ads provided to client devices being played thereon. The data processing system can use the presentation probability predictive model to select ads for transmission to client computing devices.