

## **DEVICE AND METHOD FOR PROVIDING ADVERTISEMENT CONTENT TO A TERMINAL DEVICE**

### **TECHNICAL FIELD**

[0001] Various aspects of this disclosure relate to devices and methods for providing advertisement content to a terminal device.

### **BACKGROUND**

[0002] Traditionally, restaurants may acquire new customers by offline promotions, e.g., coupons, or digital marketing. Digital marketing is a service for providing advertisement content, for example for search advertisements or display advertisements to terminal devices of users by means of a communication network. Typically, users are targeted by such a service based on their online activities, e.g., web pages visited, keywords searched, video watched, mobile apps engaged, etc. However, in particular in context of restaurants, this may not be very effective leading to a high amount of advertisement content being transmitted with little effect.

[0003] Accordingly, more efficient approaches for selecting terminal devices as a target for advertisement content, i.e. for targeting advertisement content, are desirable.

### **SUMMARY**

[0004] Various embodiments concern a method for providing advertisement content to a terminal device, including, for each of a plurality of advertisements, supplying an input including demographic information about a user of the terminal device and information about the advertisement to a machine learning model trained to output, in response to the input, a value indicating a relevance of the advertisement for the user, selecting an advertisement with a highest relevance output among the relevances output by the machine learning model for the plurality of advertisements and providing advertisement content for the selected advertisement to the terminal device.

[0005] According to one embodiment, the demographic information about a user includes at least one of an indication of a profession of the user, a household income of the user and an education of the user.

[0006] According to one embodiment, the input further includes contextual information about the user including at least one of a location of the user, information about the weather at the user's location and time.

[0007] According to one embodiment, the method includes selecting the advertisement and providing the advertisement content in response to a request from an application running on the terminal device, wherein the application is an application for using a delivery service and the plurality of advertisements are advertisements for one or more goods deliverable by the delivery service.

[0008] According to one embodiment, the method includes training the machine-learning model to map inputs including user demographic information and information about advertisements to information about relevance of the advertisements for respective users.

[0009] According to one embodiment, the method includes training the machine-learning model using training data derived from historical data of the usage of one or more services in response of being provided with advertisements.

[0010] According to one embodiment, the services include at least one of a person transport service, a food delivery service, a grocery delivery service and a parcel delivery service.

[0011] According to one embodiment, the advertisements of the plurality of advertisements are advertisements for restaurants.

[0012] According to one embodiment, the method includes selecting at least one advertisement of the plurality of advertisements to include advertising for a restaurant for which it is determined from historical data that the user of the terminal device is not yet a customer of the restaurant.

[0013] According to one embodiment, the method includes selecting all of the plurality of advertisements to include advertising for a restaurant for which it is determined from historical data that the user of the terminal device is not yet a customer of the restaurant.

[0014] According to one embodiment, the historical data includes logging data of a food delivery service.

[0015] According to one embodiment, the machine learning model is a neural network.

[0016] According to one embodiment, a server computer is provided including a radio interface, a memory interface and a processing unit configured to perform the method for providing advertisement content to a terminal device described above.

[0017] According to one embodiment, a computer program element is provided including program instructions, which, when executed by one or more processors, cause the one or more processors to perform the method for providing advertisement content to a terminal device described above.

[0018] According to one embodiment, a computer-readable medium is provided including program instructions, which, when executed by one or more processors, cause the one or more processors to perform the method for providing advertisement content to a terminal device described above.

### **BRIEF DESCRIPTION OF THE DRAWINGS**

[0019] The invention will be better understood with reference to the detailed description when considered in conjunction with the non-limiting examples and the accompanying drawings, in which:

- FIG. 1 shows a communication arrangement including a smartphone and a server.
- FIG. 2 illustrates the architecture of a system for targeting advertisement content.
- FIG. 3 shows a flow diagram illustrating a method for providing advertisement content to a terminal device.
- FIG. 4 shows a server computer according to an embodiment.

### **DETAILED DESCRIPTION**

[0020] The following detailed description refers to the accompanying drawings that show, by way of illustration, specific details and embodiments in which the disclosure may be practiced. These embodiments are described in sufficient detail to enable those skilled in the art to practice the disclosure. Other embodiments may be utilized and structural, and logical changes may be made without departing from the scope of the disclosure. The various embodiments are not necessarily mutually exclusive, as some embodiments can be combined with one or more other embodiments to form new embodiments.

[0021] Embodiments described in the context of one of the devices or methods are analogously valid for the other devices or methods. Similarly, embodiments described in the context of a device are analogously valid for a vehicle or a method, and vice-versa.

[0022] Features that are described in the context of an embodiment may correspondingly be applicable to the same or similar features in the other embodiments. Features that are

described in the context of an embodiment may correspondingly be applicable to the other embodiments, even if not explicitly described in these other embodiments. Furthermore, additions and/or combinations and/or alternatives as described for a feature in the context of an embodiment may correspondingly be applicable to the same or similar feature in the other embodiments.

[0023] In the context of various embodiments, the articles “a”, “an” and “the” as used with regard to a feature or element include a reference to one or more of the features or elements.

[0024] As used herein, the term “and/or” includes any and all combinations of one or more of the associated listed items.

[0025] In the following, embodiments will be described in detail.

[0026] FIG. 1 shows a communication arrangement including a smartphone 100 and a server (computer) 106.

[0027] The smartphone 100 has a screen showing the graphical user interface (GUI) of an app for using one or more of various services, such as ordering food or e-hailing, which the smartphone’s user has previously installed on his smartphone and has opened (i.e. started) to use the service, e.g. to order food.

[0028] The GUI 101 includes graphical user interface elements 102 helping the user to use the service, e.g. a map of a vicinity of the user’s position, food available in the user’s vicinity (which the app may determine based on a location service, e.g. a GPS-based location service), a button for placing an order, etc.

[0029] Further, the GUI 101 may also be used to present an advertisement 103 to the user (full-screen or for a certain time or for a longer time shown as a part of the GUI so that the user may use the GUI for input while the advertisement 103 is displayed).

[0030] When the user has made a selection for a service, e.g. a selection of a restaurant or a selection of food from a restaurant, the app communicates with a server 106 of the respective service via a radio connection. The server 106 (carrying out a corresponding server program by means of a processor 107) may consult a memory 109 or a data storage 108 having information regarding the service (e.g. prices, availability, estimated time for delivery etc.) The server communicates any communication relevant or requested by the user (such as estimated time for delivery) back to the smartphone 100 and the smartphone 100 displays this information on the GUI 101. The user may finally accept a service, e.g. order food. In that

case, the server 106 informs the service provided, e.g. a restaurant 104 accordingly. The server 106 may also communicate earlier with the restaurant 104, e.g. for determining the estimated time for delivery.

[0031] The server 106 may also provide the content of the advertisement 103, i.e. the data specifying what to display as advertisement 103, to the smartphone 100. In particular, the server 106 may be configured to decide which advertisement should be shown to the smartphone's user. The server 106 may for example provide an advertisement service which includes selecting advertisements which be shown to a user and the provision of the advertisement content of the (selected) advertisements to the respective user's smartphone 100. The advertisement may not only be displayed within the app for using the service but for example also in a web browser when visiting a web page or in on a search result page.

[0032] It should be noted while the server 106 is described as a single server, its functionality, e.g. for providing a certain service and advertisement data will in practical application typically be provided by an arrangement of multiple server computers (e.g. implementing a cloud service). Accordingly, the functionality described in the following provided by the server 106 may be understood to be provided by an arrangement of servers or server computers.

[0033] Data of various advertisements may be stored in the data storage 108. The data storage 108 may for example be part of a cloud-based system provided by a cloud storage provider to store and access data.

[0034] In the following, it is assumed that the service is a service for ordering food from one or more restaurants.

[0035] One major problem restaurants face is how to grow business by acquiring new users.

[0036] According to various embodiments, an advertisement service, e.g. the advertisement service provided by the server 106, enables new user acquisition by combining advertisements targeting (i.e. targeting of advertisement content, specifically to new users, i.e. providing advertisement content for, e.g. a restaurant to a user who has not yet ordered from or eaten at the restaurant) and personalization of advertisement content using user behaviour data, contextual data, transaction data (Transport, Food, Delivery, Mart, Hotel, Ticket, etc.) Specifically, according to various embodiments, this is achieved by one or more of the following functionalities:

- Behaviour-based targeting users with advertisement content of a restaurant who did not eat at (or order food from) the restaurant, wherein this information is derived using transport service data and food delivery service data.
- Targeting users with advertisement content of a restaurant who like the type of cuisine the restaurant offers, i.e. taking into account in a digital advertising mechanisms the users' interest in different kinds of cuisines, possibly derived through their online activities but in particular inferred from explicit signals such as previous food orders.
- Geo-targeting users with advertisement content of a restaurant whose home address, work address, current location or transit destination address is within reachable distance from the restaurant for eating at site or food delivery.
- ML(machine learning)-based optimization of targeting advertisement content with contextual inputs, (e.g. weather, time, current state) transaction or location history, user demographics (e.g. profession, education, household income), survey responses. The output is a relevance of the advertisement for the user, e.g., a likelihood for conversion.
- An extensible online feature store which can contain any user attributes to enable new user targeting and ML-based prediction.

[0037] Input data for the above functionalities (in particular for an ML model) may be acquired from various services (e.g. transport (such as e-hailing), food delivery or delivery of other goods etc.), in particular from an infrastructure providing multiple of these services, for example

- Location data, e.g., home, work or frequent locations of user, from a transport service and a delivery service.
- Food order transactions from a food delivery service and a grocery delivery service
- Survey data, e.g., user demographics, favourite cuisines, etc., from a rewards service (e.g. from a survey).
- User profiles derived from other data (e.g. online activities etc.).

[0038] FIG. 2 illustrates the architecture of a system 200 for targeting advertisement content.

[0039] In the system 200 includes an app 201, e.g. corresponding to the app running on the smartphone 100, for using various services, in this example one or more of a transport service 202, a (food and/or parcel) delivery service 203, a grocery service 204 and a survey

service 205 (e.g. in connection with a reward mechanism, i.e. users may take surveys for rewards). There may also be different apps for the services but in the present example, this is considered as a single app 201. Thus, the app 201 is assumed to include the one or more mobile applications for consumers to use to interact with the services 202, 203, 204, 205. The app 201 is configured to display advertisements (ads) and requests advertisement content (data) for the advertisements.

[0040] For this, the system 200 further includes an advertisement decision engine 206 which is a backend service that handles advertisement requests from the app 201 and decides what advertisement content to return to the app 201, e.g. decides for which advertisement among multiple advertisement candidates the advertisement content is transmitted to the terminal device (e.g. smartphone) running the app 201. The advertisement content comes from an advertisement datastore 207, i.e. a database housing the advertisement campaign data provided by advertisers 209 (e.g. a restaurant owner) through an advertisement campaign manager 208 which forms the user interface through which the advertisers 209 set up advertisement campaigns.

[0041] An online feature store 210 calculates geo information (such as city or state where the user of the terminal device running the app 201 lives, works or is currently located) based on GPS data.

[0042] The system 200 further includes an advertisement personalization service 211 which is a service that predicts a relevance of the advertisement for the user, e.g. how likely the user will convert on each advertisement candidate of the advertisement candidates, i.e. which one will trigger the user to respond to the advertisement and, for example, make a purchase.

[0043] The advertisement personalization service 211 does this using one or more machine learning models 212 which are trained by a model training function 213, i.e. a process that trains the models 212 for advertisement personalization.

[0044] A datalake 214 provides data services that houses advertisement and/or business related data in queriable format. Data from the services 202, 203, 204, 205 may be stored in the datalake 214 and data may be retrieved from the datalake 214 (e.g. by advertisement decision engine 206 and an online feature reducer 216) via data streams (e.g. Kafka data streams) 215.

[0045] The online feature reducer 216 performs online processes that reduce data from data streams 215 into useful features for the online feature store 210. Similarly, an offline feature reducer performs offline processes that reduce data from datalake into useful features for an offline feature store 218 which is an offline datastore that houses offline features for high-latency and high-throughput batch access and which may exchange data with the online feature store 210 and whose content may be used by the model training function 213.

[0046] From the transport service 202 (backend service for transport) pickup locations and travel destinations may be collected and stored in the data lake 213.

[0047] From the delivery service 203 (backend service for food or package delivery) food order data as well as delivery location data may be collected and stored into the datalake 214.

[0048] From the grocery service 204 (backend service for mart business on everyday essential goods) grocery order data may be collected and stored into the datalake 214.

[0049] In the following, examples for workflows using the system 200 are given.

[0050] Set Up An advertisement Campaign

- 1) A representative of an advertiser 209 (or an advertising agency) works with an internal operation team of the advertiser 209 to prepare all advertising assets, including marketing messages, creatives, targeting configuration, budget, pricing, tacking, etc.
- 2) The advertiser representative 209 sets up an advertisement campaign through the advertisement campaign manager 208 with proper start and end dates, campaign goals, capping, etc.
- 3) The advertiser representative 209 continuously monitors the performance of the campaign through the reporting UI of the advertisement campaign manager 208.
- 4) The advertiser representative 209 presents the final performance reports to internal executives of the advertiser after the campaign concludes.

[0051] See an advertisement

- 1) A user opens the app 201 on the user's terminal device (e.g. smartphone 100).
- 2) An advertisement component of the app 201 sends requests to the advertisement decision engine 206 for advertisement content.
- 3) The advertisement decision engine 206 filters advertisements based on targeting criteria, ranks advertisements based on relevance, and returns advertisement content for one or more selected advertisements.

- 4) The app 201 displays the returned advertisement content to its user.

[0052] Generate an advertisement impression (view) event (or, similarly, a click event or a conversion event)

- 1) A user sees an advertisement presented by the application 201.
- 2) Based on predefined viewability criteria (e.g. user has watched the advertisement for a certain time period), an advertisement component of the app 201 sends an impression (view) request to the advertisement decision engine 206.
- 3) The advertisement decision engine 206 logs the impression event for reporting.

Click event and conversion event logging follows a similar workflow.

[0053] Collect a user's favourite cuisine through survey service 205

- 1) A user opens the app 201.
- 2) A survey component of the app 201 sends a request to the survey service 205.
- 3) The survey service 205 filters surveys based on targeting criteria and returns a survey to ask the user's cuisine preferences.
- 4) The app 201 displays the survey.
- 5) The user answers the survey.
- 6) The survey component transmits the answers to the survey service 205 and a data base, e.g. data lake 214, stores the answers.

[0054] Log User Activities

- 1) A user uses the app 201 to order food.
- 2) The app 201 sends the request to the delivery service 203.
- 3) The delivery service 203 logs the details of the order, including delivery location, order time, basket size, restaurant, cuisine types, etc.
- 4) The delivery service 203 initiates fulfilment of the food order (e.g. contacts the respective restaurant 104).
- 5) Information about the order is stored (i.e. the order is logged) in the datalake 214.

The workflows for user activity logging for other services are similar.

[0055] Personalize advertisement experience

- 1) The advertisement decision engine 206 receives an advertisement request from the app 201.
- 2) The advertisement decision engine 206 filters advertisements to get a list of eligible ones based on targeting criteria.

- 3) The advertisement decision engine 206 collects and compiles contextual data, user data from the online feature store 210, and relevant data for each eligible advertisement, and sends the data to the advertisement personalization service 211 for scoring.
- 4) The advertisement personalization service 211 runs the inputs through internal models and produces a relevance score for each input, and returns the scores back.
- 5) The advertisement decision engine 206 ranks the advertisements based on scores and returns advertisement content for the advertisement with the highest score, i.e. the optimal one for the user in the current context in terms of relevance.

[0056] As mentioned above, the advertisement personalization service 211 may use a machine-learning model, e.g. a machine learning model 105, whose specification is stored in the memory 109 and which is implemented by processor 107) for selecting and advertisement (e.g. among a plurality of candidate advertisements) for which it transmits advertisement content to the app 201 using the output of a machine learning model 202.

[0057] For this, according to various embodiments, the advertisement personalization service 211 information about the user, including in particular user demographic data as well as information about each candidate advertisement, to the machine learning model. The machine learning model is trained to provide, for an input of information about a user and information about a (candidate) advertisement) an output specifying a likelihood of conversion.

[0058] The demographic data is for example information about the user's profession (e.g. in form of a 1-hot encoding of the profession among a plurality of professions), education (e.g. similarly in form of a one-hot-encoding) and household income (e.g. in form of a number). Similarly, information an advertisement (candidate) may be input in form of, for example, a one-hot encoding of an advertisement class or content type etc.

[0059] The machine learning model's output in response to such an input is for example a value in the interval  $[0; 1]$  which specifies a likelihood of conversion.

[0060] The machine learning model, for example a neural network, e.g. a fully-connected neural network, may be trained by supervised training from historical data: training samples may be collected by registering a tuple of information about a user (including demographic data) and information about an advertisement that was presented to the user and a ground truth output specifying whether the user has reacted to the advertisement (e.g., in one

embodiment, placed an order in response to the advertisement, or, in another embodiment, clicked on the advertisement without necessarily placing an order).

[0061] In order to score ad (advertisement) candidates for the user request, the set of relevant candidate advertisements is first generated by the ad decision engine 206 using a set of search criteria to look up ad candidates in an indexed data store. These criteria include the placement of the ad location on the app 201 user interface, user context information (such as user food search query, current time, current location, current weather and recent behavioral activity by the user), and other targeting criteria and inverted indexes specified in advertising campaign (an example of which is whether the user is in a particular audience segment that the advertiser targeted for their advertising campaign) that allow the ad decision engine 206 to look up the set of relevant and active advertiser campaigns and associated ads. Audience segment targeted is achieved through an inverted index that enables the ad decision 206 to look up the list of audiences the user is a member of (e.g. “mall shoppers”, “burger eaters”, “chicken rice eaters”, etc) and then for each segment, look up the list of ads targeted to the given segment, and in this way, combined with the other targeting criteria, look up the relevant set of ads for the given user request.

[0062] Since, according to various embodiments, these advertisements are for restaurants which are intended for on-demand food delivery, additional restriction/filter criteria including maximum expected delivery time limits and restaurant open/closed status may be used to limit the set of ad candidates that are input into the ML model 212 for relevance scoring in the ad personalization service 211. Additionally ad campaign budget limits may also restrict the set of ad candidates that are scored and returned to the user.

[0063] This set of discovered and filtered advertisements (e.g. candidate restaurants) are then fed into the ML model 212 along with all aforementioned data features for the user demographics, user behavior, user context and ad and restaurant features from the online feature store 210 (which includes features according to a certain coding, i.e. values which for example code the type of food of the restaurant, the price level of the restaurant, the type of restaurant, etc.) and then scored for total relevance to the user’s search request, fed into the ads auction in the ad decision engine 206, and then returned to the user in descending order, so the most relevant and highest value ad candidates are shown first to the user to view in the app 201.

[0064] In summary, according to various embodiments, a method is provided as illustrated in FIG. 3.

[0065] FIG. 3 shows a flow diagram 300 illustrating a method for providing advertisement content to a terminal device.

[0066] In 301, for each of a plurality of advertisements, an input including demographic information about a user of the terminal device and information about the advertisement is supplied to a machine learning model trained to output, in response to the input, a value indicating a relevance of the advertisement for the user.

[0067] In 302, an advertisement with a highest relevance output among the relevances output by the machine learning model for the plurality of advertisements is selected (from the plurality of advertisements).

[0068] In 302, advertisement content for the selected advertisement (e.g. data for graphical content to be displayed and/or sound to be played) is provided to the terminal device.

[0069] According to various embodiments, in other words, a machine-learning model which operates, e.g. among other inputs, on demographic data, is used to predict the relevance (e.g. likelihood of conversion) of various advertisements for a certain user and the advertisement content to be transmitted to the user's terminal is selected depending on the machine learning model's output.

[0070] The approach of FIG. 3 allows, e.g. when having trained the machine learning model using corresponding historical data, ensures efficient targeting of advertisement content and thus, in particular, reduces waste of communication resources used for ineffective advertisement content. For example, when a new customer can be won by an advertisement due it having been selected with a high likelihood of conversion, further advertisements may no longer be necessary for that user.

[0071] The method of FIG. 3 is for example carried out by a server computer as illustrated in FIG. 4.

[0072] FIG. 4 shows a server computer 400 according to an embodiment.

[0073] The server computer 400 includes a communication interface 401 (e.g. configured to receive requests for advertisement content and to send advertisement content). The server computer 400 further includes a processing unit 402 and a memory 403. The memory 403 may be used by the processing unit 402 to store, for example, data to be processed, such as

information about demand and supply. The server computer is configured to perform the method of FIG. 3.

[0074] The methods described herein may be performed and the various processing or computation units and the devices and computing entities described herein may be implemented by one or more circuits. In an embodiment, a "circuit" may be understood as any kind of a logic implementing entity, which may be hardware, software, firmware, or any combination thereof. Thus, in an embodiment, a "circuit" may be a hard-wired logic circuit or a programmable logic circuit such as a programmable processor, e.g. a microprocessor. A "circuit" may also be software being implemented or executed by a processor, e.g. any kind of computer program, e.g. a computer program using a virtual machine code. Any other kind of implementation of the respective functions which are described herein may also be understood as a "circuit" in accordance with an alternative embodiment.

[0075] While the disclosure has been particularly shown and described with reference to specific embodiments, it should be understood by those skilled in the art that various changes in form and detail may be made therein without departing from the spirit and scope of the invention as defined by the appended claims. The scope of the invention is thus indicated by the appended claims and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced.

**CLAIMS**

1. A method for providing advertisement content to a terminal device, comprising:  
For each of a plurality of advertisements,  
supplying an input including demographic information about a user of the terminal device and information about the advertisement to a processor, the processor implementing a machine learning model trained to output, in response to the input, a value indicating a relevance of the advertisement for the user;  
selecting at least one of the plurality of advertisements to include advertising for a service for which it is determined from historical data that the user of the terminal device is not yet a customer of the service;  
selecting an advertisement with a highest relevance output among the relevances output by the machine learning model for the plurality of advertisements; and  
providing advertisement content of the selected advertisement with the highest relevance output to the terminal device.
2. The method of claim 1, wherein the demographic information about a user includes at least one of an indication of a profession of the user, a household income of the user and an education of the user.
3. The method of claim 1 or 2, wherein the input further includes contextual information about the user including at least one of a location of the user, information about the weather at the user's location and time.
4. The method of any one of claims 1 to 3, comprising selecting the advertisement and providing the advertisement content in response to a request from an application running on the terminal device, wherein the application is an application for using a delivery service and the plurality of advertisements are advertisements for one or more goods deliverable by the delivery service.
5. The method of any one of claims 1 to 4, comprising training the machine-learning model to map inputs including user demographic information and information about

advertisements to information about relevance of the advertisements for respective users.

6. The method of claim 5, comprising training the machine-learning model using training data derived from historical data of the usage of one or more services in response of being provided with advertisements.
7. The method of claim 6, wherein the services include at least one of a person transport service, a food delivery service, a grocery delivery service and a parcel delivery service.
8. The method of any one of claims 1 to 7, wherein the advertisements of the plurality of advertisements are advertisements for restaurants.
9. The method of claim 8, comprising selecting at least one advertisement of the plurality of advertisements to include advertising for a restaurant for which it is determined from historical data that the user of the terminal device is not yet a customer of the restaurant.
10. The method of claim 8, comprising selecting all of the plurality of advertisements to include advertising for a restaurant for which it is determined from historical data that the user of the terminal device is not yet a customer of the restaurant.
11. The method of any one of claim 9 or 10, wherein the historical data includes logging data of a food delivery service.
12. The method of any one of claims 1 to 11, wherein the machine learning model is a neural network.
13. A server computer comprising a radio interface, a memory interface and a processing unit configured to perform the method of any one of claims 1 to 12.

14. A computer program element comprising program instructions, which, when executed by one or more processors, cause the one or more processors to perform the method of any one of claims 1 to 12.
15. A computer-readable medium comprising program instructions, which, when executed by one or more processors, cause the one or more processors to perform the method of any one of claims 1 to 12.