An Interactive-Content Technique Based Approach to Generating Personalized Advertisement for Privacy Protection

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Abstract. Personalized contents have been getting more attention from industry and academia due to its effective communicative role in product advertisements. However, there exist potential threats to the customer's privacy in conventional approaches where a data server containing customer profiles is employed or the customer profiles is required to be sent over the public network. To address this, this paper describes a framework that employs a script-based interactive content technique for privacy protection. We illustrate our approach by a sample scenario.

Keywords: Privacy, Interactive content, Personalized advertising.

1 Introduction

While traditional media (e.g., TV, radio station, newspaper, billboards) advertise products and services to people non-selectively, sponsors are getting more interested in personalized advertisements that present products and services for their prospective customers. Personalized advertisements also have drawn more attentions from researchers in multimedia, e-commerce, and AI because contents and presentations that are tailored to an individual's preference tend to attract her attention.

In a conventional approach for the provision of personalized contents, the service framework either contains a server that keeps track of the customer's preferences and interactions (e.g., web page visits, search keywords, shopping transactions) or requires that the customer device (e.g., mobile handsets, web browsers, IPTV) send her personal information over the public network in order to select advertisements pertinent to her [1, 3, 9, 12]. These approaches, however, have potential threats to the customer's privacy. For instance, the customer's personal information could be disclosed in the process of collecting and managing his profile in a system that employs a server storing user profiles; if the system is violated, the privacy of thousands of customers will be threatened, unfortunately. In this system, additionally, while the user profile is sent to a server over a network, the network shall be guaranteed to be secure.

To address this privacy related issues, conventional approaches to generating personalized commercials for privacy protection have focused on data management,

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data exchange protocol and security. For example, a server and a client define a privacy policy respectively and the user is asked if he consents the policy provided by the server when the two policies do not match [14]. In anonymous communication approaches, a random number is assigned to each user in order to remove his identifying information, and thus preventing his privacy from being disclosed. [7, 18] As an online practice for this approach, Phorm developed an online advertising system that provides relevant ads for internet users based on keywords acquired from a combination of search terms, URLs and contextual page analysis, etc without infringing their privacies [13]. This system anonymises the users by assigning a unique random number to each user and by incinerating the user's web surfing traces as it extracts keywords (e.g., cameras, autos, etc.) of products or services that would interest the user. These keywords are kept until appropriate advertising channels for a user are found and their advertisements are delivered to the user. Additionally, Phorm allows users to switch this advertising service on or off at any time while most advertising companies deliver advertisements regardless of users' preference.

Unlike other conventional approaches, our work is closely related to interactive contents structure and script-based graphics that realize 3D animation in real-time. Interactive content unfolds differently as it interacts with the user. There are two primary approaches to representing interactive contents (or stories), branching graphs and planning techniques. In branching graph approaches, interactive contents comprise a series of nodes and conditional branches; a node describes a unit content and a conditional branch refers to a transition from a node to another that is carried out when user inputs and/or story states meet pre-defined logical statements [4, 5, 6, 15, 16]. In the planning formalism, a content plot is constructed as the planner algorithm generates links between unit contents considering users' interaction, and preconditions and postconditions of the unit contents.

In this paper, we present a framework that employs a script-based interactive content technique [2, 6, 8, 10, 17] which can provide personalized advertisements for users without compromising their privacy. The next section details our work followed by a simple example which illustrates personalized commercial generation. In the final section, we conclude this paper by discussing the impact of our research and plan for future work.

2 A Framework for Generating Personalized Contents

This section describes our framework that generates personalized advertisement without exchanging the customer's personal information or her web surfing activities. When a request for a personalized commercial of a product is issued, the system sends entire interactive contents containing complete commercials that would cover all types of prospective customers to the user-side device so that the device can locally determine appropriate contents for the user. One major challenge of this approach is the large data volume transmitted on limited network resources, especially in wireless channels. To address this, our approach employs a script-based 3D graphic engine that converts text into 3D animation [2, 6, 8, 10, 17], as detailed below.

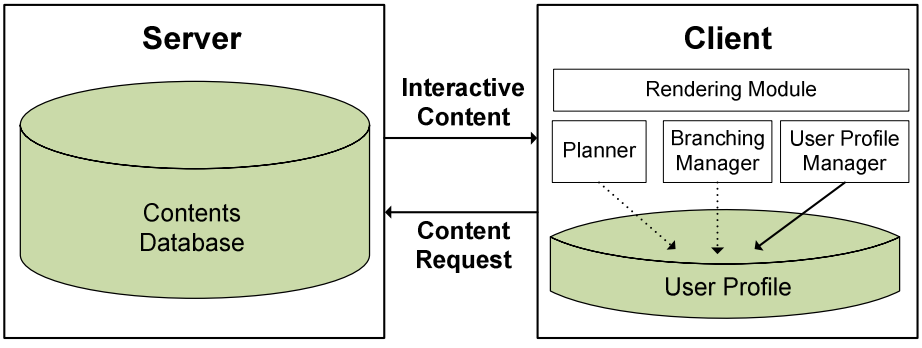

Fig. 1. A Framework for privacy-safe personalized advertisement

Our framework consists of a server and a user-device (i.e., client) as in Figure 1. When the user asks for content (e.g., an advertisement for a product), the user device sends the request (e.g., a text such as vacuum cleaner) to the server. The server then looks up the content database seeking for an interactive content corresponding to the advertisements for the product, and it sends the interactive content back to the user device over the network. Upon receiving the interactive content from the server, the user device realizes the content as a 3D animation on the device which consists of a rendering module, a branching manager, a planner and a user profile.

While producing a 3D animation, our approach achieves to generate a personalized content in a secure manner. Since a branching manager and a planner determine the next node (i.e., unit content) to be presented to the user as they consult with the user profile and then the rendering module realizes each node into an animation, a content can be displayed non-identically but in even more appealing way according to users; here, the user model could include a variety information from relatively fixed personal information such as age, gender and address to changing and complicated information such as the user's current location or life style. In addition to the matter of personalized advertising, the user profile is stored in the user device and is disclosed outside on no occasion, thereby guaranteeing users' privacy to be protected.

These node selection and realization phases iterate until the last node of the interactive content structure is finally rendered. To minimize the data volume communicated over the network, we utilize a text-based script to represent the interactive content. More details on our script-based interactive-content authoring tool and player which employ the TVML (TV program Making Language) technique as its framework can be found in Cheong et al. [2].

The client device also has a user profile manager that enables a user profile to be updated consistently with detailed version by information induced from analysis on a user's life pattern and viewing habit, environmental data surrounding a user, etc. A user's habit to viewing advertisements, for example, could be categorized into one of three propensity: indifferent, greedy or selective; to bypass most of advertisements means that the user is probably indifferent to advertisements and thus the user profile manager can update the value on the corresponding field (e.g., user's propensity to advertisements) in that user profile.

The process of presenting advertisements with our approach guarantees advertisements to be customized for each device owner and, at the same time, prevents an intrusion of user privacy by preserving the user model in the user-side device. The system, also, continues gathering a series of users' behaviors and updating the user model based on the analysis about them, thus we expect each user to have a stronger interest in an advertisement than the user would have with advertisements made only with the fixed information.

3 A Simple Example

In this section, we deal with an example for our framework and describe how a personalized advertisement could be generated without harming one's privacy. Figure 2 shows a sample advertisement which is made up with an interactive content structure proposed in Cheong et al. [2, 11], and table 1 describes two user profiles that could be applied to the sample advertisement in figure 2.

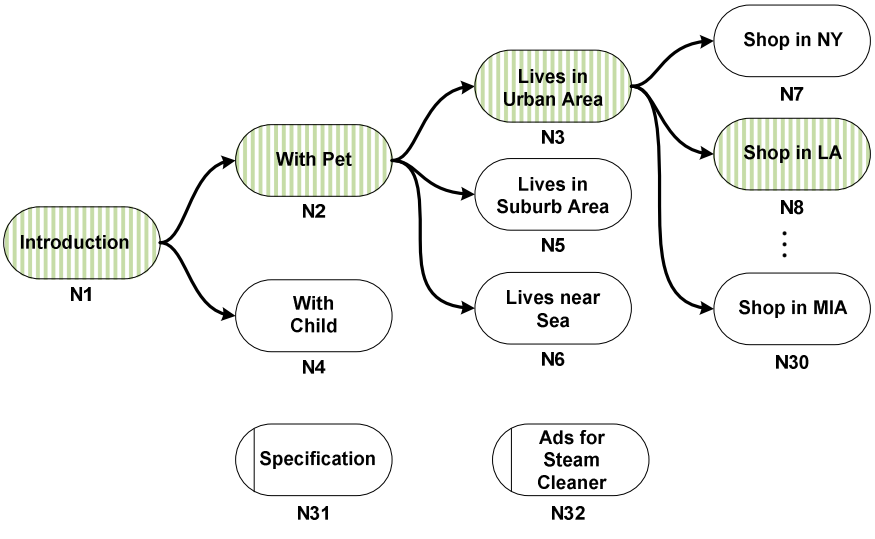

Fig. 2. Sample interactive content for a vacuuming robot advertisement

The nodes in the graph of the figure 2 constitute a sequence of actions, and the branches structure the multi-story line by integrating nodes with events which represents a transition between a pair of nodes. While an event in a conventional interactive content system corresponds to a user input such as mouse movement or text typing, our approach utilizes a user model (e.g., the target user's profile) as well as the conventional events in order to determine the unit content to be presented in the next sequence.

Table 1. Sample user profiles for the interactive content described in figure 2

Field name	User profile 1	User profile 2
Name	Wooky, Min	Rita, Lee
Gender	M	F
Address	San Monica, CA, USA	Chicago, IL, USA
Marriage	N/A	Y
Children	None	3 year-old baby
Pet	Cat	None
Job	N/A	Computer Scientist
Current Location	Town and Country Resort & Convention Center, San Diego, CA, USA	N/A

Figure 2 describes an interactive content for the advertisement of vacuuming robot products. The initial node N1 begins with a voice introduction of a vacuum cleaning robot. On the completion of N1, the system checks if the device owner has a pet by referencing his user profile stored in the device; in the case of a user who corresponds to the user profile 1, an animation that the robot cleans up the pet's hairs scattered on the floor can be shown to the user (as textually described in N2). A user whose information constitutes the user profile 2, on the other hand, would experience N3 which illustrates a child dropping her cranberry juice on a carpet followed by the vacuum machine removing the stain. The rest of this section discusses an advertising scenario when the user profile 1 is employed.

When the presentation of N2 is completed, the system tests the user's residential district to determine the neighborhood and cultural environment with which the user would feel familiar (e.g., background setting in the advertisement). For instance, a resident in an urban community may prefer an episode in a busy town. This data can be reused for selecting the final node which contains the direction to the nearest store from the user's place.

In case where the user actively tries to check out other aspects of the products which are not explained in the main plot of an advertisement, we define global content units (N31 and N32 in the Figure 2) that can be accessed in response to the user's input. Since these nodes do not have any incoming or outgoing branches, they are presented to the user only when he directly inquires through an input device such text typing or mouse click. For instance, if he touches a button labeled "specification" in the middle of watching the advertisement, the product specification will be shown to him before the next content unit is presented. More details on managing main plot and global units are explained in Cheong et al. [2, 11].

4 Conclusion

In conclusion, we present a personalized advertisement generation approach that protects the target user's privacy by the use of interactive content techniques. Unlike other conventional approaches, our approach creates personalized advertising contents without exchanging the user's private information on the communication channel.

Instead, we send an interactive content structure that contains the entire advertisement scenarios to the user device; then the device is responsible for selecting and rendering some of the contents that are appropriate to the user model on the device.

Since there is an issue regarding data volume in transmitting the whole content structure as 3D raw images, we also give a brief introduction of our framework that employs a text-based approach in representing 3D animation thereby minimizing the data transmission cost. Up to this point, we have implemented a text-based 3D animation toolkit, which enables users to describe a story in a script format and realizes it into a 3D animation. Our future work is to augment the functionalities of the toolkit to the extent that it supports authoring and rendering interactive contents so that it can facilitate to create and present personalized advertisements and to conduct formal evaluation of our framework.

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