

MyAds—A Proposed Adaptive Social Online Advertising Framework

Dana A. Al Qudah and Alexandra I. Cristea

Abstract—The seemingly ‘magical’ developments of the World Wide Web have challenged the computer science researchers, analysts, designers and developers to think outside the box and apply their creativity. One of the main sectors that have paid great attention to the World Wide Web is the advertisement sector. Online advertisement is known to be one of the major incomes for many companies, social networks and search engines online. This paper proposes a framework that provides adaptive advertisements to be displayed to online users based on their social network profiles via creating an individual user model for each user. The framework was built based on literature research and an exploratory study conducted with actual web users. The framework is a layered model, where each layer provides a different functionality, but works towards a homogenous outcome of adaptive ads.

Index Terms—Adaptive systems, e-advertisement, proposed framework, social networks.

I. INTRODUCTION

One of the challenges faced by web service providers is to insure users’ acceptance and usage of their services; this challenge has led to approaches striving to fulfill users’ needs. Adaptive hypermedia has become one of these methods to achieve better users’ experiences, since it is based on tailoring the web content provided to users based on many factors such as; knowledge, capabilities, experiences and interests, to mention just a few [1].

As many companies operate online, one of their main incomes is advertisement. E-advertisement is a branch of e-commerce [2] and has a major role on the return of investment (ROI) of online companies [3]. One of the main problems related to e-advertisement is that most of the time users tend to ignore these advertisements or block them [4], [5].

This paper is looking at proposing a framework that deals with *how e-advertisement can be presented in a way that is non-intrusive and smoothly integrated with users’ expectations and needs*. The suggested framework has been derived from a set of requirements and hypotheses found based on studying previous literature and a preliminary study conducted earlier.

The main hypothesis beneath the research question is that: *Personalization, based on customization and adaptive hypermedia techniques, as well as social networking data, provide the means to create non-intrusive, smoothly*

integrated, attractive adverts, aligned with user expectations.

A set of sub-hypotheses and requirements will be discussed further in the paper.

The paper will discuss the hypotheses and requirements, then present the proposed framework and proposed the system evaluation techniques and end up with conclusions.

II. RELATED WORK

E-advertisement has increased its online space dramatically over the years [4]; unfortunately this increase in availability of on-line advertisement didn’t result in a similar increase in the click-through rate, which has been shown to have decreased by 2007 from 3% to 1% [5].

Research has in fact shown that people avoid advertising, irrespectively of the position on the screen where the advert is placed [6].

Targeted advertisement focuses on two main things; delivering the appropriate advertisement to the desired users segments as well as enhancing the performance of click-through rates and purchasing [4]. Although targeted advertisement has become an important approach to attract more users, only famous ones like Google provide some kind of personalization in Ads like AdSense [7].

AdSense is a commercial targeted advertising program, which aims at increasing its profit by charging the publishers for each user’s action [8]. It is specialized in banner advertising. It adapts its targeted advertisements on geographical location as well as the content of the website retrieved by the user [9]. The important thing however is that it doesn’t do any user modeling, collecting of user data, or usage of such data for personalization.

Adaptive hypermedia is potentially one of the approaches possible to choose the right type of ads for users, matching the advertisement to their taste; this is achieved through user modeling, which is one of the key aspects in user-adaptive systems [10].

The prime objective of using *user models* is to collect as much data as required about the user and then tailor the system data to address the users’ different needs. Creating an accurate user model can be challenging, since there is a need to collect the appropriate set of data about users, then refine these data in a usable way.

Social network platforms are one of the rich sources of data, since users willingly provide a huge amount of data that can help in understanding their expectations and behavior [11]. Social networks data can be used as a source of data for creating the user model that determines which adaptive content can be displayed. Another reason for using social networks is the availability of large numbers of users in famous platforms such as Facebook and Twitter with more

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than 908,000,000 users on Facebook and 500,000,000 users on Twitter in 2004 and the number is increasing [12].

On a research level, AdRosa is an advertising tool that works through remote open site agents. AdRosa is a system that deals with automatic personalization of web banners as it doesn't produce this type of automatic personalization in the same time maintains users' privacy. The functionality of the system is based on deriving the needed knowledge from webpage content, previous users' sessions and current behavior of users [5].

Unlike the current research, AdRosa uses lightweight user models, based only on the interaction with the system, and no further user data. Moreover, AdRosa doesn't use the rich source coming from social networks, which the current research implements. Online advertisement frameworks have been around for some time now but most of them as part of e-commerce frameworks. One of these frameworks is the ubiquitous advertising on WWW framework [13]. Which has been used for a long time.

The previously mentioned frameworks appraised the idea of creating a more personalized and targeted advertisement environment for the users. The next sets of frameworks are adaptive hypermedia frameworks that have been used in different applications but mainly on e-learning. Some of these famous models are; AHAM: adaptive hypermedia model [14], the WebModeling Language [15] and LAOS Framework [16] AHAM is a reference hypertext system that is divided into three main layers in order to achieve the separation of concepts. The first layer is the run-time layer followed by the storage layer then the component layer that is connected with the presentation and interfaces of the system. The trick is within the second layer which has three sub-layers that empower the model. The first sub layer is the domain model where the concepts are saved, the user model that saves data about users and the adaption model that consists of the rules and attributes of adaptations [14],[17]. The WebML Model has four main perspectives that are intersected with each other. The first perspective is the structure model where the relationships within the web application are examined. It is followed by the hypertext model that looks at the way the web application has published its content, the presentation model is for the layout and the graphics within the application and finally the personalization model examines the application users' and their grouping [15]-[17]. The final model to present is the LAOS model which an authoring adaptive hypermedia model. This model is based on AHAM model presented earlier as well in-cooperating some features from the WebML model. It uses the concept of layers separation presented in AHAM but adds another layer which is the goal and constraints model as well as adding the presentation model presents in WebML. The main aim of adding the goal and constraints model is that purposes a high level of system flexibility and reuse [16], [17].

Thus, looking at related application and research areas, the decision is to use adaptive hypermedia techniques to extract information from social networks, and generate thus a collection of information on the user that can help in linking users to customized and thus potentially more effective adverts. Another advertisement framework proposed by

Woodside, suggests 20 steps that should work interactively with the user – marketer and the advertisement database. The framework operates by creating a linkage between the user and the advertisement. The process starts by exposing the user to the advertisement, then examines if the user notices the advertisement or the link to it. It then goes into a set of processes to finally achieve what they call a better customer experience by providing the needed advertisement [18].

Another framework is the interactive advertising and presences framework. This framework focuses on interactive advertising it suggests changing the general definition of advertisement and moving it from the generic and massive approach to more of a personalized, quiet and engaging one[19].

III. FROM HYPOTHESES TO REQUIRMENTS

The suggested framework is based on a set of hypotheses, as follows.

A. Set of Hypotheses

Hypothesis 1: Adaptive Advertising is appropriate for online Advertising in terms of user acceptance and ROI.

Hypothesis 2: Social network data can be used to build an individualized user model for each user.

Hypothesis 3: Social networks themselves can play a role in the usage of personalized e-advertisement applications.

Hypothesis 4: Prior frameworks are not appropriate to reflect the features needed as described by the previous hypotheses.

In light of the above, we aim at creating a flexible framework that allows building of flexible systems, supporting the various features determined by the previous hypotheses, and further details this into a set of requirements.

B. Preliminary Study

A preliminary study was conducted for two main reasons; the first reason was to have the involvement of actual users before implementing the system. The second reason was to test the validity of the idea presented before taking any step further. The experiment was conducted with the help of a class of 3rd year students enrolled in the Computer Science degree, Faculty of Engineering Sciences in Foreign Languages, at the University "Politehnica" of Bucharest, Romania, studying a course entitled 'Web Application and Development'. 12 students volunteered to take part of the experiment.

The experiment lasted for over two hours. The methodology used for the experiment was the *user-centered methodology* [20]. Based on the methodology, the experiment should go through three main stages, where participants '*say – do – make*'. This was achieved by dividing the experiment into three main stages; the first stage was for the student to fill a questionnaire so they get to *say* what they think. The second stage was a short seminar to expand the students' knowledge about certain e-advertisement platforms and some adaptive hypermedia and social interaction concepts. In this stage students got to *do* by familiarizing themselves with all these concepts. The final stage was for the students to *make* their own systems. In this stage, the students were asked to design what they thought is the best

online advertisement system that is capable of fulfilling their needs. The whole experiment was supervised by two facilitators. The first facilitator, who was an expert on e-commerce systems, helped in ensuring that the participants were deploying the appropriate knowledge, without any direct intervention with design ideas from her side. The second facilitator was an expert on experiments monitoring, and was there to provide feedback on the experiment atmosphere and time frame.

The experiment resulted into two main outcomes; the first outcome was a set of requirements the users needed in their system. Some of these requirements were social interaction, the use of social network as a platform for adaptive advertisement and getting notifications about any new ads that they may be interested in. These are listed below. The second outcome was a set of statistical results from a questionnaire, based on the set of hypotheses, which the result of the questionnaire has proven to a certain extend. This is not further detailed here, as it has been described elsewhere [21].

In short, some of the main outcomes of this preliminary study are that advertisement is considered a major activity online, that looking at the advertisement (clicking on it) depends on what the advertisement is, and that users tend to check advertisement displayed within Facebook, possibly because these involve some small degree of personalization. From this and other responses, results showed that the main factors affecting e-advertisement are the personalization of the advertisement, as well as the popularity of the service/product advertised.

C. Set of Requirements

The requirements obtained are briefly listed below and are divided into input and output requirements. The input requirements are to be used in the development of the suggested framework and the output requirements to be displayed and used by end users.

- 1) Personalized advertisement should be based on (input):
 - User modeling techniques.
 - Browsing and purchasing history.
- 2) Personalized advertisement should provide (output):
 - Live notifications about the advertisement in terms of what has been clicked on or viewed by other users.
 - Targeted advertisements using social networks.
 - Social capability to interact with the advertisement in order to chat about it or comment.

IV. PROPOSED FRAMEWORK

The proposed processing framework was established based on two main resources. The first one is building upon previous literature and filling in the gaps by incorporating the social aspect that has not been introduced before in advertising. The second resource is the set of requirements and hypotheses proposed based on the outcomes from the preliminary study conducted.

A layered model has been derived in order to understand the proposed framework, seeing Fig. 1.

The layered model proposes three layers that work

interactively with each other. The first layer is basically two sub-layers working simultaneously, which are the data collection layer and social layer. Each layer works separately to perform a different task. The data collection layer is responsible for collecting the data related to online advertisements to be stored later in databases and the users' information that will be used later for building the user model. The social layer is responsible for aspects related to social networks (SN) application and any social interaction to be conducted. The adaptation layer is the layer that performs the personalization and adaptation by taking the data collected from both the data collection layer and social layer to build the user model appropriate for each user. The presentation layer is responsible for presenting the adaptive content to users where users interact with this content.

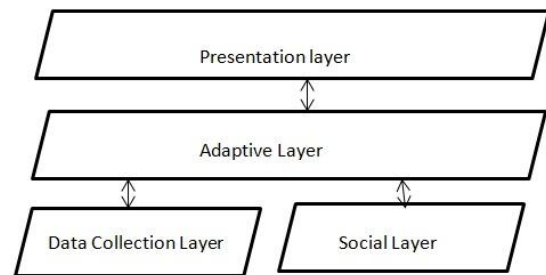


Fig. 1. MyAds layered processing framework.

The architecture of the system based on the above processing framework is further built upon the MVC – model, view, and control – design pattern where it uses the three tier architecture [22]. In our architecture, five main controllers establish the functionality of the system, as will be explained below. The proposed system is web based and is divided into the MyAds web services section, and the MyAds interface section (see Fig. 2). In the web services section, three main controllers work together, so the adaption can be performed and then presented on the interface, as shown in Fig. 2.

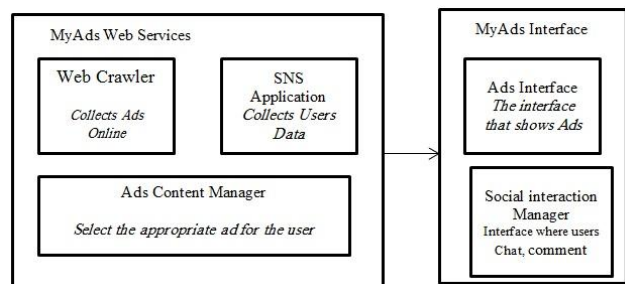


Fig. 2. MyAds architecture.

The layered framework proposes the layers in order to insure the separation of functions, reusability, felexibility and creating a dynamic web application. The system architecture fulfills what the framework proposed by creating different controllers each controller has a different functionality as works as follows

Web Crawler: the web crawler is responsible for crawling the web for all the ads available. These ads will be refined and mined based on specific parameters that are going to be defined based on the user model for each user. All the ads will be saved in a database to be retrieved later. The reason for using the web crawler at this stage is to collect as many ads as possible to insure that there is enough amounts of data to be used.

SNS Application: the social network application is built on top of the social network platform. The main aim is to collect all the relevant data related to users, data such as age, gender, interest and background, to mention some. These data will be used later on, to build the individualized user model for each user.

Ads Content Manager: in this part of the system the user model is built for each user, taking the information collected from the SNS application and connecting it with the appropriate ad(s) collected from the crawler. This operation is performed by mining the data from both the crawler and the SNS application and then suggesting the most appropriate ad to the user and getting it ready to be presented to the user.

Interface of the system: in the interface of the system that ad that has been adapted to the user will be displayed.

Social interaction Manager: on the interface of the system a live social interaction bar is located. In this section the users will get to comment, chat, share blogs and rate ads. This has been added based on the suggestions of the students in the preliminary study, who would want to be able to more comprehensively interact with the given ads. This would also be part of what we believe will encourage users to use this system.

The system should take into consideration accessibility issues and have a simple but coherent design. Fig. 3 is a snapshot of how the suggested system's main page would look like.

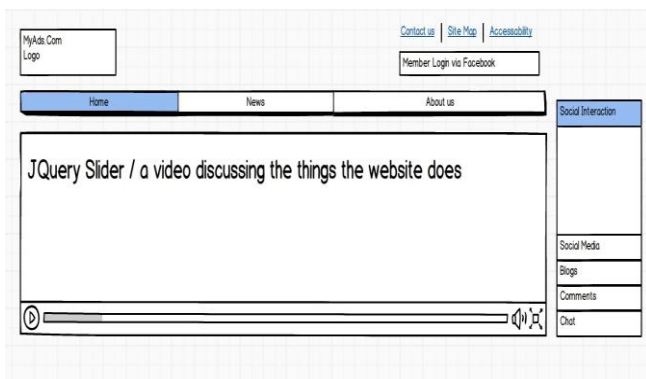


Fig. 3. Suggested home page of MyAds.

One of the main sources of data about users is the applications built on top of existing social networks, as well as the user's browsing history. In order to be able to collect these data, users should use MyAds by signing in with their social network user name and password. This may lead to issues such as the fact that users who don't have a social network profile cannot use the system, as well as potential privacy considerations. These need further explored during the system evaluation, beside the evaluation of the main functionality and usability.

V. SYSTEM EVALUATION

Since the proposed framework is a research-based system, the actual return of investment cannot be measured, because there won't be any actual buying of products/services or companies paying to display advertisements within the system. So there is a need for the development of another evaluation technique.

There are two ways of collecting data for evaluation purposes; the first one is via direct answers from users, which

can be performed via direct questionnaires given to them to evaluate the system as soon as they finish trying it. The second way is via tracking the type and number of clicks they have performed; for instance, did they click on the advertisements that are supposed to match their expectations? Also viewing time of ads can be taken into consideration, as well as the users' social interaction actions, such as commenting, chatting and rating.

The system will be implemented and then evaluated using questionnaires, which will provide qualitative as well as quantitative information, because questionnaires can collect enough data in a standard fashion and at the same time giving an adequate insight about the perceptions of participants [23]. The system will go through three iterations, and in each iteration the system will be evaluated to ensure the it satisfies the requirements of the theoretical framework.

VI. DISCUSSIONS AND CONCLUSION

This paper has suggested a new layered processing framework for adaptive online advertisement using social networks. The framework has been transformed into an initial architecture proposal, leading to a stand-alone web-based system that runs in a webserver. The system relies on a SNS application to collect data related to users by making the access to the system via a single sign-in line that is connected to the SNS application. The architecture of the system is based on the MVC pattern design since it is well known for its usefulness in interactive web based systems.

This system has come with challenges; one of the major issues is that if users don't want to use their SNS profile they won't be able to use the system, which is a limitation, since many users may have reservations to share their personal profiles, and thus the issue of privacy could be a major concern to users. Another limitation is the evaluation of the system. Since this is a research based system, the return of investment cannot be measured in terms of money, so the actual evaluation for this kind of systems cannot be measured accurately.

Although there are a number of limitations using the suggested system, there is also great potential for future work. For iteration number two of the system, access via the system will be extended to cover not only one SNS application but two or three, so the user will have the freedom to decide on the platform that he/she wishes to login in from. In the third and final iteration, the system will look into more than demographic data, interests and background. It will include text analysis of users' comments, wall posts and tracking the hitting of the 'like' button.

As discussed before, the suggested framework was a result of research of the literature and trying to fill the gaps on adaptive e-advertisement systems. Also an exploratory study was conducted to include actual users in the design of the system and record their perceptions and needs.

The results of both the literature and the exploratory study were used to design a layered processing framework, which includes three main layers. The first layer is divided into the data collection layer and the social layer, the second layer is the adaptive layer where all the adaptation and the building of the user model take place. The last layer is the presentation

layer, as based on the different users' preferences, different presentations will be displayed. Based on the layered processing framework, the three tier architecture was presented and the main controllers were defined.

The main evaluation tools will be questionnaires and studying the log file of users to track the number of clicks, viewing time and analysis of their social interactions.

As mentioned earlier, the system has some limitations, but at the same time it proposes an innovative approach of combining social aspects within adaptive advertising.

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