Towards Advertising on Social Networks

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ABSTRACT

Web advertising has become a financial backbone of business success nowadays. All major Web search engines such as Google, Microsoft and Yahoo! derive significant revenue from advertising. However, as a new area of research, online advertising has not yet reached its full potential. In particular, little research has been done on advertising on social networks. In this position paper, we present our review of some research issues related to advertising on social networks and some preliminary results in a related task of recommending news articles to users of Facebook.

Categories and Subject Descriptors
H.3.3 [Information Storage and Retrieval]: Information Search and Retrieval

Keywords
Algorithms, Advertising, User Modeling, Social Network

1. INTRODUCTION

Nowadays, the Web has become an integral part of our lives. The prevailing business model of Web search relies heavily on advertising. A major part of advertising is textual ads which are short textual messages. There are two types of advertising: (1) Sponsored search places ads on the result pages from a web search engine according to the user’s query. All major web search engines support such ads. Usually an ad consists of a title (3-5 words long), a description (around 20 words) and a URL that users are directed to by clicking on the ad. (2) Content Match or Contextual Advertising displays ads within the content of third-party Web pages.

As an emerging research area, online advertising has attracted much attention recently. The previous work can be summarized briefly as follows:

Ads matching: A lot of previous works have focused on developing methods to match pages to ads [20, 8, 4]. All these methods extract some features related to web pages to relate ads to pages. Some other works reduce the contextual advertising problem to sponsored search by extracting phrases from pages and matching those phrases with the bid phrase of ads [24].

Query expansion: Since user queries are short, some other works [18, 8] use additional sources of information for ad selection to expand users’ short queries. In this approach, offline query rewriting is done by using various sources of external information and thus can only be applied to repeating queries. In a more recent work [7], authors propose a more efficient online expansion-based algorithm. Their algorithm builds an expanded query by leveraging offline processing which is done for related popular queries. Their results show the effectiveness of such a method for advertising on rare queries.

Clickthrough prediction: In online advertising, predicting the clickthrough rates; i.e., the number of clicks a given ad will solicit if it is displayed on the Web page is done previously. Authors in [19, 21] predict clickthroughs by clustering ads by their bid phrases and by analyzing the different parts of the ads (e.g., bid phrase and title, . . . ), respectively. However, these works focus on ad-based features to predict the clickthrough for a new ad. Authors in [5] study the intention underlying users’ queries. They showed that clickthrough features such as deliberation time are effective in detecting query intent.

It seems that most research in online advertising has been focused on improving the relevance of the displayed ads to the page content. In other words, all these methods focus on maximizing the match between individual ads and the content of the page. However, there are other factors which also play an important role in effective advertising. In particular, as in the case of search, accurate understanding of a user’s interest and need is critical for effective advertising. A lot of previous works [1, 13, 23] of modeling the behavior of Web search engine users have shown improvement in ranking documents by Web search engines. It is thus important to study how to improve user modeling for advertising.

In this position paper, we suggest that tapping into the growing research on social networks opens up many interesting opportunities to obtain more knowledge about users, thus potentially improving the effectiveness of online advertising. Compared with the traditional sponsored search and contextual advertising, advertising on social networks has not been studied much yet. The purpose of this paper is to lay out some interesting research issues related to advertising on social networks and to discuss some preliminary results from a related task to advertising on social networks.

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SIGIR-IRA, July 2009, Boston, USA.
2. ADVERTISING ON SOCIAL NETWORKS

People usually live in some communities and are associated with (potentially multiple) social networks. A human social network can be a group of friends living within a city, or a group of college classmates who remain in frequent contact. It can also be a group formed specifically to accomplish a set of tasks over time. Social networks are well-trusted because of shared experiences and the perception of shared values or shared needs [10]. For example, friends tell friends about restaurants and movies. These characteristics of social networks have two important potential benefits for advertising:

First, advertising propagated through a social network can be expected to be more trustworthy. Indeed, people in social networks are often more willing to trust and accept recommendations from their neighbors. It is human nature to be interested in what a friend buys more than in what an anonymous person buys, to be more likely to trust a friend’s opinion, and to be more influenced by a friend’s actions. A Lucid Marketing survey found that 68% of individuals consult friends and relatives before purchasing home electronics – more than the half who used search engines to find product information [9].

Second, social networks potentially allow us to obtain valuable information about users through observing their activities. Moreover, social communities of users can also be leveraged to infer a single user’s interest in the same spirit as collaborative filtering. All these indicate that we can potentially leverage social networks (particularly interactions and relations of people) to better model users and improve effectiveness of advertising.

Based on this analysis, we believe that the three most interesting high-level research issues about advertising on social networks are:

- Advertising via relations: How to effectively advertise through relations and interactions of people in a social network?
- User modeling based on social networks: How to leverage social networks to obtain an accurate model of user interests and needs?
- Evaluation: How to evaluate the effectiveness of an advertising system in a social network?

2.1 Advertising via relations

Unlike conventional Web search, if query terms match some documents in the index, this query will lead to some results, whereas in Web advertising, if no good results are available for the user query, it is better/desirable not to show any ad results. In other words, showing irrelevant ads would annoy the user and not yield any economic benefits [6]. Indeed, a study in [22] confirms that ads need to be relevant to the user’s interest to avoid impairing the user’s experience.

Social networks offer unique opportunities for advertising through relations and interactions of people, which can increase the trust of users in the advertisement. Patterns of influence and cascading behaviors have been studied in social networks [17, 16, 12] previously. In [16], authors have studied a very large recommendation network and observed the propagation of recommendations in such a large social network. Their findings show that the recommendation chain does not grow very large and it terminates after the initial purchase of the product. They also observed that the product will propagate through a very active social network. In addition, they defined the stochastic model which explains the propagation of recommendations. Authors in [12] have also measured the network value of a customer. For each customer, they model the probability of buying a product as a function of both the intrinsic properties of the customer and the product and the influence of the customer’s neighbors in the network. Indeed, such studies open up new research directions and challenges in social networks for advertising.

The following are some interesting additional challenges for advertising through social networks:

- All social networks evolve over the time; as a result the advertising algorithm should take into account such evolutions, making modeling network evolutions an interesting challenge. If the network and this evolutionary behavior are well understood, it may be possible to drive a network to a profitable state.
- Modeling the influential nodes in social networks according to time for advertising is another challenge. These influential nodes are good targets for advertising as they could also influence others.
- Choosing an optimal set of users (group of people) to send advertisement to so as to maximize network profit is an NP-hard problem. Approximating algorithms will need to be developed to incorporate multiple factors such as relevance of an advertisement to a user, influence of users [11], and potential profit of an advertisement.
- Modeling how user’s interactions and interests would change not only with time but also with the specifications of the product is yet another challenge. These are related to the user’s interests which might also evolve over time. Modeling the evolution of interests of users in social networks is very challenging.

2.2 User Modeling in Social Networks

In social networks, we can gain more knowledge about a user, but the integration of this wealth of information also presents challenges. In general, users in social network for advertising can be modeled in two ways:

- Gaining direct knowledge about the users. For example, in Facebook, we can gain information about the networks/groups one belongs to, activities one does, one’s friends’ networks and a wealth of information one can post on his profile such as links to the news, youtube links and a lot more.
- Inferring the behavior and preferences of a user based on knowledge about other people on a social network that the user interacts with.

A major challenge here is how to integrate these pieces of information.

In addition to characterizing a user based on the information associated with the user in a social network, we may further incorporate other relevant external sources such as user’s blog posts, query logs, homepages etc., leading to
an even more challenging question of how to gain all such knowledge and then integrate it.

2.3 Evaluation

In general, evaluation of computational advertising may involve multiple performance factors (e.g., profit of product providers, profit from placing ads, and user experiences). Depending on which factor(s) to emphasize, we may need different evaluation methods. When relevance of advertisement is the primary factor for evaluation, we may adapt existing evaluation methods for information retrieval to evaluate advertising on social networks. However, since ad relevance is much more subjective than topic relevance, creating a static gold standard test collection may be difficult, making it a significant challenge to directly adopt the standard Cranfield evaluation methodology.

A more promising solution may be to use the logs of ad clicks to quantitatively evaluate an advertising algorithm by assuming a clicked ad to be relevant and a skipped one non-relevant [15]. Clearly, this evaluation strategy requires the deployment of a prototype advertising system and careful logging of user activities. There is also the challenge in developing an optimal interleaving strategy to compare different advertising algorithms.

3. LESSONS FROM A FACEBOOK NEWS RECOMMENDATION SYSTEM

As a study of user responses to recommending information through social networks, which is related to advertising on social networks, we present some lessons learned from developing a Facebook application for recommending news articles (called Facebook Newsletters). Since recommendation of news to users of a social network resembles advertising on social networks, some observations with our system may shed some light on the promise of advertising on social networks. Preliminary results indicate that most users find such an application useful and easy to use. It also shows that users of Facebook welcome recommendations given by their friends.

3.1 Overview of Facebook Newsletters

Facebook is one of the fastest growing social networks. It consists of many networks, each based around a school, workplace, or a region. It has users ranging from college students to working professionals. More than 100 million users log on to Facebook at least once each day [14]. As an experimental system for recommending information over social networks, we developed Facebook Newsletters, which provides daily newsletters for communities on Facebook.

In Facebook, each user has a personal profile and most users belong to one or more networks. Also, a user may join various interest-based groups on Facebook or may even start a new group. So, two users may be connected in three different ways: 1) User a is a friend of User b. 2) User a and User b belong to the same network. 3) User a and User b belong to the same group. We refer to both network and group as “community”.

A user may register a community by providing a keyword description and a set of news sources. The system then fetches the news articles from the specified sources (as well as standard sources such as Yahoo! News), and filters them based on the community description to prepare the daily news digest. It also prepares a list of popular articles for each community based on user feedback by using collaborative filtering techniques.

The application uses Facebook API to find out the networks of the user. The newsletters for the networks are available as tabs on the top of the page. The newsletter is presented as a list of articles, each with its title, news synopsis, links to original article and the locally cached page. Users can rate an article on a scale of 1 to 5. In the newsletter, the news articles are clustered, and the clusters are sorted on the score of the most relevant document in each cluster. Only one result per cluster is presented to the user, but the user can look at the other results by navigating through the “Similar pages” link. Only the top 5 results are presented to the user. The users can also recommend particular news articles to their friends through a recommendation button provided beside each news result. When a user makes a recommendation, his friend is sent a notification.

The recommendation of news articles was initially based on matching news articles with manually created keyword descriptions of a community. Matching articles are clustered using a centroid-based agglomerative clustering algorithm to alleviate the problem of redundancy. After obtaining user feedback, the system would improve recommendation decisions based on feedback information. The system is designed to collect and leverage the following three kinds of feedback information: (1) Clickthroughs of articles; (2) Ratings of articles; and (3) Recommendation of an article by a user to another user. All the feedback information is combined heuristically to improve filtering accuracy. More details about the system can be found in [2, 3].

### Statistics for all the communities:

<table>
<thead>
<tr>
<th>Statistics for all the communities:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of people registered:</td>
<td>60</td>
</tr>
<tr>
<td>No. of clicks:</td>
<td>350</td>
</tr>
<tr>
<td>No. of recommendations:</td>
<td>15</td>
</tr>
<tr>
<td>Average rating (out of 586 ratings):</td>
<td>3.41</td>
</tr>
<tr>
<td>Average rating for clicked article:</td>
<td>3.71</td>
</tr>
<tr>
<td>Average rating for recommended articles:</td>
<td>4.07</td>
</tr>
</tbody>
</table>

Table 1: Usage Statistics

3.2 Results of a pilot study

The Newsletters application was launched on Facebook for three months to conduct a pilot study of user responses. The application was advertised amongst university students by “word of mouth” publicity. In about three months, sixty people have added the application on Facebook from a number of universities. There were initially 3 seed communities on the application with available newsletters but for the period of this study (three months), this number has increased to 25. All the new communities are user initiated.

Table 1 shows the basic statistics of user clickthroughs and ratings. We can see that the average rating of a news article is 3.41 (out of 5), and it is higher for clicked and recommended articles. From these results, it seems that the articles that users clicked or recommended are the best candidates for including in the user feedback. This result suggests that if a user finds an article interesting, he would recommend the article to those friends who might also have an interest. This observation is true for advertising for products in that if a user finds a product useful, he suggests that product to those friends of him who have also indicated in-
terest in that product. A set of University of Illinois students were asked to use the application on a regular basis. They used the application for about one month and then a user survey was conducted to garner explicit feedback from them. Twenty two users participated in the survey. The survey results indicate that most users plan to continue using the application in future and said that they at least got one interesting article every time they used the application. 18 users (81.8%) said that they got some articles that they would not have gotten otherwise, through their newspaper or regular web browsing. This is a very encouraging result. 95% of the users found the application from somewhat useful to very useful. 95% found it fairly easy to use. Only 14% think that the application helped them somewhat useful to very useful. 95% of the users found the application from aging result. 95% of the users found the application from a very encouraging result. The results indicate that users find such a recommender system that leverages user communities in social networks is promising and presented some major results. In this position paper, we discussed why advertising on social networks is promising and presented some major research questions related to advertising on social networks. We also reported some preliminary results of a user study on a popular social network; Facebook, to understand the feasibility of recommending news to users in a social network. The results indicate that users find such a recommender system acceptable and useful, suggesting that it is potentially feasible to deploy a similar recommendation system on social networks for advertising.

4. SUMMARY

In this position paper, we discussed why advertising on social networks is promising and presented some major research questions related to advertising on social networks. We also reported some preliminary results of a user study on a popular social network; Facebook, to understand the feasibility of recommending news to users in a social network. The results indicate that users find such a recommender system acceptable and useful, suggesting that it is potentially feasible to deploy a similar recommendation system on social networks for advertising.

5. REFERENCES