A SOCIAL ENDORSING MECHANISM FOR LOCATION-BASED ADVERTISING

Lien-Fa Lin, Department of Information Communication, Kao Yuan University, Kaohsiung, Taiwan, R.O.C., lienfa0704@gmail.com

Yung-Ming Li, Institute of Information Management, National Chiao Tung University, Hsinchu, 300, Taiwan, R.O.C., yml@mail.nctu.edu.tw

Abstract

The proliferation of smartphones exploits many new opportunities for mobile advertising. Many researchers believe that mobile advertising will be not only a killer application in mobile commerce, but also a noteworthy business model for many emerging mobile applications to monetize. Location based advertising (LBA) is a new advertising that integrates mobile advertising with location based services. Since LBA is related to the location of smartphone users, we analyze the moving trajectory of smartphone user and then try to find out the suitable endorsers for disseminate advertising. In this paper, a mobile social advertising mechanism, which considers the factors of preference, location of service, moving trajectories of smartphone users, and the influence power of endorser, is proposed to enhance location based commerce. When the targeted users for location based service is identified, the proposed mechanism can discover the most appropriate endorsers, which can disseminate the ads to the target users at a suitable location. According to the evaluation model, location based service providers know that how to choose the endorsers for disseminating advertising messages so as to attract the most smartphone users.

Keywords: Mobile Commerce, Social Advertising, Location Based Service, Social Analysis.
INTRODUCTION

With the rapid rise of smartphone developments and online technological advances has brought about a burst in new forms of advertising (Nielsen report 2012). Mobile advertising is becoming a new marketing channel and has the capability to reach millions of smart mobile devices at the right time, the right place, and to the right consumer (Aaker & Stayman 1990). Along with the emergence of social media, location-based service and mobile device, John Doerr (2013) proposed a concept named SoLoMo (Social-Local-Mobile), taking the form of social networking service (e.g. Facebook, Twitter, and Foursquare) combined with mobile phone platform and positioning service (e.g. check-in and navigation), to envision a new paradigm of mobile commerce. Many new business applications are injected with the concept of SoLoMo. For example, marketers can explore potential customers by analyzing their behaviors on the social network platform and current location to make personalized recommendation of POI (point-of-interest), coupons or ads (Li & Du 2012) through the mobile channel to increase business opportunities. With the applications empowered with social and mobility intelligence, vendors can discover potential customers with high possibility of buying merchandise and the customer can also benefit from reducing the cost of finding the stores that suit their needs.

Although this new paradigm, it has a rising trend. However, it is still a big issue faced by enterprise about how to apply mobile advertising to effectively create value in business. According the report by Mary Meeker in 2012 Internet Trends D10 Conference (Mary Meeker’s 2012), mobile devices account 10% of the time spent on media, but to our surprise, the money spend in mobile Ad is only account for 1% of advertising spending, USA 2011. The average revenue per user (ARPU) also remains far behind on mobile. One of the primary benefits of mobile advertising is the potential to instantly link with consumers wherever they are positioned. Location-based services (LBS) appeal enormous attentions due to their potential to transform mobile communications via realizing a variety of highly personalized and context-aware services (Menon & Horney 2009). How to provide integrated social and mobile media is attracting increasing attentions from academics and practitioners. The traditional mobile advertising mostly relies on geographic location based mobile advertising. The ads are disseminated simply based on the information of user’s location. It is insufficient to meet the users’ need, which changes with dynamic contexts.

In this paper, a mobile social advertising mechanism, which considers the factors of preference, location of service, moving trajectories of smart phone users, and the influence power of endorsers, is proposed to enhance the effectiveness of location based advertising (LBA).

The proposed mechanism can feasibly distribute various types of LBS ads by considering the following three aspects. First, from the targeting aspect, the suitable receivers could be found based on the contents and characteristics of individual information and the service range constrained of LBS. The fitness degree between the ads and the receivers is evaluated before the advertising activities launched. Second, from the ad agencies aspect, the ad agency with high reputation and social influence is a powerful ad distributing strategy to reduce the negative reaction during advertising. Especially, when the endorsers with high influence to the receivers are selected, the ad will be more likely acceptable to the receivers. It helps to overcome the issues of the advertising avoidance. This helps the information propagation of the ad and reduces the occurrence of advertising avoidance. Third, from the synthesizing aspect, the proposed mechanism combines both the power of target and social advertising. When the targeted receivers are identified and clustered by the preference analysis, the system could further find out the set of most influential endorsers to deliver the advertising messages. Filtering out the targeted users helps to scale down the scope of advertising and discover the advertising agency effectively. The marketers can meet their expected outcome based on the objective of advertising by utilizing this synthesized target and social advertising strategy.

The remaining sections are organized as follows. Section 2 discusses the related literature. In Section 3, the research model will be demonstrated, and the experiments will be presented in Section 4. The
experiment results and evaluation are discussed in Section 5. Finally, Section 6 concludes this study and presents the directions of future research.

2 RELATED WORK

2.1 Location-Based Services

Location-based services (LBS) are a class of a computer program service, including the specific position and time data as control characteristic in computer programs, which is accessible with mobile devices and which uses knowledge on the geographical position of the mobile device. This service has become increasingly prominent with the growing of the market of smart phones and tablets. How to utilize smart mobile device and LBS to increase the sale volume is becoming a striking issue among the e-commerce market. The global location-based services market is a delight in high growth. Revenue forecasted reaches US $10.3bn in 2015, from $2.8bn in 2010 (Sythoff & Morrison 2011). A number of different factors driving market growth, such as increasing GPS and smartphone adoption, success of new business models, persistent growth of mobile advertising, and the broader coverage and higher speeds of wireless mobile networks. However, with the growth of LBS market, there are problems of low acceptance of LBS. Hence, how to meet a consumer’s need and attract more customers to use LBSs is the key issue. In this paper, we motivate on how to improve the acceptance of LBS with social advertising mechanism by exploiting social, location, and mobility data, which can also raise the revenue of LBS.

2.2 Online Advertising

There are three online advertising paradigms which have been popularly implemented: target advertising, social advertising, and location-based advertising. Target advertising focuses on identifying the right (targeted) receivers of the ad. By specializing and segmenting the market, the precise specific customers can be identified (Li & Du 2012). However, even the target advertising approach can effectively identify the end audience, an effective distribution channel is required to ensure the success of marketing. For example, when target advertising is applied in the form of direct marketing, the audience would feel offended and refuse to accept the ads delivered by the advertiser or the firm. This dismisses the effectiveness of the ad due to its inappropriate distributor. Fiorillo (2009) notes that social advertising can distribute appropriate ads through the friend network of users. Bagherjeiran and Parekh (2008) point out that the social relations and social interactions between users are the critical factors in realizing activities of social advertising.

The mobile advertising market poised for massive growth as it continues to exploit some appealing features of mobile devices, such as portability, personalization and instant access, mobility and wireless internet connectivity, context-aware and location-aware. All these appealing features coupled with useful applications have increased the adoption rate of these devices and as a consequence of these usages of these devices are growing fast. Therefore, it makes business sense to use the mobile devices as new platform for advertising, which can be customized based on the user’s preferences and geo-position. The users can also select the kinds of ads they want to receive on their smart phone. This information would be kept on a server, and the ad would be sent accordingly. During the first time set up, the subscribers will have the chance to provide their preferences for the kinds of ads to be received and displayed on his mobile device. In this paper, we also utilize these three factors to design the LBS advertising strategy and develop a social advertising mechanism to enhance the value of LBS advertising.

2.3 Endorser Marketing

Marketing with endorsers is a common and useful strategy. The person who can appear this influence on an individual or group is called the endorser (McCracken 1989). Kiss and Bichler (2008) widely review the general centrality measures for selecting influencers/endorsers from an endorser network.
for online marketing. An endorsed advertising message can affect the behaviors of customers. A celebrity endorser is a person who owns public recognition and uses this recognition on behalf of a consumer good by appearing with it in an ad. In other words, a celebrity endorser has a significant influence to affect people on behaviors.

The advertising researchers note that the positive emotional attitude is prominent on the goal of advertising and can be viewed as an indicator on advertising effectiveness (Aaker & Stayman 1990). Lee et al. (2003) also indicate that a greater pleasure and arousal emotion significantly led consumers to have a more positive attitude in the Internet shopping mall. This suggests that the endorsement strategy, especially the celebrity endorser approach, is helpful to conduct advertising and can be expected with better effectiveness. Since the endorsers can influence the behaviors of customers, the endorsement mechanism would be extremely helpful on advertising. In this paper, we adopt the concept of endorser marketing to develop a social advertising mechanism for LBSs to enhance the value of the ad received.

3 THE SYSTEM FRAMEWORK

To improve the positive impressions through a successful mobile social advertising, we should first find out the right target audiences to receive an LBS ad, and then exploit the social influence and trajectory analysis approach to identify the right location of endorsers to disseminate the LBS ad to do so. These ads would be spread within a valid LBS service scope (Lee et al. 2010) and realize the spirit of “disseminating the right ad to the right people via the right endorsers at right place.” Figure 1 depicts the system framework of the proposed system.

1. The system identifies targeted customers according to the product, location and promotion characteristics of the LBS that the advertiser is planning to distribute.

2. The system constructs a network of candidate endorsers located at the valid service scope of the LBS.

3. The system discovers the most appropriate endorsers from the network of candidate endorsers. These seed endorsers should be delegated to disseminate LBS ad to the target smart phone users (SPU) that they will move across the valid service scope of the LBS service provider.

In the context of traditional service cell without disseminating LBS ad, the target users just move in accordance with the established path of habitual. However, it cannot make the most of the target users to use the LBS. With the help of the social advertising nowadays, the most target users of LBS can be attracted and turn their moving direction to the service provider. Figure 2 illustrates this scenario.

To match the objective of attracting the smart phone target users to turn their moving direction to the location of LBS service provider, several techniques are required. The main components considered in the system framework consist of the target discovering mechanism, the endorser candidate network constructing mechanism, and the seed endorser identifying mechanism. The system framework is depicted in Figure 3.

3.1 Target discovering mechanism

The target discovering mechanism analyses the fitness degree between the preferences of users and the service type of LBS. Measuring the similarity between the categories of their preferences and the category of the LBS will discover target users. In addition, because the service is location dependent, only those customers close to the valid service scope can be the finally target users.

3.1.1 Preference Analysis Module

Because the property of a user group is considered as a vital factor, using preference analysis techniques to identify target users is essential. This module is designed to analyze the preferences of
users and categorize them. The basic measurement is to analyze the profiles and the posts of users. It helps to find the keywords representing the key characteristics and tendencies of users.

The static preferences of users are the information obviously discovered from their profiles. Since the profiles data will not be updated frequently, it is viewed as “static” preference. The data can be gathered from self-revealed information.

The interests of users are not always identical all the time. In general, the user profiles will not be updated regularly. This makes it difficult to find the changes in their interests from their profiles. However, their changes in interests could be learned from their recent conversations. What they mention in their latest conversation might reveal their new concentrations and interests. The information revealed from users’ recently posts is defined as “dynamic” preference. The dynamic preferences are used to support and expand the static preferences discovered from user profiles. Consistent with frequently used the keywords discovered from the messages of interactions, we can categorize them by matching the keywords described in the LBS service type developed in subsection 3.1.2. As stated by the preferences of users, they can be classified into different categories.
3.1.2 Ad Attribute Analysis Module

The objective of this module is to position a given ad. The target users are discovered and identified by analysing the similarity between the users’ preference categories and the ad’s category. To evaluate the fitness between an ad and users’ preferences, a tree-like structure is adopted in this study. There are several prior studies used the same structure, particularly in the fields of product taxonomy (Ziegler et al., 2004) and semantic similarity in taxonomy (Resnik 1999). We use the distance-based approach, which has been shown better than other keyword-based similarity estimate approaches (Yuan & Cheng 2004), to evaluate the similarity between an ad and a target user’s preference. Assume user \( u \) is allocated under category \( C_u \) and ad \( a \) is under the category \( C_a \). The \( C_m \) presents the first mutual node that \( C_u \) and \( C_a \) has. So the distance from \( C_u \) to \( C_m \) and \( C_a \) to \( C_m \) will be used to measure their similarity based on the category tree. This similarity degree is formulated as:

\[
\text{Sim}(C_u, C_a) = \frac{2D_{an} + D_{am} + 2D_{mn}}{D_{an} + D_{am} + 2D_{mn}},
\]

(1)

The distance from node \( C_u \) and \( C_a \) to the node \( C_m \) is denoted as the \( D_{an} \) and \( D_{am} \). And the length of the path from \( C_m \) to the root node in the category tree is represent as \( D_{mn} \). As a user may have multiple preferences, we can further compute the average fitness score by the following formula.

\[
\text{Fitness}(u, LBS) = \frac{1}{|\Phi\text{Cate}(u)|} \times \sum_{C_a \in \Phi\text{Cate}(u)} \text{Sim}(C_u, \Phi\text{Cate}(LBS)),
\]

(2)

\( \text{Cate}(X) \) denotes that \( X \) is categorized into which category. \( \Phi\text{Cate}(X) \) represents all preference categories of \( X \). By the fitness computation formula, we can find the set of targeted customers who have interest in the advertising message the sponsor will distribute. We denote the set of target customers as \( TU. \ TU = \{u | \text{Fitness}(u, LBS) < \epsilon \} \), where \( LBS \) is the service type promoted by LBS service provider and \( \epsilon \) is the threshold for fitness acceptance level.

3.1.3 Valid Service Scope Analysis Module

Due to location-dependent service is only serviced at specific location. Hence, even the smart phones users have received a very attractive ad for LBS, if the distance is far away from the smart phone users to LBS, the smart phone users can’t drive to the LBS destination and use this service. To ensure having the positive effect for mobile advertising, in this paper, a valid service scope is given for LBS. The objective of this module is to find the customers who live nearby the location or habitually move across the service range of LBS. The measurement of this module is denoted as GF score that represents the degree of geographic fitness for a customer to use the LBS. The processes of location dependent information collection bounded with the LBS are explained as follows.

The location data is obtained directly from the user profile recorded in the mobile social network platform to find out the customers who lives or has ever lived in the city where the LBS locate. The location information of a customer, such as company address and current city he/she lives, can be obtained from his/her profile. The static location vector of customer \( i \) is represented as \( SL(u_i) = [\text{company}(u_i), \text{city}(u_i)] \). If \( LBS \) providing the service is located in city \( L(LBS) \), the static location score for customer \( i \) with respect to \( LBS \) is measured as formula (3).

\[
\text{Static}(u_i, LBS) = \begin{cases} 
1 & \text{if } \text{company}(u_i) = L(LBS) \text{ and } \text{city}(u_i) = L(LBS) \; , \\
0 & \text{if } \text{company}(u_i) \neq L(LBS) \text{ or } \text{city}(u_i) \neq L(LBS) \; .
\end{cases}
\]

(3)
where $0 < a \leq b < 1$.

As well as static profile information, some hidden information from the customer activities on the online social network platform could be gathered as well. Numerous social networking services, such as Foursquare, Whrrl and Facebook allow users to “check in” to a physical place and share their location with their friends. Users can issue a message of check-in information to a specific location via text messaging or by using a mobile application on a smartphone.

In this paper, check-in information is used to analyse user’s activity location information. In general, check-in information has the coordinate of physical check-in position and tagged friends who are staying together with the check-in user. According to the address of the LBS, we can calculate the distance between the check-in position and LBS service provider and use it to find the candidate customers. For $LBS_j$, a distance score of certain check-in information was used to express the distance degree from the position of check-in to $LBS_j$.

We denote $CI$ as the number of total tag-ins contained in all check-in information. The rank value of check-in information $CI_i$ toward $LBS_j$ is represented as $rank(CI_i, LBS_j)$. If the rank value of check-in information $CI_i$ is the nearest one from $LBS_j$, the rank value of check-in $CI_i$ is equal to 1. The distance score of check-in information $CI_i$ toward $LBS_j$ is normalized as formula (4).

$$
activity_{-rank}(u, LBS_j) = \frac{CI - rank(CI_i, LBS_j)}{CI},
$$

(4)

For $LBS_j$, the activity score of customer $i$ is measured by averaging all the distance score of each check-in information which customer $i$ had published or was tagged in. The activity score for customer $u_i$ with respect to $LBS_j$ is measured by aggregating all the check-in ranks of user $i$ who was tagged and is formulated as:

$$
Activity(u_i, LBS_j) = \frac{\sum_{i \in \Theta_{Tag}(u_i)} rank(u_i, LBS_j)}{|\Theta_{Tag}(u_i)|},
$$

(5)

where $ci$ and $\Theta_{Tag}(u_i)$ is the set of check-in in which user $u_i$ was tagged. Finally, the final $GF(u_i, LBS_j)$ is obtained by aggregating Static and Activity scores and expressed as:

$$
GF(u_i, LBS_j) = Static(u_i, LBS_j) + Activity(u_i, LBS_j),
$$

(6)

3.2 **Endorser Candidate Network Constructing Mechanism**

After discovering the target users, an endorser candidate network can be constructed within the valid service scope of LBS. Endorser candidate $E$ refers to people or organization with sufficient capability to serve as advertising seeds for these target users and are predefined, registered or contracted, with fitness the LBS service type and within the valid service scope of LBS, as shown in Figure 1 step 2.

3.3 **Seed Endorser Identifying Mechanism**

Having constructed the endorser candidate network, the system will identify the suitable seed endorsers from the network and delegate them to deliver the ad. In this paper, users’ social factors are analyzed to find out the suitable seed endorsers. The following modules are designed to identify suitable seed endorsers.

3.3.1 **Social Influence Analysis Module**

Excellent endorsers should have a great influence on their customers. The greater the influence, the more people he or she can influence. In this sense, the influence of all candidate users should be analysed. Popularity influence is used to measure the popularity degree of a user’s posts. The
messages posted by a user might be responded to, forwarded, or even just marked as ‘like’. These three kinds of feedback actions from friends are collected to calculate the popularity degree of a user.

We denote $\Phi_{\text{post}}(u_i)$ as the set of messages posted by user $i$, while $\Phi_{\text{resp}}(u_i)$, $\Phi_{\text{ford}}(u_i)$, and $\Phi_{\text{mark}}(u_i)$ represent the sets of $i$’s posted messages that are responded to, forwarded, and marked by other users respectively. The formula for the social influence of user $u_i$ is represented below:

$$S_F(u_i) = \frac{|\Phi_{\text{resp}}(u_i) \cup \Phi_{\text{ford}}(u_i) \cup \Phi_{\text{mark}}(u_i)|}{|\Phi_{\text{post}}(u_i)|},$$

(7)

### 3.3.2 Mobility Influence Analysis Module

In general, customers are willing to use the service whose location is close and convenient to reach. Transportation convenience is one of the important factors affecting the customers’ purchase intention. If the transportation convenience is greater, more people will be attracted to use the LBS. In this sense, the moving trajectories of all candidate users should be analysed.

First, we consider the influence of distance between the current position of $SPU$ and $LBS$. Generally, the longer the distance between $SPU$ and $LBS$ service provider, the lower the probability that the $SPU$ will move to the $LBS$ service provider. On the contrary, the shorter the distance between $SPU$ and $LBS$ service provider, the lower the probability of $SPU$ moving to the $LBS$ service provider. Taking figure 4 as an example, if $u_i$ receives $LBS$ ad at advertising cell $Endorser_j$, then the distance from the $Endorser_j$ to $LBS$ service provider will affect the $u_i$ to use this $LBS$ service. We denote $d(Endorser_j, LBS)$ as the distance between the location at which the target user receives the ad and the $LBS$ service provider. The formula for the distance influence of user $u_i$ is represented below:

$$L_F(u_i) = e^{-d(Endorser_j, LBS)},$$

(8)

Next, we consider the location of the $LBS$ service provider is consistent with $u_i$’s moving direction or not to decide whether the $users$ will go to use the $LBS$ or not. Following general behaviour patterns, when $u_i$ receives the $LBS$ advertising message, $u_i$ will go to use the $LBS$ is decided by the direction to the position of $LBS$ service provider is consistent with the moving direction of $u_i$. If $u_i$’s direction of movement is consistent with the position of the $LBS$, then the probability for $u_i$ to use the $LBS$ is high. On the contrary, if $u_i$ moves in the opposite direction with $LBS$ service provider, then the probability for $u_i$ to use the $LBS$ is low. We term this factor as moving direction effect ($Md_F$ for short). The $Md_F$ is measured as:

$$Md_F(u_i) = e^{-\theta(\text{Endorser}_j, LBS) - \theta(\text{Path}(u_i), \text{Endorser}_j)}},$$

(9)

When we select a suitable endorser, the influence degree, the distance, and the moving direction to $LBS$ service are three important factors to be considered. By this reason, the three scores are...
aggregated to get an overall score for the endorser. The endorser score (ES) for a typical user $u_i$ can be defined as below:

$$ES(u_i) = So\_F(u_i) + Lo\_F(u_i) + Mo\_F(u_i),$$

(10)

We use the endorser score $ES$ to rank all the users existing in the endorser candidate network. The Top-$K$ ranked users would be selected as endorsers to spread advertising information.

4 Performance Design

In this section, we describe the experiments used to verify the proposed social advertising mechanism. The experiments are conducted in a popular social networking website, Facebook. The experiment is designed to send messages in private. On Facebook, when the message publisher delivers a message to a receiver by the message sending function, only the receiver can receive this message. The experiment’s LBS ad will be delivered in this way to measure the source of LBS message. The LBS message used in the experiment is a hyperlink with social text (endorser + distance to LBS + moving direction) (See Figure 5). When the participants click the hyperlink, they will be redirected to visit the webpage of product with detailed information. The category tree of LBS is built according to the product category of Amazon. The information collected from the Amazon is used to build a category tree with three general categories (Entertainment & Living, Consumer Product, and Computer, Communication & Consumer Electronics).

![Figure 5. Social diffusion of LBS Ad](image)

The category tree is important and helpful in categorizing for users’ preference and the LBS type. Regarding the experiment ads, all the required product information for the experiment is collected from or referred to the famous web sites like Amazon, best Buy, and Yahoo. This provides various kinds of ads for the experiment in this research. After ad receivers visiting the web site, they can click the hyperlink under the LBS ad to provide their feedbacks on the ads received. The feedbacks of the receivers, we collect the following information (the user id of the receiver, the user id of sender, the degree of preference matching, the appropriateness of the ads sender, and the willingness of using LBS inspired by the sender).

The information collected from the first two questions would be used to understand the diffusing path and touching the target users or not. The rest questions would be used to collect the information of receivers’ subjective comments as the indicators for evaluating the effectiveness between different diffusing strategies. In the experiment, the snowball sampling method (Wilson and Nicholas, 2008) is used to construct the network structure of the experiment. Initially, we invited 7 users, who are willing to authorize us to collect their social information. With their help, we further invite their friends and friends-of-friends. After removing these users without any check-in of which position falls in LBS’s
valid service scope during recently three months. Finally, there are totally 67 users participated in the experiment (male: 56\% and female: 44\%).

In order to decrease the limitation made by the lacking profile information, the participants are requested to select at most five types of interested information when they first join the experiment. These information would be taken as the static preferences of users. The dynamic preferences are discovered by the CKIP, a system for Chinese word segmentating. To discover the dynamic preference of user SPU, the posts within recent three months would be collected and then processed by CKIP to token the frequent appeared word. If this word represents a new interest of user SPU, it would be added into the preferences of user SPU.

To exploit the efficiency of the proposed mobile social advertising approach, we compare the performance of our approach with others approach. In this paper, three different endorser selecting strategies are designed to identify the set of seed endorsers. The three different strategies are as follows.

1. Mobile Social Endorser approach (MSE): this advertising approach is based on the proposed architecture.
2. Hot Spot approach (HS): this approach identifies the seed endorsers by directly evaluating the candidate endorser sites which has the most target users move across.
3. Random selection approach (Random): In this approach, the seed endorsers are selected randomly.

These three different advertising strategies will be designed as a set in each experiment to collect the reaction of receivers. Each strategy prepares similar but not the same ads for the target receivers. So in each experiment, we will get feedbacks for three different approaches.

5 Experiment Results

In this session, we discuss the results of the experiment and insights discovered. The attracted rate of the target users and ad effectiveness level are used to measure the performance of various advertising strategies.

5.1 Target User Attracted Rate

Target users are the users whose preference matches the ad to distribute. The target user attracted rate (TAR) is defined as the ratio of the target users who actually drive to the destination of LBS service provider and can be calculated as:

$$TAR = \frac{|\Theta_s \cap \Theta_t|}{|\Theta_t|}, \quad (11)$$

where $\Theta_s$ is the set of users who drive to the destination of LBS service provider. The target user attracted rates of different advertising approaches are shown in Figure 6:

![Figure 6. Average TARs of different advertising strategies](image-url)
In average, the target user attracted rate TAR of MSE is 41.17% and the TAR of the HS is 35.35%. The average TAR of the random approach is 15.78%. The results demonstrated that MSE performs better than other advertising approaches in attracting the targeted users to destination of LBS service provider.

5.2 Ad Effectiveness

In the following, we examine the feedbacks and ratings collected from the users diffused to verify the effectiveness of the advertising strategies. Three indicators, satisfaction on ad information, sender appropriateness, and purchase willingness, are used to measure the effectiveness of advertising. The distributions of these three indicators among three different strategies are depicted as below:

![Figure 7. The average score on three different strategies](image)

From Figure 7, the MSE approach has higher average rating scores than other two strategy approaches. The higher average score of MSE in the preference matching shows that MSE can effectively send the fitter LBS ads to target users. The higher average score of MSE in the sender appropriateness suggests that MSE can effectively select out suitable spreaders which are favoured by the receiver to share the ads. Also, when discussing to the willing accepts LBS, MSE gains a better persuasive effect than HS and Random selection approaches.

6 Conclusion

In this paper, we study the problem for attracting the smart phone users to the destination of LBS service provider. To solve this problem, we proposed a social endorser advertising framework, which consider the social influence of endorsers and the distance and the moving direction of targeted users to the LBS service provider. To improve positive impressions through a successful social advertising we first find out the right target audiences to receive an LBS ad and exploit the social influence and trajectory analysis approach to identify the right location of endorsers to disseminate the LBS ad to do so. The experiment results demonstrated that proposed mechanism performs better than other advertising approaches in attracting the targeted users to the destination of LBS service provider.

There are several limitations and research issues that can be studied further. First, constrained by the users’ concerns about privacy, the experiment was only conducted in a small part of the whole networks. This limits us to use a more rich and comprehensive data to valid the proposed goal. With the comprehensive data of the whole users, it might conduct more significant experiment results. Second, location-based group-recommendation is also a new area for advertising. With the help of GPS and social media, we find a set of friends nearby and recommend what they like to consume together. Lastly, the trend of synchronizing information to operate several social media should be further examined. It will be a new issue to measure and manage the social activity among different social media platform. This issue also affects the idea of the nature of information delivering and advertising.
References


