

# DESIGNING A RECOMMENDER SYSTEM BASED ON SOCIAL NETWORKS AND LOCATION BASED SERVICES

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## ABSTRACT

*Mobile devices have diminished spatial limitations, in a way that one can personalize content in a suitable frame considering individual's location and present it. Yet, it is not possible to consider user's interests and preferences in a suggestion provided using just place-based services. Current generation of place-based services do not provide users with personalized suggestions, instead they just offer suggestions close to interests based on users distance from the place where they are. In order to solve this problem, the idea of using social recommender systems was discussed which contains capability of identifying user's interests and preferences and based on them and user's current place, it offers some suggestions. Social recommender systems are a combination of social data on web like; user's social networks and spatial information. Because user's information include personal information and interests in social network sites, considering user's current location and the information existing in social network data base, it is possible to provide user with a suitable suggestion. Through this method users' interaction decreases and they can acquire their favorite information and services.*

## KEYWORDS

*Recommender System, Social Networks, Location based services, Mobile Device,*

## 1. INTRODUCTION

Mobile devices have removed the location limitation such that one can personalize and suggest content in suitable form to him or her while considering the environment where the person is. For example, the tool can be used to obtain updated information about sightseeing around the world. The information can be shared with other users interactively. There are certain challenges in this area such as lack of an efficient model, diversity of information and the reality that the information is not collected in a central server [1].

Personalization process is fulfilled using the information obtained from learner. On the whole, the goal for personalization is to suggest a collection of comprehensive activities taking into consideration factors such as location, user preferences and interest and so on [2]. Personalization is performed through two methods: adjusting the learning services with learner's features such as learning methods, demands, situations, efficiencies, preferences and criteria; learning system conformation with learner's surroundings. Interrelation between user and user with the nearest neighborhood algorithm is used by most personalized systems. User-user interrelation is resulted from statistics and figures which signify the interrelations between variants and it is used to measure the model efficiency. In recommender systems, the interrelation is used to measure the rate of similarities between two users and to identify the users who are expected to be categorized.

There are just a few systems that use a combination of spatial data and social data on web like social networks, web page visits by users or applying search engines simultaneously. Biancalana et al [2] discussed the idea of such compound system. The system designed in [3] uses the information which is collected based on user's preferences and its content information includes location, elapsed time in the distance, the direction of the selected path, personal preferences and various user systems. Buchman and Hinze designed a system which suggested information about the sightseeing to tourists [4] and its content information included user location, present time, interests and such information about sightseeing as their locations, types and similarities. Other system called Cyber guide has been designed for tourism industry [5]. This system acts as human guide and uses PDA and GPS to give service to tourists in a site. Other system designed in [1], called Murshid uses Google Map as a visual guide. It is a content intelligent system which uses user location information, his or her interests, job and time schedule.

New generation of place-based systems do not provide users with personalized suggestions, rather, based on the distance from where they are, they just offer suggestions close to interests. In order to solve this problem, the idea of using recommender social systems was discussed. Those systems contain capability of realizing user interests and preferences and based on them considering user current place, they provide some suggestions. In systems which are based on user preference place, the data required or points related to the content being used e.g. day of the week, time, weather, user activity and transfer tool are not provided. Therefore, users become afloat in suggestions which can even be of no interest for them and there is a possibility that this suggestion results in user's dissatisfaction. In mobile devices, due to limitations like; small screen, limited input and things like that, the problem is intensified. Many investigations have been performed about content to suggest suitable services to users and certain recommender systems are introduced in brief in table 1.

	<b>MIT Media Lab</b>	<b>National Tsing Hua Univ.</b>	<b>Telematica Institute</b>	<b>Murshid</b>
<b>Recommendation type</b>	Restaurant	Restaurant	Travel information	Tourism industry
<b>Context information</b>	Location	Location, Time, Weather	Location, Time, Weather, Shopping list, Schedule	Location, profile, Time, user interaction
<b>Recommendation method</b>	Interaction between 2 agents	Search after requesting	Variable prediction strategy	reasoning engine, J2ME
<b>Device</b>	PDA, GPS	Pocket PC, GPS	Mobile phone, GPS	Mobile phone, GPS, Google map

Table 1: some existing context-aware recommender systems

The model suggested in this article shows the process of providing recommendations for the user, considering spatial factors and user's personal information. In a touristic place, suggested model can be used to find entertainment places like; parks and restaurants or art museums and concerts held in that area.

Article's structure is as follows: social networks are defined and analyzed in second section. Section 3 discusses place-based services. Suggested model is considered in section 4. Section 5 considers evaluations and conclusion is contained in section 6.

## **2. SOCIAL NETWORK**

### **2.1. Social Network definition**

A social network is defined as a social structure of people having relationship based on casual interests e.g. friendship and honesty [6]. Social network system focuses on the structure and identification of on-line social networks for those who share their interests and activities or those who are interested in browsing others' interests and activities. These networks, first, are used in order to making friends and sharing ideas among members but today they are used in order to do business and data sharing. Of course as the time passes, two business and friendly environments are combined and change into compound environments [7 & 8].

Generally speaking, based on kind of their application, social network environments are divided into following groups:

1. Friendly environments where people mostly chat or share ideas. These groups are formed in order to make friendships and share photos and videos among friends for free.
2. Business environments where users perform business tasks as sellers or costumers. For sellers, these groups are formed due to monetary benefits and for costumers for supplying needs.
3. General environments which are formed in order to discuss and share information and create knowledge as well.
4. Compound environment where there is a combination of friendly environment and business or scientific environment users. As the time passes two friendly and business environments are combined and change into a compound one [8].

Social networks are reliable due to their experiences, understanding values and needs [9]. For example, friends chat about restaurants and cinemas. This point about social networks contains two important potential benefits for advertising as well [10]:

- The advertisement displayed through social network can be considered as more reliable. Actually, people prefer to rely on recommendations provided by their friends and neighbors because human nature is more interested in what a friend buys, not an unknown person, and it is likely that the user relies on a friend's ideas and is influenced by his/her actions.
- Potentially, social networks allow organizations to acquire valuable information about users through observing their activities and this property of social network results in an improvement of advertisement effects.

### **2.2. Social Network analysis**

The title Social network analysis includes recording and measuring the relationships and events among individuals, organizations and basically any other identity containing a capability of data and knowledge process. Nodes in this network are individuals and groups and its edges are their relationships. Social network analysis includes visual and formal analysis of human relationship. Web and pages existing in it are an example of social network. Actually, pages can be considered as nodes and links among them as edge among these nodes. On the other side, as new generation of webs appeared and considering their main factors i.e. weblogs and wikis, the importance of social networks in web is now higher.

Through theoretical rules, methods and related researches, social networks analysis has transformed from an implicit industry into an analytical route for paradigms. Analytical proofs evaluate all things from whole to component, structure to relations and individuals, from manner to behavior of all through networks where all courses including special relationship among population are defined or they consider individual networks which include courses like; private societies acquired by special individuals [11].

Recently, much attraction and interest has been observed in social network analysis among data mining groups. Its main motivation is exploitation, recognition and awareness of values collected concerned with users' social behavior in on-line environments. Data mining techniques when analyzing social network data especially for massive data collections are considered as useful which are not controllable through traditional methods. This section provides an introduction to important issue of data mining in social network analysis and research routes review where even primitive application of data mining techniques results in a considerable statistical improvement of reaction accuracy throughout cyber community [6].

Social networks have been used for evaluating the quality of mutual effects within systems and describing lots of informal connections which connect administrators to each other and in this regard, they cover individual relationships among employees in different organizations very well. These networks play a crucial role in commercial success and job achievements. They provide paths for companies to collect information, avoid competition and even collude with each other to adjust prices and policies [12].

### **3. LOCATION BASED SERVICES**

Location-based services are value added ones in which position information is used to present diverse and interesting services to user including emergency services, vehicle navigation systems, tourist broadcasting services, searching in country- wide or urban sites data banks using map.

Geographic Position System (GPS) works based on satellite tracking and allows user to locate every point on the globe accurately. Mobile learning can be conducted through tracking by GPS. The GPS data can define three concepts: users, locations and activities in a certain site [13].

Another facility is communication network (BSC and BTS).BTS is responsible for exchanging radio waves with mobile unit as well as control and exchange data with BSC. BTS consists of independent transceivers, providing aerial and radio connection with mobile unit. BTS is the smallest unit of service provider in mobile radio network, supporting the certain region of the network called cell. BTS is designed to support higher radio coverage in roads or where the signal is weak and to meet traffic needs and its regular range in a smooth region is 30-35 KMs but it is 20 KMs in practice.

Radio Frequency Identification (RFID) is one of modern tracking technologies to locate user. This system identifies mobile and static objects by radio waves. In this new method, certain tags are used to store data. The data would be restored when needed [14]. The smart tag can be embedded inside electronic and non electronic products, animals and human body. The tag can be identified via transceiver waves in any time and place. RFID is now used for tracking vehicles, people, objects, security, transaction register and so on.

Google Map is another method in which the map can be efficiently downloaded and stored for future use. In its new versions, maps can be illustrated two and three dimensionally and it is possible to search the locations, to mark the interested points on the map, to give support for such services as Street View and My Tracks and audio guide.

#### 4. THE SUGGESTED MODEL

Mobile devices have diminished spatial limitations, in a way that one can personalize content in a suitable frame considering individual's location and present it. Yet, it is not possible to consider user's interests and preferences in a suggestion provided using just place-based services. Current generation of place-based services do not provide users with personalized suggestions, instead they just offer suggestions close to interests based on users distance from the place where they are. In order to solve this problem, the idea of using social recommender systems was discussed which contains capability of identifying user's interests and preferences and based on them and user's current place, it offers some suggestions.

In place-based systems, user's preferences, its required information or dimensions related to the content used e.g. day of the week, weather, time, user's activity and transfer tool are not presented. Therefore, user becomes afloat in suggestions that may even be of no interest for him/her and there is a possibility that this suggestion result in dissatisfaction for user. The problem gets worse in mobile devices due to limitations like; small screen, limited input and things like that. Figure 1 shows the process of recommending a visitor a new place to visit.

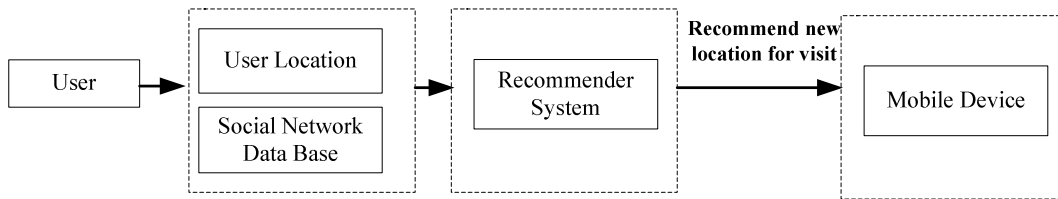


Figure 1. process of suggesting new place to visit

Social recommender systems are a combination of social data on web like; user's social networks and spatial information. Because user's information include personal information and interests in social network sites, considering user's current location and the information existing in social network data base, it is possible to provide user with a suitable suggestion. Through this method users' interaction decreases and they can acquire their favorite information and services.

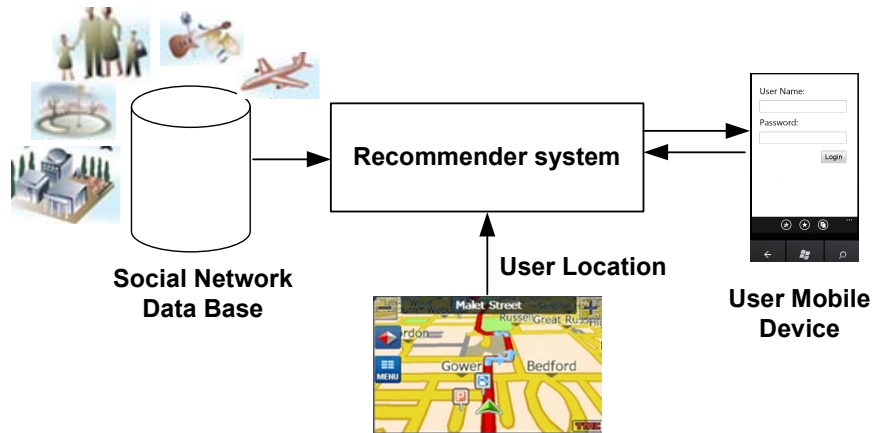


Figure 2. Spam traffic sample

Figure 2 shows the process of suggesting to a user considering spatial factors and user's personal information. Suggested model can be applied in a touristic area in order to find recreational places

e.g. parks, restaurants or to find art museums or concerts held in that area. These steps are discussed in the following:

One valuable capability of recommender systems is applying social network. Applying social information on the web like; social network, visiting web pages by user and manner of search engines in order to personalize content is very important for the user. Social network data base includes issues like; age, job, skill and expertise, favorite food, favorite entertaining places ... people can discuss their ideas about different issues and share them with each other in these networks. For example, if a person has visited a special place, he/she can discuss it his/her personal page and others give ideas.

User's location can be measured by technologies like; GPS, RFID or Google map. If this location is not defined automatically, user can declare the location manually. In suggested model Google map is used to identify user's location. This software is a very efficient map with a capability of downloading it for considered place, saving and keeping it for when map is needed.

User plays a crucial role in system and its information exists in social network data base. So it can login a system using mobile device and is identified for the system through this method. The task is done by entering a username and password in order to distinguish users as well. The method used in recommender system is collaborative grouping. The main idea in this article is that similar users receive similar services, i.e. if two users have similar interests they are placed in one group. Recommender system provides a suitable suggestion using contents existing in data base and conforming it to user's location.

## 5. CONCLUSIONS

Personalization process is fulfilled using the information obtained from learner. On the whole, the goal for personalization is to suggest a collection of comprehensive activities taking into consideration factors such as location, user preferences and interest and so on. New generation of place-based systems do not provide users with personalized suggestions, rather, based on the distance from where they are, they just offer suggestions close to interests. In order to solve this problem, the idea of using recommender social systems was discussed. Those systems contain capability of realizing user interests and preferences and based on them considering user current place, they provide some suggestions. The model suggested in this article shows the process of providing recommendations for the user, considering spatial factors and user's personal information. In a touristic place, suggested model can be used to find entertainment places like; parks and restaurants or art museums and concerts held in that area.

## REFERENCES

- [1] A. Echtibi, M. J. Zemerly, and J. Berri, (2009) "A Service-Based Mobile Tourist Advisor", *International Journal of Computer Information Systems and Industrial Management Applications (IJCSIM)*, Vol.1, pp.177-187.
- [2] A. K. Dey, and G. B. Abowd, (2001) "A Conceptual Framework and a Tool Kit for Supporting The rapid Prototyping of Context aware Application", *Journal Human-Computer Interaction*, Vol. 16 Issue 2, pp. 97-166.
- [3] C. Biancalana, F. Gasparetti, A. Micarelli, G. Sansonetti, (2011) "Social Tagging for Personalized Location-Based Services", *Workshop SRS'11*, Hangzhou, China.
- [4] A. Pashtan, R. Blattler, A. Heusser, and P. Scheuermann, (2003) "CATIS: A Context-Aware Tourist Information System", *Proceedings of the 4th International Workshop on Mobile Computing*, Rostok, June, pp.1-8.

- [5] A. Hinze, and G. Buchanan, (2005) "Context-awareness in Mobile Tourist Information Systems: Challenges for User Interaction", Int. Workshop on *Context in Mobile HCI*, Salzburg.
- [6] A. Garcia-Crespo, et al., (2009) "SPETA: Social pervasive e-Tourism advisor", *Telematics and Informatics*, Vol. 26, pp. 306-315.
- [7] J. Srivastava, (2008) "Data Mining for Social Network Analysis", *Intelligence and Security Informatics (ISI)*, *IEEE International Conference on Advances in Social Networks Analysis and Mining*, Taipei.
- [8] Y. Qiao, (2008) "Social networks and E-commerce", TKK, T-110.5190 *Seminar on Internetworking*.
- [9] G. Swamynathan, C. Wilson, B. Boe, K. Almeroth, and B. Y. Zhao, (2008) "Do Social Networks Improve e-Commerce? A Study on Social Marketplaces", ACM WOSN'08, Seattle, Washington, USA.
- [10] E. K. Clemons, (2007) "The future of advertising and the value of social networks", Wharton ISE Blog, pp. 1–16.
- [11] M. Karimzadehgan, M. Agrawal, C. X. Zhai, (2009) "Towards Advertising on Social Networks", *Proceedings of the ACM SIGIR workshop on Information Retrieval and Advertising(IRA)*, Boston, MA, USA.
- [12] W. Barry, and S. D. Brekowitz, (1998) "Social Structure: A Network Approach", *Cambridge University Press*, page112.
- [13] W. Standly, K. foust, (1994) "Social Network Analysis: Methods and Applications", *Cambridge University Press*, page 48.
- [14] V. W. Zheng, B. Cao, Y. Zheng, X. Xie, Q. Yang, (2010) "Collaborative Filtering Meets Mobile Recommendation: A User-centered Approach", *Association for the Advancement of Artificial Intelligence (www.aaai.org)*.