

Design Context Aware Activity Recommender System for Iranian Customer Mind Activism in Online Shopping

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Abstract

E-commerce has made life simple and innovative of individuals and groups. Nowadays, social networks are widely used by everyone. So, it is necessary to do appropriate and situation aware activities in these networks to gain benefits. In this research, a context aware recommender system has modeled for using in social networks focus on Iranian customer mind activism in online shopping. This system makes its recommendations for user based on behavior and activities of her friends in the same situation in social network. In other word, this modeled recommender system uses collaborative filtering algorithm. All the connections of user in social network, containing direct and indirect, are considered for recommending by recommender system; but, based on connection type and its distance to user, proportional factor is assigned. On the other, In this research we study the consumer behavior in online shopping of electronics especially in Iran. Primary data was collected through the questionnaire survey and by emails from personal contacts in two major cities of Iran. Price, time saving and convenience were identified as important factors which lead to certain buying behavior in online shopping.

Keywords: *recommender system, Consumer behavior, trust, context aware, collaborative filtering.*

1. Introduction

Nowadays, use of social network in all fields has grown. People use this network for identifying themselves, communicating, and interact with the others, and do

different activities based on the environment of this network. Actually, social network is a graph which the people are its nodes and links between them can be considered as its edges. Widely use of these networks by many people lead to create a large volume of information in them and make it difficult for users to access relevant information and have an appropriate decision. So, for this so called “information overload” problem, recommender system is a good choice. Recommender systems are techniques and intelligent applications which often make their recommendations using two approaches: collaborative filtering and content-based filtering [1]. Content-based systems produce recommendations by analyzing the content of profile and previously behavior of the user. But, in the collaborative filtering systems, recommendations are made based on the similarity between different users and provide user with the items that have been selected by similar users [1]. Also, recommender systems are going to be context aware; this mean that they consider the context of user in their recommendations. Nowadays, recommender systems are widely used in social networks, specifically in fields such as friend recommendation. But, the operation range of these systems can be broader and includes any context aware recommendations in these networks. By doing this, recommender system performance would be higher and users are more satisfied. In this work, a context aware recommender system in social network is modeled which makes its activity recommendations for users based on the behavior and activities of their friends. This system uses

data-mining and neural network techniques and would have a high precision. "Consumer behavior is the study of individuals, groups, or organizations and the processes they use to select, secure, and dispose of products, services, experiences, or ideas to satisfy needs and the impacts that these processes have on the consumer and society" (Kuester, 2012) [2]. As Kuester (2012) stated, consumer behavior of every individual is different from other depending on buying choices which is influenced by buying habits and choices that are turn tampered by psychological and social drivers that affect purchase decision process. "We're not aware of changing our minds even when we do change our minds. And most people, after they change their minds, reconstruct their past opinion they believe they always thought that" (KEYS, 2011) [2]. Total global E-commerce sale in 2011 have grown to Euro 690 billion (USD 961 billion) and recorded an increase of 20 % with an estimation of increase in the

coming years and to cross the 1 trillion Euro mark in 2013. Asia pacific region is leading in terms of growth as compared to mature markets like US, UK, Japan and European countries. Asia Pacific recorded 130 % growth specially China in 2011. The online retailing is becoming an integral part of an economy and country and worldwide increasingly seeing trust and confidence in purchasing online. (AadWeening, 2012) [19]. online shopping is becoming increasingly popular. Online retail sales are estimated to grow from \$ 172 billion in 2005 to \$ 329 billion in 2010. There are 32 countries worldwide with the Internet penetration rate higher than 50%. As of April 2006, 73% of American adults are Internet users. Moreover, Internet users' ability to shop online has significantly improved from 16% to 32% since March 2001 (Zhou et al., 2007) [3,6]. The Economist Intelligence Unit overviewed the e-readiness of the world's largest economies including Iran in 2008. It measures the quality of a country's information and communications technology (ICT) infrastructure and the ability of its consumers, businesses and governments to use ICT to their benefit. Economist Intelligence Unit measures e-readiness based on six criteria of connectivity and technology infrastructure, business environment, social and cultural environment, legal environment, government policy and vision and consumer and business adoption (Economist Intelligence Unit, 2008). The results this study in Iran shows improvement in four criteria of connectivity and technology infrastructure, business environment, social and cultural environment and legal environment. Government policy and vision criterion did not change in comparison with 2007. However, consumer and business adoption criterion has been changed. Thus, it is very important to know about online customers' behavior and

understand what they require and need. Since online shopping is the new medium of shopping with new demands of consumers. All customers have their own desires and demands for products so that it is very crucial for all online retailers to identify and know about their online consumers (Hasslinger, 2007) [3]. For this purpose, this research was to study the consumer behavior in online shopping of electronics especially in Iran and designed Context Aware Activity Recommender System. This document is set in 10-point Times New Roman. If absolutely necessary, we suggest the use of condensed line spacing rather than smaller point sizes. Some technical formatting software print mathematical formulas in italic type, with subscripts and superscripts in a slightly smaller font size. This is acceptable.

2. Literature review

Kayaalp in 2009 [8] proposed an event recommender system in a social network environment made by users. That was a hybrid recommender system which used content based and collaborative filtering algorithm. Brun et al in 2010 [9] proposed an approach for mentor selection in a collaborative filtering and also, social network environment when no rating is available. This paper solution was based on direct links between people in a social network made of them. Likewise a recommender system was designed by Wang et al in 2010 [10] which was used in social networks and was based on collaborative filtering algorithm; but, instead of using only similarity between people, this algorithm used the trust between them for computing similarity and making recommendations. In 2011 [11] Chiu et al proposed a recommender system for using in social networks. But, this system didn't use common algorithms such as content based or collaborative filtering and instead of them applied information existed in social networks. At last, this paper used precision and recall metrics for evaluating the system. Zhou in 2009 [12] proposed a trust based recommender system which was based on the analysis of social network data and information. In this system a trust network was constructed between people and making recommendations was based on its links. Social network data analysis for this system was done by using data-mining technique. An online friend recommender system in social networks was proposed by Xie in 2010 [13]. This system considered context and current situation of any person for making recommendation for her. Also, this system received feedback from each user after making recommendation to upgrade performance. Wang et al in 2010 [14] proposed a user-centric approach for integrating social data from different social networking

sites and provided personalized recommendations for each user. In this manner user can rate her friends and their activities. Yang et al in 2010 [15] proposed collaborative filtering recommender system that used social networks data and information.

3. Basic concepts

3.1 Recommender system

'Recommender systems are technique and intelligent applications to assist users in a decision making process where they want to choose one item among a potentially overwhelming set of alternative products or services' [9]. These systems are a field in the wide range of personalization, too [10]. Recommender systems make their recommendations based on information about users, meta-data associated with items and implicit or explicit ratings made by users about items [8]. From business perspective, recommender systems can be used as an advertising tool for attracting new customer and retaining prior ones [9]. These systems use two approaches: collaborative filtering and content-based filtering. In collaborative filtering algorithm, system makes its recommendation based on account of other customers that are similar to our desired customer. For doing this a matrix named interest matrix can be used. But in content-based filtering, systems produce recommendations by analyzing the content of profile and previously behavior of the user [5]. So, recommender systems try to guess how users think and based on it, recommend the best and most beneficial items to him.

3.2 Social networks

Internet makes life simple and innovative. People are doing business online and trade has become more easy and fast due to this. Internet provides new ways to promote business. Website becomes the essence of online business as to show their services and products. Internet gathers all competitors and consumers in one place. It brings new lane to promote, advertise products and services in market

(Barry Silverstein, 2002, p. 3) [19]. Social networks have been part of peoples' life. People usually spend hours on digital social networks such as emails, weblogs, instant messaging and also social activity networks. In general, social networks are interactive networks for the purpose of communication, which use the Internet use as connectivity media. The term "Social activity networks" is used to make a difference between two general groups of social networks. Some of the most attractive social activity networks are Facebook, Twitter, Google Plus and

MySpace. The core of social networks consists of a user's profile. Through profiles people make friendships and as social networks are constructed on the base of web2.0 and others prepare the contents themselves, each user who can prepare and post more attractive topics and practical information would make more friends. These kinds of users are considered as effective users because others could share their information and they would be referenced by others. Those users also have a critical role in WOM and they could spread advertisements easily and quickly. Social networks are set of users and links when a connection is available between two nodes. The thickness of the link shows the level of similarities between two users[4].

3.3 Web mining

The Web provides a direct communication media between business organizations' services and their customers with very low cost. It is revolutionizing the traditional way of doing commerce, and is becoming more and more popular in the business community. At the same time, it is important for business organizations to assess whether their Web-based services are fulfilling the intended purpose, personalize their services, evaluate the effectiveness of promotional campaigns and build competitive advantage based on the understanding of users' access behavior. Web mining is the intelligent analysis of Web data. With Web mining techniques, business organizations are able to gain a better understanding of both the web and web users' preferences to help them run their businesses more efficiently. One kind of outcome of Web mining is Web browsing patterns. By the use of Web browsing patterns, business organizations can perform mass customization and personalization, adapt their Web sites, and further improve their marketing strategies, product offerings, and promotional campaigns. Therefore, Web browsing pattern mining has special meaning for business organizations. Thus, it has attracted much attention from data mining, machine learning, and other research communities for many years. Of the existed methods, some are non-sequential, such as association rule mining and clustering; and some are sequential, such as sequential or navigational pattern mining. Both approaches ignore the site topology and need to identify user sessions [17,7].

3.4 Online buying behavior

Online shopping consumer behavior is also called online buying behavior and internet shopping/ buying behavior. The online shopping behavior has a direct relationship with these five elements such as e-stores, logistics support, product characteristics, websites' technological characteristics, information characteristic and home page presentation. According to studies, those people who have wired lifestyles and who had time constrained, they spend less time to buy things online (J. Johnson, 1999). [3] Authors have different definitions of the characteristics of consumer behavior. Many studies have been done on the online consumer behavior. Research in the field of online consumer behavior is important Because it helps us to improve our sales and also can attract Customer satisfaction [16,18].

3.5 Experimental online shopping behavior

Experimental is the hedonic mindset where consumer reacts more on the basis of experiments rather than cognitions or sensory attraction, consumer deemphasize on external elements and more respond to their past experience (Robert W.Proctor, 2005, p. 597).Experiential consumer behavior is characterized by non-direct search because they directly search online shopping particulars on their experience basis along with hedonic benefits (Pedersen, 2002, p. 3). This behavior is more focused on pleasure and by seeking information on the basis of consumer's experience with sensory elements, this mind set is refer as "search as recreation", it is by nature has experimental influence and consumer wants to have experience new things which pursue him to be as motivator (Saaksjarvi, 2007, p. 29) . This situation would be explained in e-Shopping context as a consumer is visiting website in order to buy a particular item because he had already purchased that item from this website. He would have all necessary things to start transaction, all steps he would do easily because he would had experience[19].

4. Proposed System Architecture

Figure 1 shows the proposed system architecture.

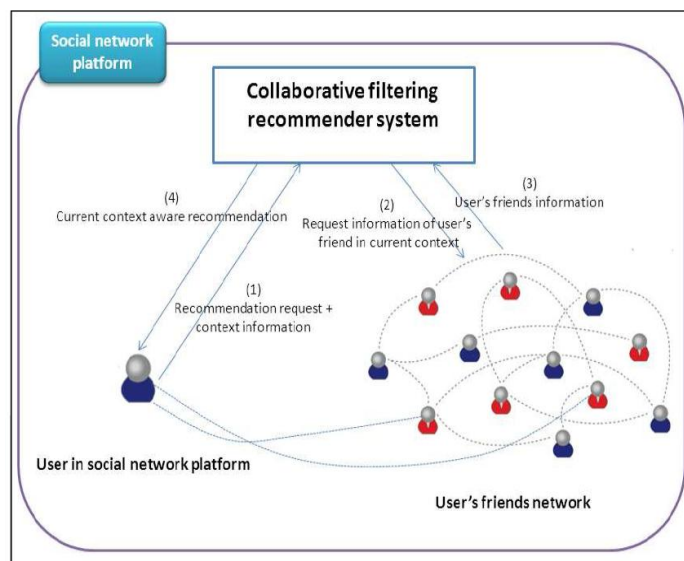


Figure. 1 Proposed System Architecture

The main architectural components are as follow:

- Collaborative filtering recommender system

This is the main part the proposed system that makes its recommendations

based on collaborative filtering approach.

- User in social network platform

A user who is in social network site and she requests to be serviced by recommender system.

- User's friends network

A network which is constructed from users who are in relation with target user and making recommendations is based on their behavior and activities.

The proposed system procedure is as follow:

At first, the user who is in social network platform runs an application in this site to send her request for receiving recommendations related to her status. With this request, user's context information such as time and location are sent to recommender system. In the second step, when recommender system receives user's request and her context information, it identifies user's friends and their social network to extract their information. This information is sent to the server of recommender system, and after making user's context aware recommendations, they are presented to her.

Before designing the proposed model we need to study purchase behavior of customers in Iran, So we designed many questions:

- 1: what are the Iranian consumer major concerns about online shopping?
- 2: Which products were mostly sold online?
- 3: What is the education level's the majority of consumers?
- 4: How do consumers research about products?

4.1 Research findings

According to research (ADIL BASHIR 2013), which has been in Pakistan, One in four consumers indicated that they spend more time online because of the tough economy and 53 percent of consumers said they spend about the same amount of time online[19].

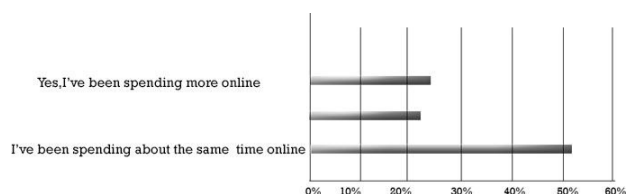


Figure. 2 Consumers Spend More Time online

And also, consumers are divided by age wise and then take into account the online shopping to analysis the scenario. after survey it is clearly shown that older aged online consumers are totally different from younger online consumers. Why is it that? The answer is that older online consumers have the sense of saving and purchasing while younger online consumers have no experience and don't have enough maturity to buy goods with planned spending (Rodriguez, 2009). With the help of below table, it is clearly demonstrated[19].

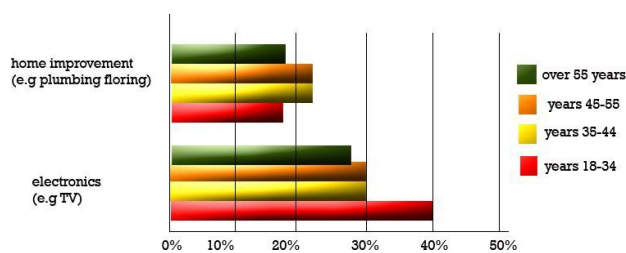


Fig. 3 Online Planned Spending by Age Segments

Based on content the above we did research in Iran .The easiest way to analyze the data is using sampling methods. Therefore we have prepared Questionnaire and analyzed responses collected from the Questionnaire by non-probability sampling technique and Spss software. 458 online respondents who had answered the questions were two major cities of Tehran and Mashhad that The main basis of the response by email and phone contacts. The questionnaire was divided to, first, the demographics segmentation among the respondents and second to, collect the data about the factors like price, convenience, brand consciousness, safety, trust which affect directly or indirectly to the decision making process and ultimately highlight the main concerns of consumers while shopping online. We have received following responses such as:

Table 1: Gender Analysis

Gender	Frequency	Percentage
Female	107	23.36%
Male	351	76.64%
Grand Total	458	100.00%

The table top is easy to understand that more men than women had a response. In this study, almost 77percent of men and 23 percent of women who participated in Tehran and Mashhad.

Table 2: Age Analysis

Age Distribution	Frequency	Percentage
20-25	238	51.97%
26-30	110	24.02%
31-35	70	15.28%
36 or more	40	8.73%
Grand Total	458	100.00%

In Table 2, paid to analyze the buying behavior Versus age people. The highest percentage of respondents in the age range 20 to 25 years who have contributed to 51.97%. It's mostly young people in our study were active.

Table 3: Education Analysis

Education Background	Frequency	Percentage
Less than secondary/high school	10	2.18%
Secondary/high school	77	16.81%
Bachelors	248	54.15 %
Masters or Above	123	26.86%
Grand Total	458	100.00%

In Table 3,As is known, the highest rate among respondents have B.Sc. Degree.

Table 4: Crucial Factor affecting the consumer mind in Iran

What are the crucial factors which affect your decision making in the final selection of the product?	Frequency	Percentage
The best prices	186	40.61%
Convenience and Time saving	152	33.19%
Not available in local stores	50	10.92%
Product reviews available	40	8.73%
Price comparison available	30	6.55%
Grand Total	458	100%

As analyzed from the result in online shopping in Iran (Table 4), consumer concerns are price factor, convenience and time saving. 40.61% of respondents believe the most important factor is prices and 33.19% of people are looking for convenience and saving time. The remaining percentage of 26.2 % falls under the category of those respondents for whom the particular product is not available in local stores, product reviews available and price comparisons available. Iran's mind about consumer buying behavior is consistent with other states and have not significant difference And the people are very cautious about cutting costs and saving time. Most people are impressed at the best price and that means online product vendors should be behaving according to customers' purchase behavior to adjust to achieve greater profitability.

Table 5: Main barriers in online shopping

<i>What are the main barriers which keep you away from shopping Online?</i>	<i>Frequency</i>	<i>Percentage</i>
Safety of Payment	215	46.94%
Low Trust level of online stores	1022	22.27%
High Shipping Cost	58	12.66%
Value Added Tax/ Customs duty	36	7.86%
Refund Policy and Warranty Claims	28	6.11%
Warranty and Claims	10	2.18%
Delivery too slow	6	1.31%
Others (Don't have Credit Card)	3	0.66%
Grand Total	458	100%

(In Table 5) Studies show that the biggest barrier to online buying in Iran is payment security. 46.94% of the respondents have expressed concern about the safety and 22.27% of them do not trust online stores. 12.66% of people rejected online buying due to the high international shipping costs and And 7.86% of the respondents prefer to buy in local stores , The remaining 10.26% of the respondents due to the refund policy,

claims, slow delivery and lack of availability of credit card Are not willing to online buying.

5. Methodology

5.1 Research findings

The first step in this system is running an application in social network. Running of this application is user's request for receiving recommendation. By this request user's information are sent to recommender system, too. Each of user sent data are listed in the Table 6 with their specific symbol which is used in next section.

Table 6. User's Sent Information to Recommender System

Parameter	Symbol
Current time	t
Current location	l
Number of friends that should be considered in recommending to user and the output is average of their rate	n

5.2 Identifying and extracting user's information by recommender system

After receiving user's request and information, recommender system identifies the user's network and relations of her in that. In other word, since this recommender system is based on collaborative filtering algorithm, it should identify all the people related to target user, their relation type, and their activities in different contexts. In this context, relation type means the distance of each person in user's network to her; thus, direct friend's adjacency factor is 1, her friends of friends' factor is $\frac{1}{2}$ and so on. So, recommender system can recommend friends' activities to the target user based on their relation type and contexts. Thus, the output of this step is a matrix which its rows are persons in relation with the user and its columns are relation type which is shown by D_{ij} symbol, time, location, and their rates to different activities, respectively. The rates of persons are shown by R_{ila} symbol, where t and l are time and location, and a is a specific activity.

5.3 Information processing and making recommendation

In this step, data and information gained in previous step are processed to extract suitable recommendation for user. In the processing phase, data-mining and neural network

techniques are used for clustering data. In other word, since our proposed recommender system is context aware, by clustering algorithm, friends' rates in current context can be extracted. Then, these extracted information are sorted descending based on their relation type factors and top n of them are selected.

5.4 Making recommendation

After identifying top 'n' people in relation with target user and their activities in current context, context aware recommendations are made and given to user. These recommendations are computed as follow:

$$R_{itla} = \frac{\sum_{j=1}^n (R_{jila} * D_{ij})}{\sum_{j=1}^n D_{ij}} \quad (1)$$

In the equation (1), R_{itla} which is the rate of user i (associated user) to activity a , in location l and time t , is the average of user's friends rate in current context. Also, in this formula:

- D_{ij} is the distance between user ' i ' and user ' j ' which is specified by relation type.
- ' j 's are person in relationship with user and have the most ' n ' distances.

5.5 Result and Discussion

To evaluate this proposed model, the system is implemented on a specified dataset and mean absolute error (MAE) of it is computed. MAE is used, because the rates of user are predicted and so, "predictive accuracy" metric should be computed. For this attribute, MAE is a good metric which could be used.

This metric is computed by the following formula:

$$MAE = \frac{\sum_{i=1}^N |p_i - q_i|}{N} \quad (2)$$

In equation (2), p_i is the predicted rate and q_i is real rate. Also, N is the numbers of predictions have done for user. The following diagrams show the results of

implementations: Figure 2 demonstrates the MAE based on number of friends user selected.

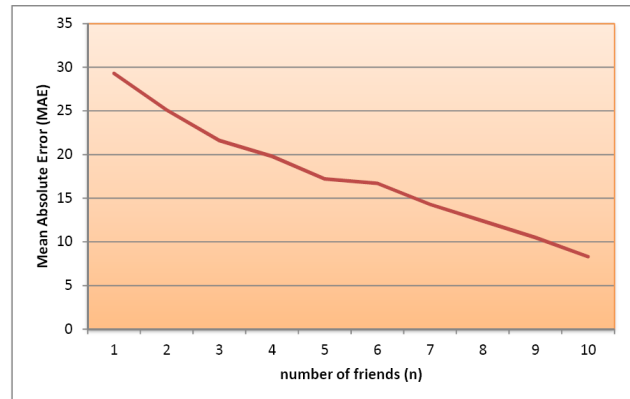


Figure. 4 Diagram of MAE Based on Number of Considered Friends in Recommending

Diagram in Figure 4 demonstrates that when number of friend is 1, MAE has a high value; but by increasing the number of friends gradually, MAE value decrease more and more. Thus, for a higher number of friends, proposed system performance is higher and its MAE is less. In diagram of Figure 5, in addition to number of friends, numbers of total activities which can be recommended are changed, too.

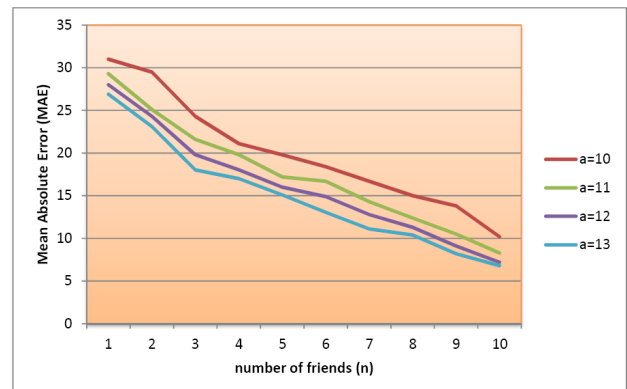


Figure. 5 Diagram of MAE Based on Number of Friends and Number of Total Activities

Diagram in Figure 5 demonstrates that MAE is better and has a lower value for higher number of friends and total activities. In other word, by increasing the number of friends and the number of total activities, this paper proposed recommender system would have a higher precision.

6. Conclusion

This study was accomplished to determine the consumer behavior in Iran towards online shopping for electronic

products. Online shopping is increasing in Iran but acceleration of online shopping is not as rapid as compared to other developed countries like USA and UK. The survey questionnaire was prepared and distributed among personal contacts and received 458 responses. The questionnaire format have three main segments such as general, identified variables then in last customer concern in online shopping. From the survey it is accessed that online shopping is more popular among the males as in Iran most online shopping was made by males with 76.64% and majority of the respondents were young; aged between 20 to 25 years old with 51.97% weight age and income distribution fell into less than 30k as lower middle class while majority of the respondent are educated and have done graduation. Therefore it is essential that design Context Aware Activity Recommender System. With the advent of social network and widely use of it by all the people. Widely use of these networks by many people lead to create a large volume of information in them and make it difficult for users to access relevant information and have an appropriate decision. So, for this so called "information overload" problem, recommender system is a good choice. In this paper, a context aware recommender system is modeled which in social network platform and make suitable recommendations for users. This recommender system works based on collaborative filtering algorithm and makes its recommendations due to behavior and activities of people in relation with the target user. At last, in evaluation section, it is shown that this system has a high performance and by increasing the number of friends for recommending and also, the number of total activities, system performance would be higher and MAE decreases.

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