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A survey of recommendation systems for companies

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Informations	Abstract
Key Words : Recommendation system, Content based filtering, Collaborative filtering , Hybrid filtering E-marketing. *Corresponding : laibkamilya@gmail.com,	Recommendation systems have become very popular in e-marketing. many of companies are using recommender systems to maximize their gain . Recommender systems have formulated in parallel with the web. Initially Recommender systems were based on demographic, content-based filtering and collaborative filtering. This is a survey paper on recommendationsystems and details the various techniques, challenges and benefits of RSs and lists some research papers about recommendation systems for e-marketing.

1. Introduction

Recommender systems have become an important research area in recent years. When people purchase products, they have to make decisions which items to buy. They also have to decide which book to read in open access portal or which film to watch in multimedia store or witch product to buy in digital markets. Their choice often depends on the other users' opinion, especially in the e-commerce. So in general this is the idea of recommendationsystem it helps users to find content by aggregating and analyzing suggestions from other users, which mean reviews from various authorities, and users [1].

These systems use three major ways to recommend the right products to purchase for each user. Recommender systems are classified into collaborative filtering content-based , and hybrid filtering [2].The most latest research now use hybrid approaches that combine both of colaborative and contenet-based methods.

Digital marketing is one of the most important reseach filed in RSs.where the last one use a logic like: customers with similar purchase and browsing histories will purchase similar products in the future. To make such a system work, you either need a large number of

historical transactions or detailed data on your user's behavior on other websites[3].

In this paper, we organized our reseach as follows:

- (1) The Domains where the recommendation systems are used the most
- (2) In the second section we mentioned the major challenges and benefits of recommendation systems
- (3) The known recommendation systems techniques as the collaborative filtering, contenets -based and hybrid filtering.
- (4) Criteria for classification of research papers on recommender systems in E-business are presented.
- (5) Conclusions are presented, and the future works are discussed.

2. Applicable Areas

Recommendation systems are important to araise gain for any business and we can see that in [4]:

- **E-Commerce** : it is where the recommendation systems are used the most, it generate recommendations to users witch means more data of their behavior and that whats we can find in e-commerce.

- **Media:** Similar to e-commerce, media businesses are the first to jump into recommendations. It is difficult to see a news site without a recommendation system.
- **Banking:** A mass market product that is consumed digitally by millions. Banking for masses and SMEs are prime for recommendations. Knowing a customer's detailed financial situation, along with their past preferences, coupled by data of thousands of similar users is quite powerful.
- **Telecom:** Shares similar dynamics with banking. Telcos have access to millions of customers whose every interaction is recorded. Their product range is also rather limited compared to other industries, making recommendations in telecom an easier problem.
- **Utilities:** Similar dynamics with telecom but utilities have an even narrower range of products, making recommendations rather simple.

3. Advantages of Recommendation Systems

- **Increased sales :** There are very few ways to achieve increased sales without increased marketing effort. Once you setup an automated recommendation system, you get recurring additional sales without any effort [5].
- **Increased user satisfaction:** Shortest path to a sale is great both for you and your customer reducing their effort. Recommendation systems allow you to reduce your customers' path to a sale by recommending them an appropriate option sometimes even before they search for it [5].
- **Increased loyalty and share of mind:** By getting customers to spend more on your website, you can increase their familiarity with your brand and user interface, increasing their probability to make future purchases from you[5].
- **Reduced churn:** Recommendation system powered emails are one of the best ways to re-engage customers. Discounts or coupons are other effective yet costly ways of re-engaging

customers and they can be coupled with recommendations to increase customer's probability of conversion [5].

3. Challenges in Recommendation Systems

- **Data sparsity :** the recommender system increase very rapidly and produce large and very sparse datasets and because of that the recommendation performance can degrade [6].
- **Scalability :** Traditional algorithms of RSs will suffers from scalability problems as the numbers of users and items increases. When it must respond with high performance [1].
- **Cold Start problem :** this problem showed up when a new user enter to the site or a new item has added to the system, this item cannot be in a list of recommendations unless it is rated by a substantial number of users [6].
- **Security :** is one of major issue of recommender system .as we know the system recommend list of items so we need to know certain infomatios about this list of data and the user s should know what information are recommended for them. This is one of major challenge faced by the developer of recommender system [7].
- **Vulnerability to attacks :** this problem occurs if a malicious user or competitor enters into a system and begins giving false ratings on some items either to increase the item popularity or to reduce its popularity [6].

5. Categories of Recommender system

The recommendation system collect information about useres using several methods in order to pridict and give them suggestions based on their preferences. Recommendation system suggest tousers a list of items after analysing their previous actions, preferences and even other's suggestions.

There are several thechniques of recommendation systems and they are classified as followed : collaborative filtering, content-based filtering, and hybrid methods. These three techniques are the most used and significant recommendation methods [2].

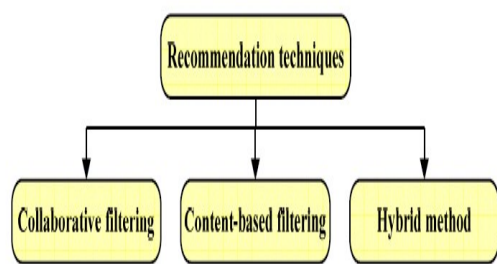


Fig. 1 :An example of Recommender Systems

5.1 Collaborative Filtering :

Collaborative filtering is known as the most used recommendation technique. Many companies like amazon and netflix use this method. CF work by collecting and examining a large amount of data about users activities or preferences and anticipating taste for each particular user then calculating the similarity with other users [8].

CF give recommendations that will be liked by the current user based on a list of items of users who may have similar profiles and preferences.

Advantages

- Although it is the oldest technique of recommendation systems but it still effective and the most successful
- This method does not require providing the representation of the object that can be easily read by the computers.

Disadvantages

- Problems with new users (cold start), and new products (the early-rated problem)

5.2 Content Based Filtering

The content-based filtering (CBF) recommend items to activate user based on description of items and content that they liked in the past. For example, if a user buy a mobile, computer and a CD, the CBF will recommend electronics product. A user profile is made by analysing the content of items that the user was interested by in the past [9].

Advantages

- Only the analysis of the items that one independent user has seen or bought must be done. In contrary to CF, this technique is not so complex

Disadvantages

- It is a difficult task to generate the attributes for items in certain areas.
- CBF advocate the same types of items because of that it suffers from an overspecialization problem.
- It is harder to acquire feedback from users in CBF because users do not typically rank the items (as in CF) and therefore, it is not possible to determine whether the recommendation is correct.

5.3 Hybrid Method

The hybrid approach combines many other methods some of them are mentioned above. The main goal of this method is to take advantages of each method in order to minimize the disadvantages of them. There are many different ways to combine the content-based and collaborative filtering. The best known are [10] :

- Implement both methods separately and combine the outputs of these methods
- Add some of the content-based characteristics to the collaborative filtering
- Add some of the collaborative characteristics to the content-based filtering
- Develop one model that applies both content-based and collaborative characteristics These two approaches complement each other and contribute to the other's effectiveness.

6. Recommender System for Companies

Recommendation systems have gained importance in recent years. The RSs are able to predict which items the users will purchase and it became very popular in business.

6.1 Literature review

In this section we will discuss research papers studying recommendation system in E-Marketing.

Liu Yan propose in his paper [11] a personalized recommendation method for e-commerce using collaborative filtering the experimental results

achieve higher accuracy and provide more suitable products for e-commerce users.

In this paper [12] Przemyslaw Kazienko and Pawel Kolodziejski implements a system named WindOwls. The results shows a full personalization that provides users with a dynamic list of products most likely to be interesting the results was more interestih using associationsrules then other methods.

Badrul Sarwar, George Karypis, and al [13]. This groupe presented an experimental using colaborative filtering techniques to solve the scalability in large e-commerce Data and also to improve the quality of the recommendations.

Hyunwoo Hwangbo, Yang Sok Kim and al [14] propose a new method of recommending products to customers by extending the existing colaborative filtering the new one decreases the intensity of preference. The proposed system generates better performances then the typical CF.

In this paper [15] the main contributions was to maximize Customers satisfactions using The content-based filtering and associative classification. The model predict the appeal of the specific products to the costumer witch means the personalization of services.

In this paper, Li Niu, Xiao-We Yan, and al [16] define business data and customer profile based on product hierarchy for E-commerce recommendation propose an incremental approach to construct customer preference profiles using a mining techniques. The study shows a very remarquable results in term of personalization.

In this paper[17]a new algorithm presented and experimentally evaluated concerning the collaborative filtering based on item and user. Therresults showed that the algorithm hold the promise of allowing CF-based algorithms to be adaptive to data sets in which users have many different interests or items have completely content.

In this paper[18]Yukun Cao, Yunfeng Li create a personalized recommendation system for the consumer electronic products .The system construct an optimal recommendations based on the costumers preferences-list the evaluation have shown very promise results.

This work proposed by Duen-Ren Liu, Ya-Yueh Shih [19]. They Introdcue to us an hybrid approach using colaborative filtering and KNN-based to gather customers in groups then extcat ruled from each group.The experimental results has improve the quality of recommendations

Yung-Ming Li, Chun-Te Wu, and al [20]. they propose a social recommender system that incorporates the preference similarity, recommendation trust, and social relation analyses in order to offer product recommendations in e-commerce. The experimental results improve the service quality and enhance customer relationships.

In Tables 1 we discuss papers, author names and Techniques they used to overcome recommender systems challenges and the advantages of every paper :

Table 1. Comparison between papers techniques and advantages

No	Authors	Techniques	Advantages
01	Liu Yan	Collaborative filtering	Higher accuracy and provide more suitable products for e-commerce users.
02	Przemyslaw Kazienko and Pawel Kolodziejski	They use collaborative filtering and association rules	Offer to users dynamic list of products most likely to be interesting
03	Badrul Sarwar, George Karypis, and al	Collaborative filtering	Solve any scalability and increase th quality of recommendations
04	Hyunwoo Hwangbo, Yang Sok Kim and al	extending the existing collaborative filtering	Higher performance than the typical CF
05	Yuanchun Jiang ,Jennifer Shang, and al	The content-based filtering and associative classification	maximize customers satisfactions

06	Li Niu, Xiao-We Yan, <i>and al</i>	Mining techniques	Personalization of recommendation
07	Yu Li, Liu Lu, <i>and al</i>	collaborative filtering	Personalization of recommendation
08	Yukun Cao, Yunfeng Li	Fuzzy-based recommendation techniques	Optimization of the preferences-list
09	Duen-Ren Liu, Ya-Yueh Shih	Collaborative filtering and KNN-based	Improve the quality of recommendations
10	Yung-Ming Li, Chun-Te Wu, <i>and al</i>	Hybrid filtering	Improve the quality and accuracy of recommender systems.

7. CONCLUSION AND FUTURE WORK

Recommendation system is a powerful technology for extracting interest of users. In this paper we discussed the have three major techniques of RSs (collaborative, content-based, and hybrid). Further we discuss the various challenges and benefits of recommendation systems. We also discussed literature review and solutions they used for e-commerce.

With the appearance of more recommender systems in e-commerce companies, we think in the future to implement a system that can help companies to maximize their gain by providing better recommendations.

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