A Survey On Recommendation System For Marketing Services Using Collaborative Filtering And Spatial Social Union

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Abstract - Collaborative filtering (CF) system and most influential recommendation algorithms implemented in this proposed work. In this system, unlike the content-based approaches, CF only relies on the item ratings from each user. It is based on the assumption/guess that users who have rated the same items with similar ratings are likely to have similar preferences. CF is specifically designed to provide recommendations when detailed information about the users and items is inaccessible. In this proposed framework of a typical CF, recommender system includes Data Collection, Preprocessing, and Collaborative Filtering. Firstly, user data are collected through wireless networks and stored in the cloud database. Then certain pre-processing operations are imperative for ensuring the data integrity and reliability. Based on these data, CF algorithms are implemented to predict use interests and recommend related items to save time and effort. This project proposes addition spatial-social union, measures similarity between two users that integrates the interconnection among different users, items, and locations. The Spatial Social Union-aware location-sensitive recommendation algorithm is then devised. This project evaluates and compares the proposed approach with the existing rating prediction and item recommendation algorithms. The results show that the proposed Spatial Social Union -aware recommendation algorithm is additional effective in recommending items with better consideration of the user's liking and locality.

Keywords - Spatial Social Union, Collaborative Filtering.

I. INTRODUCTION

Along with the rapid development of mobile Internet and cloud computing, massive amounts of data are produced every day by both people and machines. Our society has already entered the era of Big Data [1]. Thanks to the various smart devices and mobile applications, Internet users can acquire all sorts of information about education, shopping, social activity, etc. However, as the volume of data increases, individuals have to face the problem of excessive information, which makes it more difficult to make the right decisions. This phenomenon is known as information overload. Moreover, limited by the input ability of mobile devices, users are usually unwilling to type in lots of words to describe what they want. Recommender system can alleviate these problems by effectively finding users' potential requirements and selecting desirable items from a huge amount of candidate information. Recommender systems are usually classified into two categories, i.e., content-based and collaborative filtering (CF).

Content-based recommender system utilizes the contents of items and finds the similarities among them. After analyzing sufficient numbers of items that one user has already shown favor to, the user interests profile is established. Then the recommendation system searches the database and chooses proper items according to this profile. The main complexity of this algorithm is in finding user interests based on the contents of items. Many approaches have been developed to solve this problem in the areas of data mining or machine learning. For example, to recommend some articles to a specific reader, a recommender system firstly obtains all the books this reader has already read and then analyzes their contents. Key words can be extracted from the text with the help of text mining methods, such as the well-known TF-IDF. After integrating all the keywords with their respective weights, a book can be represented by a multi-dimensional vector. Specific clustering algorithms can be implemented to find the centers of these vectors, which represent the interests of this reader. On the other hand, collaborative filtering (CF) has become one of the most influential recommendation algorithms. It is based on the assumption that users who have rated the same items with similar ratings are likely to have similar preferences.

CF is specifically designed to provide recommendations when detailed information about the users and items is inaccessible. Furthermore, it successfully mitigates the problem of over-specialization, which is quite common in content-based systems. Over-specialization is the phenomenon that recommended items are always much the same, and the diversity of recommendations is neglected. As CF makes recommendations according to the neighborhood (people with similar preferences), the item one user has consumed maybe something new to his neighbors. The above features are

particularly attractive, which make CF algorithms extensively employed in recommender systems. However, to the best of our knowledge, very few studies have revealed the common features of the various CF algorithms for mobile Internet applications. Also, most of the existing surveys merely introduce the principles of CF algorithms, ignoring the importance of the case study, which can demonstrate the performances of typical algorithms visually and specifically.

Therefore, this paper focuses on collaborative filtering based recommender systems for mobile Internet applications. In particular, the main contributions of this paper are highlighted as follows: We introduce a general framework of CF recommender system. This framework assists recommender developers to utilize the gathered data and to generate proper recommendations. The features of data collected from both user behaviors and user ratings are also discussed and compared. Main procedures of CF are briefly summarized and introduced. Two case studies are presented to validate the proposed framework. Evaluations of representative CF algorithms are conducted based on real-world datasets with detailed analysis and comparison. The remaining section of this paper is structured as follows. Section II presents the framework of CF. Both classification and main procedures of typical CF algorithms are introduced in Section III. In Section IV, we conduct two case studies based on real-world datasets to analyze the performances of CF algorithms. Finally, Section V concludes the survey work.

II. LITERATURE SURVEY

A. Boosting Response Aware Model-Based Collaborative Filtering

Recommender systems are hopeful for providing personalized favorite services. Collaborative filtering (CF) technologies, predicting user's preference based on users before behaviors, have become one of the most successful techniques to build modern recommender systems. Several challenging issues occur in before proposed CF methods: 1) Most CF methods ignore users response patterns and may yield biased parameter estimation and suboptimal performance; 2) Some CF methods adopt heuristic weight settings, which lacks a systematical implementation; 3) The multinomial mixture models may weaken the computational ability of matrix factorization for generating the data matrix, thus increasing the computational cost of training. To resolve these issues, incorporate users' response models into the probabilistic matrix factorization (PMF), a popular matrix factorization CF model, to create the Response Aware Probabilistic Matrix Factorization (RAPMF) framework. More specifically, they assume on the user reply as a Bernoulli distribution which is parameterized by the rating scores for the noticed ratings while as a step function for the unnoticed ratings.

B. Location-Aware and Personalized Collaborative Filtering for Web Service Recommendation

As the number of web services with the same functionality increases, service users usually depend on web recommendation systems. Nowadays the service users pay additional important on non-functional properties, which are also known as Quality of Service (QoS) while finding and selecting appropriate web services. Previous recommendation systems rarely consider the personalized influence of the users and services in determining the similarity between users and items. The proposed technique is a ranking oriented hybrid approach which integrates user and item-based QoS predictions. The system thus employs the location information of users and items in selecting similar neighbors for the target user and service and thereby making personalized service recommendation for service users. Comparing with other recommendation systems and the existing methods infrequently consider the user and service location in determining QoS values. The existing recommendation systems are either based on user-based or item-based QoS value prediction. Integrating both the methods for QoS predictions along with the location information will give better recommendation than the individual predictions. The system can be a better performance by integrating different non-functional properties into consideration, which helps in providing better results.

C. Collaborative Deep Learning for Recommender Systems

Collaborative filtering (CF) may be a booming approach unremarkably employed by several recommender systems. Conventional CF-based methods use the ratings given to items by users as the single source of information for learning to make a recommendation. However, the ratings are often very sparse in many applications, causing CF-based methods to degrade radically in their recommendation performance. To address this Sparsity problem, secondary information such as item content information may be utilized. Collaborative topic regression (CTR) is associate appealing current methodology taking this approach that tightly couples the parts components that learn from two completely different sources of data. Nevertheless, the latent representation learned Collaborative filtering (CF) is a successful approach commonly used by many recommender systems. Conventional CF-based methods use the ratings given to items by users as the sole source of information for learning to make a recommendation. However, the ratings area unit usually terribly distributed in several applications, causing CF-based methods to degrade significantly in their recommendation performance.

D. Role of matrix factorization model in collaborative filtering algorithm

Recommendation Systems apply Information Retrieval techniques to select the online information relevant to a given user. Collaborative Filtering (CF) is the most extensively used approach to build a better Recommendation System. A CF technique uses the user's behavior in the form of user-item ratings as their information source for prediction. The sparsity of rating matrix and growing nature of data are the main challenges which are faced by CF algorithms. These challenges are handled by Matrix Factorization (MF). They try to present an overview of different MF model to address the challenges of CF algorithms, which can be served as a roadmap for research in this area. Collaborative Filtering is the most popular approach to build a Recommendation System and has been successfully employed in many applications. The CF recommender system works by collecting user feedback in the form of ratings for items in a given domain. The most common types of CF systems are user-based and item-based approaches. The key advantage of CF recommender system is that it does not rely on the machine analyzable contents and therefore, it is capable of accurate recommendations. In CF, the user who had similar choices in the past will have similar choices in the future as well. The Matrix Factorization (MF) plays an important role in the Collaborative Filtering recommender system. MF has recently received larger exposure, mainly as an unsupervised learning method for latent variable decomposition and dimensionality reduction. Prediction of ratings and Recommendations can be obtained by a wide range of algorithms, while Neighbourhood-based Collaborative Filtering methods are simple and intuitive.

The Matrix factorisation techniques area unit sometimes more practical as a result of they permit users to find the latent options underlying the interactions between users and things. Matrix factorisation is just a mathematical tool for taking part in around with matrices and is so applicable in several domains wherever one would really like to seek out out one thing hidden below the information. To describe an email filtering system called "Tapestry." The tapestry was an electronic messaging system that allows users' to rate messages "good" or "bad" or associate text annotations with those messages. In a recommendation application, CF system tries to find other like-minded users and then recommends the items that are most liked by them based on the opinions of other users. The explosive growth of net usage has created the difficulty of data search and choice of things a awfully tedious task for the users, demands more CF methods commonly give better performance and exactness than Content-Based technique of suggestion System. Earlier Collaborative Filtering (CF) algorithms for recommendation systems used to use the association inference, which has very high time difficulty and very poor scalability. Recent strategies build use of matrix operations, that area unit additional ascendible and economical.

III. EXISTING SYSTEM

The memory-based CF is useful in effectively predicting missing ratings and presenting recommendations: it still has a few limitations. For instance, whenever a recommendation task is conducted, the system has to load all the ratings into the memory and implement a specific algorithm based on the complete dataset. Limited by the storage and computing resources, memory-based CF may often become quite time-consuming. Therefore, a recommender system which can provide proper items with acceptable time-consumption is highly desired. Model-based CF algorithms are designed to mitigate these problems whose general principle is to use machine learning or data mining approaches to establish prediction models offline. Based on these models, missing ratings can be predicted efficiently. Typical model-based algorithms include matrix factorization-based algorithms, clustering-based algorithms. The existing system to improve processing capacity and reduce time consumption, developing algorithms for distributed computing systems may become a significant research direction in the future. It is believed that the continuously improved CF recommender systems can greatly help mobile Internet users find proper items without excessive time and energy consumption in the era of Big Data.

IV. PROPOSED SYSTEM RESULT &DISCUSSION

In addition to all the existing system mechanism, the proposed study also presents age group based similarity measurement. Here Similarity measurement based on users' ages is also taken into a study as simA (Age) along with simR (Rating), simA (User) and simD (Location). And so, Rating prediction and recommendation adopts the finalized similarity matrix with including simA to predict the missing ratings and provide the recommendations. Also, time intervals are taken for matrix calculation.

Community: In this module, the community id and name are added in the 'Community' table. The details are displayed using data grid view control and modified if required.

Fig. 1 Community Details

User: In this module, the user id and name are added in the 'users' table. The details are displayed using data grid view control and modified if required.

Fig. 2 User Login Details

Item: In this module, the item id and name are added in the 'items' table. The details are displayed using data grid view control and modified if required.

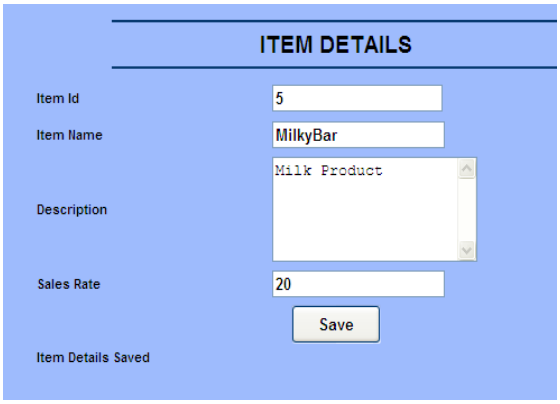


Fig. 3 Item Details

Location: In this module, the location id and name are added in the 'location' table. The details are displayed using data grid view control and modified if required.

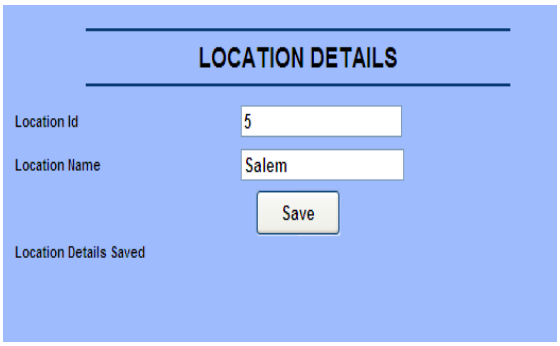
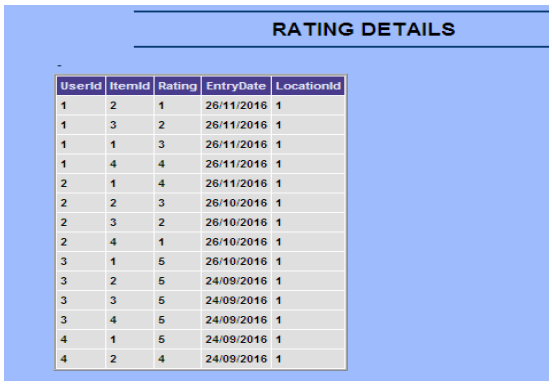


Fig. 4 Location Details

Rating: In this module, ratings are added for the given user for the given item. The details are saved in 'ratings' table. The details are displayed using data grid view control and modified if required.



UserId	ItemId	Rating	EntryDate	LocationId
1	2	1	26/11/2016	1
1	3	2	26/11/2016	1
1	1	3	26/11/2016	1
1	4	4	26/11/2016	1
2	1	4	26/11/2016	1
2	2	3	26/10/2016	1
2	3	2	26/10/2016	1
2	4	1	26/10/2016	1
3	1	5	26/10/2016	1
3	2	5	24/09/2016	1
3	3	5	24/09/2016	1
3	4	5	24/09/2016	1
4	1	5	24/09/2016	1
4	2	4	24/09/2016	1

Fig. 5 Rating Details

Matrix Calculation:

User Item Matrix (R): In this module, users are taken row-wise, items are taken column-wise, and the matrix data is filled with rating values.

Rating Similarity Matrix (simR): In this module, rating similarity is calculated by users taken both row and column-wise, and matrix data is prepared which is the cosine similarity of user-item rating matrix R.

User Similarity Matrix (simA): In this module, user similarity is calculated using M-FriendTNS: Modified-FriendTNS algorithm which takes a) user-user relationship matrix A and b) the number of users N as input. The output prepared is simA.

Location Similarity Matrix (simD): In this module, location similarity is calculated by applying cosine similarity of D matrix (which is a matrix with users taken row-wise and column-wise).

SSU-Aware Location-Sensitive Recommendation Algorithm*(No Time Interval)*: The input of the algorithm includes the user-item rating matrix R, user-user relationship matrix A, user-location metric matrix D, and the number of users N which involves the newly added user, property between item and location Cil, a given targeted location l, and type of recommendation Z.

V. CONCLUSION

This article discusses the CF algorithms employed in mobile Internet applications. A framework is firstly proposed to demonstrate the main procedures of a typical CF recommender system, i.e., data collection, data pre-processing, and collaborative filtering. Features of two kinds of user data, i.e., user behaviors and user ratings, are analyzed and compared in detail. After transforming the user behaviors into implicit ratings through specific methods, the sparsity problem of the rating matrix can be mitigated to some extent. Typical CF algorithms, including memory-based and model-based, and their general procedures are summarized for the sake of revealing the common features of these methods. Finally, to validate this framework, two case studies were carried out based on user behaviors and user ratings, respectively. The SSU-aware location-sensitive recommendation algorithm is then devised. This project evaluates and compares the proposed approach with the existing rating prediction and item recommendation algorithms. The results show that the projected SSU-aware recommendation is more practical in recommending things with higher thought of the user's preference and site

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