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Survey on collaborative filtering for Digital Libraries

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Abstract - *Library management are of huge importance in colleges and universities. Though the present management approaches have made major achievements, these approaches do not consider college students' parallel education trajectories in the same way. In order to manage and recommend books to students is very critical for college. This paper proposes a library management and book recommendation process for student and staff on the basis of algorithm which is based on the time sequential collaborative filtering recommendation, which is combined with students' learning path. In order to suggest books resourcefully, our algorithm leverages space distance. In this algorithm, we consider two important characteristics: first is time sequence information of borrowing books and the flow times of books. Our new results show that our book recommendation algorithm is in accordance with the college students' requirement for learning.*

Key Words: **Time sequence information, collaborative filtering, and book recommendation.**

1. INTRODUCTION

An academic library plays an significant role in teaching and supporting scientific study in universities. In current years, universities have enlarged their financial asset and purchased plentiful electronic resources. Books share a significant part of these built-in resources. The number of books holding library is ranges from tens of thousands to millions. The primary issue of administrators is how to direct readers or students to make full use of library resources. A substantial number of students go to the library without clear aim. Some readers may come up to the library to kill time, and they may sense tough to decide suitable books for reading since they face a group of books. Some may go to the library with some goals, but the goals are not specific. They only know what type of books they wish to read, but they are not apparent which books to borrow. It is a very general reality for readers to face information overload. Someone or some tackle are desire to help students to filter and to make a choice. You cannot always have an skilled person by your side to provide or recommend a few books, If there is a person by your side at that instant, you can request him for help. You require deciding some books with the assist of some tools, which are recommendation systems. Recommender systems connect student and items automatically by the recommendation algorithm. They have concerned complete attentions [1]. The systems can help users to find the information to which they are concerned and drive the information to them in information overload environments. According to diverse recommendation strategies, recommendation algorithms can be differentiate into a number recommendation which are content-based recommendation, collaborative filtering-based Recommendation, association rule-based recommendation, utility-based recommendation, knowledge-based recommendation and hybrid recommendation [1]. Collaborative filtering recommendation was first given by Goldberg in 1992 and was practical to the research-based email recommendation system called the Tapestry. Collaborative filtering recommendation algorithm defines target users' choice for a exacting product by adopting the user behavior, which is same as target users then makes a suggestion according to the first choice degree [2]. Collaborative filtering recommendation method has turn into one of the most capable recommendation method. In this paper, we suggest a modified time sequence information collaborative filtering proposal to get better book proposal. The main contribution of our methods is that it combines students' learning trajectories with time-sequence-based collaborative filtering proposal algorithm in order to boost recommendation accuracy rate.

2. Overview

Our second section Author includes overview of our survey with various type of operations and technology.

A. Literature Survey

J. Bobadilla, F. Ortega, A. Hernando, and A. Gutiérrez In This article they have provides a general idea of recommender systems as well as collaborative filtering methods and algorithms. They also clarify their development which provides an unique categorization for these systems, identifies are as of future execution and expand definite areas selected for past, present or future significance [1].

Qi Liu, Enhong Chen, *Senior Member, IEEE*, Hui Xiong, *Senior Member, IEEE*, Chris H. Q. Ding, *Member, IEEE*, and Jian Chen, *Fellow, IEEE* propose a iExpand methods to deal with or to overcome the many issues that exist in traditional

collaborative filtering such as the *overspecialization* problem and the cold-start problem. The given method is a novel based collaborative-filtering recommender system by user concern growth via modified ranking. The objective of this system is to build an item-oriented model-based collaborative filtering framework. The iExpand method introduces a three layer, which are user–interests–item, representation scheme, which guide to more exact ranking recommendation results with less computation cost and helps to understand the connections among users, items, and user interests [2].

Zhongqi Luy, Zhicheng Dou, Jianxun Lian, Xing Xie and Qiang Yang. In this paper, they put forward a Content-based Collaborative Filtering approach (CCF) to bring both Content-based Filtering and Collaborative Filtering approaches as one. From this approach they found that the combining process of these two is not an simple job, but the reimbursement of CCF are impressive. On one hand, CCF makes recommendations based on the rich contexts of the news. On the other hand, CCF collaboratively examines the scarce feedbacks from the long-tail users. They modified this CCF approach for the news topic displaying on the Bing front page and verified great gains in attracting users[3].

Yongfeng Zhang, Min Zhang, Yi Zhang,Guokun Lai, Yiqun Liu, Honghui Zhang, Shaoping Ma proposed a method to improve the often altering user preferences and/or item profiles for dynamic modeling of users and items in personalized recommender systems. In this paper, they make use of the huge quantity of textual reviews for the automatic removal of domain knowledge, namely, the explicit features/aspects in a exact product area. Due to which it degrade the product-level modeling of user preferences, which go through from the lack of data, to the feature-level modeling, which not only grant the capability to guess user preferences through direct time series analysis, but also allow us to know the spirit under the surface of product level changes in purchasing patterns. they build up the Fourier-assisted Auto-Regressive Integrated Moving Average (FARIMA) process to tackle with the year-long seasonal period of purchasing data to achieve daily-aware preference predictions[4].

Antonio Hernando, Jesús Bobadilla, Fernando Ortega In this paper they present a technique for guess the tastes of users in recommender systems based on collaborative filtering which is based on factorizing the rating matrix into two non-negative matrices whose components lie within the range [0, 1] with an understandable probabilistic meaning. Thanks to this by the decomposition they accurately predict the ratings of users, find out some groups of users with the same tastes, as well as justify and understand the recommendations [5].

Youngki Park, Sungchan Park, Woosung Jung, Sang-goo Lee In this paper, they give a Reversed CF (RCF), a fast CF algorithm which utilizes a k-nearest neighbor (k-NN) graph to conquer the harms with the item-based and User-based collaborative filtering (CF) methods which are the most broadly used techniques in recommender systems. The main approach of this is to reverse the process of finding k neighbors as an alternative of finding k similar neighbors of unrated items, RCF finds the k-nearest neighbors of rated items. This method gives fewer predictions while filtering out inaccurate results, but it also enables the use of fast k-NN graph building algorithms such as greedy filtering [6].

Fuli Zhang gives a personalized book suggestion algorithm that is based on the time sequential collaborative filtering recommendation, joint with students' learning paths. In order to advise books efficiently, their algorithm leverages space distance. In this method, he considers two significant characteristics: the time sequence information of borrowing books and the circulation times of books. The experimental results show that our book recommendation algorithm is in accordance with the college students' demand for professional learning [7].

P. Kouki, S. Fakhraei, J. Foulds, M. Eirinaki, and L. Getoor. To overcome the problem of flexible recommender systems which can incorporate richly structured data sources to improve recommendations they propose a hybrid approach, HyPER (HYbrid Probabilistic Extensible Recommender), incorporates and cause over a wide range of information basis. Such sources contain multiple user-user and item-item similarity measures, content, and social information. Hyper automatically study to sense of balance these different information signals when making calculation. They build a system using a powerful and intuitive probabilistic programming language called probabilistic soft logic, which enables efficient and accurate prediction by formulating the custom recommender systems with a scalable class of graphical models known ashinge-loss Markov random fields[8].

S. Feil, M. Kretzer, K. Werder, and A. Maedche they presented a kind approach that does not require any modification to the recommendation algorithm. they draw a motivation theory and reward users for rating items. In particular, they instantiate different gamification patterns and examine their effect on the average user's number of provided report ratings to improve the cold start problem in recommender systems refers to the inability of making reliable recommendations if a critical mass of items has not yet been rated[9].

X. Wang, J. Zhu, Z. Zheng, W. Song, Y. Shen, and M. R. Lyu. They give a spatial-temporal QoS guess approach for time-aware Web service recommendation, in which a sparse demonstration is in use to model QoS variations. Specifically, they make a zero-mean Laplace prior sharing assumption on

the residuals of the QoS prediction, which corresponds to a Lasso regression problem. To successfully select the nearest neighbor for the sparse representation of temporal QoS values, the geolocation of web service is employed to reduce searching range while improving prediction accuracy. From this experimental results demonstrate that the proposed approach outperforms state-of-art methods with more than 10% improvement on the accuracy of temporal QoS prediction for time-aware Web service recommendation [10].

B. Related Work

Recommender systems have been broadly useful in many domains such as book, music, and movie recommendations [2]. In latest years, with the quick growth of information technology, a rising number of books are shared in many digital libraries. Recently, many have made a lot of revolution in recommender systems. Lu et al. [3] proposed a content-based filtering and collaborative filtering methods. The two-way filtering recommendation method can be separated into two parts, the memory-based and the model-based. Some scholars also separate them into the neighbor-based and the model-based [4]. even though their names are different, the depiction of the core content of classification algorithm is similar. Antonio Hernando et al. projected a forecast method of collaborative filtering recommendation for the ratings of users based on Bayesian probabilistic model [5]. Kouki et al. [8] intended a hybrid probabilistic extensible hybrid recommendation method, which could mechanically learn and make prediction by incorporating diverse information signals. The memory-based filtering algorithm compute the resemblance in users or products according to the existing data set and products that having high resemblance as neighbors of the aim users. Then computing neighbors' rating is used to expect target user's first choice degree for that product. This type of recommender system gives a recommendation on the basis of the preference degree. The model-based collaborative filtering algorithm draws a model by studying the teaching data set and uses the model to forecast the unknown data. Typical model-based collaborative filtering contains the clustering-technique based collaborative filtering, probability-method-based collaborative filtering, and matrix-decomposition-based Collaborative filtering, etc. The main gain of the usual collaborative filtering is that it can gives recommendation service for users under the circumstance of not considering the content of recommended items. Because users interfere less during the process of recommendation, and the technology is easy to apply, collaborative filtering has become a popular recommendation skill. The ratings of the related items are usually calculated in the process of recommendation, but the related time sequence behavior information is easily ignored. Many scholars proposed the improved recommendation algorithm based on time sequence information for this problem. Time-sequence-based recommendation methods add the time sequence information into the existing recommendation model. This method enables the model to study the data changing over time. In addition, the recommended dataset will be optimized. As a consequence, the accuracy of recommendation results would be improved. A real-time stream-based recommendation algorithm was based on collaborative filtering. Some scholars add time sequence information into the feature vector of the user. Some scholars also get time information as the third dimension and then use tensor decomposition to model dynamic change.

3. CONCLUSIONS

This paper has given a method for book recommendations and library management based on time sequence information. The most benefit of our technique is that it combines knowledge learning systems of college students in diverse majors, gives a new way for universities' book recommender systems. The correctness of recommendation results is exaggerated due to our new dataset has certain boundaries, In the prospect, under the premise of keeping the correctness of the recommendation system, we graph to discover further on the novelty and diversity of the book recommendations.

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