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LIBRS: LIBRARY RECOMMENDATION SYSTEM USING HYBRID FILTERING

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***Abstract*— Recommender systems give suggestion according to the user preferences. The number of contents and books in a university size library is enormous and a better than ever. Readers find it extremely difficult to locate their favorite books. Even though they could possibly find best preferred book by the user, finding another similar book to the first preferred book seems as if finding an in nail the ocean. That is because the second preferred book might be at very last edge of long tail. So recommender system is often a requirement in library that should be considers and need it to come into make the above finding similar. They have become fundamental applications in electronic commerce and information retrieval, providing suggestions that effectively crop large information spaces so that users are directed toward those items that best meet their needs and preferences. A variety of techniques have been suggested for performing recommendation, including collaborative technique and its three methods which are Slope One used for rating prediction, Pearson's correlation used for finding the similarity between users and last but not the least item to item similarity. To upgrade the performance, these methods have sometimes been combined in hybrid recommendation technique.**

***Index Terms*— Collaborative, Hybrid, Item to item similarity, Pearson's correlation, Recommender, Slope one.**

I. INTRODUCTION

Recommender Systems (RS) are software tools and techniques providing suggestions for items to be of use by the user. Recommender systems have evolved since the early 1990's as a response to increasing information overload. These systems help users to identify a subset of items within a large information space. Unlike ordinary keyword search systems, recommenders attempt to find items that match user tastes and the user's sense of quality.

In their simplest form, recommendations are offered as ranked lists of books. In performing this ranking[6], RSs keep try to predict what are the most suited products or services, based on the user's taste[6] and restraint.

In order to complete such a computational job [6], RSs collect from users their preferences and taste, which are either explicitly or specifically expressed [6], e.g., as ratings for items, or are assume by interpreting user actions. Also by combining ideas from user profiling, information filtering and machine learning, recommender systems have proven to be effective at delivering the user a more intelligent service.

In general two recommendation strategies are widely considered: Content-based recommenders depend on content or descriptions of the items that are being recommended to the user and another one is of the most successful technologies for recommender systems is Collaborative Filtering (CF). Collaborative filtering systems use the perspective of a group to recommend items to individuals. For example in case of book recommendation, a collaborative filtering recommender would identify other people who share a user's book tastes, and would then recommend the book to user that those "neighbors" liked but that user hadn't yet read. To limit the disadvantages of individual RS systems these systems are combined in a new hybrid system. Generally there are several approaches to implement hybrid system, some of them are: (a) Implementing various methods separately and combine their recommendations (b) Incorporating some characteristics of one method into another method and vice versa.

II. SYSTEM ARCHITECTURE

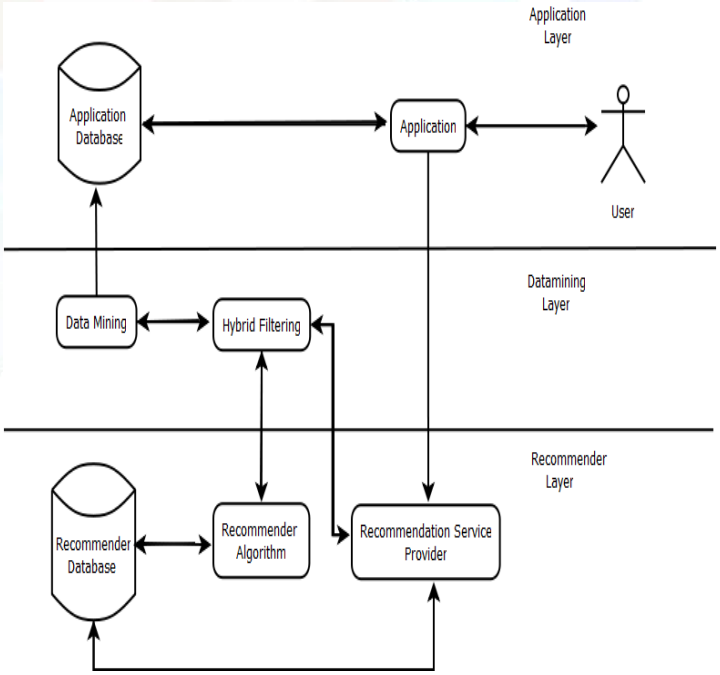

Fig 1. System Architecture

Fig 1 shows the system architecture. In this system, when new user comes a login page will appear. After login, system provides some list of books so that according to his/her taste he/she gives ratings to those books.

Application Database is data repository which is created by using user's profile, his interest, current data as well as historical data. The next block is Data Mining. In this, preprocessing of data is carried out by removing special symbols, duplicates etc. Then this data is fed to next block which is Hybrid Filtering. It collect frequent items set as input and generate recommendation set for user by finding similarity between users and items using cosine and Pearson's algorithm and predicting the rating of user on particular item by using slope one method.

In Recommender Database, all recommendation result which is recommended by recommender engine and it provide data to Recommender Service Provider for further recommendation. Last block is Recommender Service Provider. It periodically analyzes all recorded data to generate recommendation.

III. PROPOSED SYSTEM

The proposed system performs different functions in which first is User Profile. When user first visit to the login page, system provide some list of books so that according to his/her taste he/she gives ratings to those books. By predicting interest of user according to rating or predilection given by user recommendations are given to the user. In the next step that is Rating Prediction, rating of some unrated item is calculated which are somehow resemble with taste of user's similar to another user by using slope one collaborative filtering algorithm. Rating value is determined by using available rating values of other users.

Then the further step is Graph Construction. After extracting the data from database the first job is constructing the graph of all the valid available data. After that the strong association between item to item and user to user is determine. Due to graph, the effectiveness of the algorithm improves because rather than taking whole data set for processing by generating graph and there sub-graph and apply algorithm on sub-graph so that it takes slighter time for execution.

Recommendation technique is used for predicting user's taste according to preferences and rating given by user. It is calculated by using collaborative filtering algorithm [7]. There are different types of collaborative filtering algorithm for determining relationship between item to item, items to person etc. The Personalization feature of system is that one algorithm which is used to develop the system is collaborative filtering. Collaborative filtering has three methods. Collaborative filtering Slope one method use for rating prediction, Cosine method [7] gives relationship between item and item and Pearson correlation method gives the relationship between user and user.

IV. ALGORITHM DETAILS

A. Item-based Collaborative Filtering Algorithm:

In this section we study a class of item-based recommendation algorithms for producing predictions to users. The item-based approach looks into the set of items the target user has rated and computes how similar they are to the target item i and then selects k most similar items {i1, i2. . . ik }. At the same time their corresponding similarities {si1, si2,. . . sik } are also evaluated. Once the similarities between items are found, the prediction is then evaluated [1] by taking a weighted average of the target user's ratings on these resembling items. We depict these two views namely, the similarity computation and the prediction generation in details here [2].

B. Item Similarity Computation:

One critical step in the item-based collaborative filtering algorithm is to compute the similarity between items and then to select the most resembling items. The basic idea in similarity evaluation between two items[1] i and j is to first isolate the users who have rated both of these items and then to apply a similarity computation technique to determine the Similarity sim(i, j) .

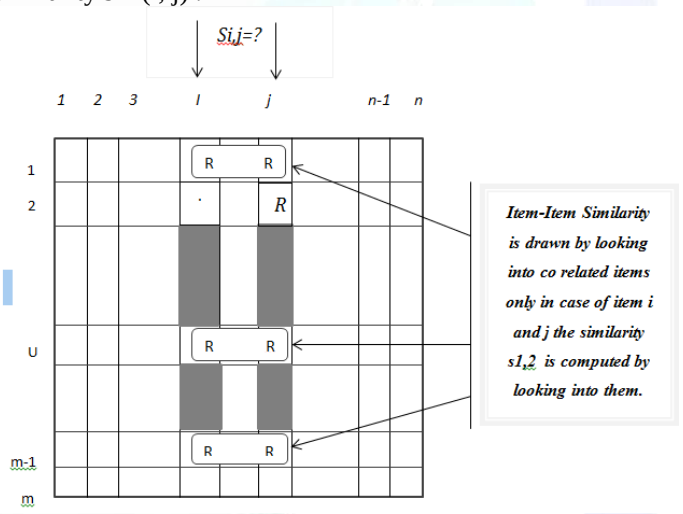

Fig.2 item-item similarity matrix

Here in fig 2, the matrix rows represent users and the columns represent items[3]. There are a number of different ways to compute the commonality between items. Here we represent two such methods. These are cosine-based similarity and correlation-based similarity [2].

C. Cosine-based Similarity:

In this case, two items are thought of as two vectors in the m dimensional user-space. The similarity between them is measured by the cosine of the angle between these two vectors[3]. Formally, in the m × n ratings matrix in above figure, similarity between items i and j, denoted by

sim (i, j) is given by

$$sim(i,j) = \cos(\vec{i},\vec{j}) = \frac{\vec{i},\vec{j}}{\|\vec{i}\|_2 . \|\vec{j}\|_2}$$

…….. (1)

Where "·" denotes the dot-product of the two vectors.

D. Pearson's Correlation Coefficient:

One of the most often used similarity metrics in collaborative-based system Pearson's is correlation coefficients .Pearson's Algorithm is a type of memory based collaborative filtering algorithm.

Pearson's correlation reflects the degree of linear relationship between two variables, i.e. the extent to which the variables are related, and ranges from +1 to -1. A correlation of +1 means that there is a perfect positive linear relationship between variables or in other words two users has very similar tastes, whereas a negative correlation indicates that the users have dissimilar tastes.

Pearson's algorithm is used to determine the degree of correlation between an active users a and another users' b[4]. A formula which is commonly used for Pearson's correlation coefficients is:

$$W_{a,b} = \frac{\sum_{i=1}^{n}(r_{au,i} - \bar{r}_{au}).(r_{bu,i} - \bar{r}_{bu})}{\sqrt{\sum_{i=1}^{n}(r_{au,i} - \bar{r}_{au})^2}.\sqrt{\sum_{i=1}^{n}(r_{bu,i} - \bar{r}_{bu})^2}}$$

…….. (2)

Where:
a: active user
b: another users of the system
n: the number of items that both the active user and ALL recommender users have rated.
rau: is the average ratings of the active user
rbu: is the average of another user b's ratings
w(a,b): the degree of correlation between user a and user b.

Then, the prediction for user a on item i denoted by p(a,i) is calculated as follows:

$$P_{a,i} = \bar{r}_{au} + \frac{\sum_{b=1}^{t}(r_{bu,i} - \bar{r}_{bu}).W_{a,b}}{\sum_{b=1}^{t}|W_{a,b}|}$$

Where, t is the total number of users[5].

A. Slope One Algorithm:

Slope one is a simple algorithms used for producing predictions to users. This algorithm uses item-based collaborative filtering which is based on ratings.

In this algorithm, how much better one item is liked than another is determined in a pairwise fashion. It uses a simpler form of regression with a single free parameter f(x)=x+b . The free parameter is then simply the average difference between the two items' ratings. It was shown to be much more accurate in some instances, and it takes half the storage or less.

Slope One algorithm process: firstly, calculate the average deviation devj,i of the target item j with other item i; then, predict the rating P(u,j) of the currently active user u on the target item j. Calculate the deviation. Given user rating vector set Sj,i(SU)-, the average deviation devj,i (mean difference between item j and item i) is calculated.

$$dev_{j,i} = \sum_{u \in S_{j,i}(SU)} \frac{r_{u,j} - r_{u,i}}{c_{j,i}}$$

…….. (4)

Formula:

$$P(u,j) = \frac{\sum_{i \in S(SU)-\{j\}}(dev_{j,i} + r_{u,i}).c_{j,i}}{\sum_{i \in S(SU)-\{j\}}.c_{j,i}}$$

…….. (5)

Where,
P(u,j) : is the predicted value of item j for target user u.
ru,I : rating given by user u to item i.
ru,j : rating given by user u to item j.
devj,i : is the deviation value calculated.
cj,i : denotes the number of Sj,i(SU).

Firstly, the difference between the averages of two items can be calculated via subtract operation. Then, once one item's value is available, the other's value can be predicted according to such difference. The process can be illustrated in Fig. For two users (A and B) and two items (I and J) in user-item matrix, the values of these two items for user a are known and the differential from I to J is 1.5-1=0.5. Thus, the item J's value for user B can be predicted via this mapping relationship, that is, 2+(1.5-1)=2.5.

Hence, the average of these differentials will be taken for predication.

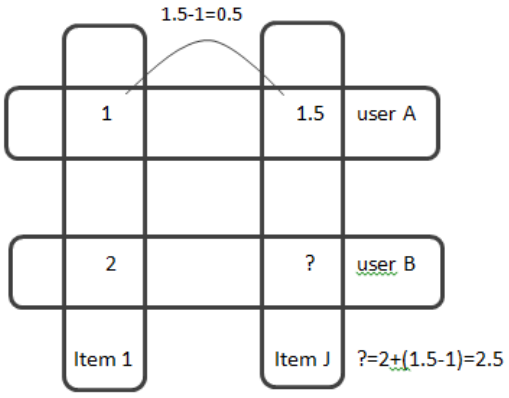

Fig.3. Example of Slope one.

V. CONCLUSION

In this paper recommendation system gives the solution to user's taste but recommendation using collaborative filtering

hybrid increase the efficiency of algorithm.Item-item based collaborative filtering algorithm form the association between item to item. Pearson's correlation algorithm used to determines the association between user to user, so hybrid algorithm of this techniques guide to personify the result of recommendation. Hence, by using these methods Pearson's correlation, slope one, and item-item based collaborative filtering user's interest is achieved.

VI. REFERENCES

[1] BadrulSarwar, George Karypis, Joseph Konstan, and John Riedl,Item-based Collaborative Filtering Recommendation Algorithms,1feb 2002.

[2] BadrulSarwar, George Karypis, Joseph Konstan, and John Riedl , Item-Based Collaborative Filtering Recommendation Algorithms ,Department of Computer Science and Engineering University of Minnesota, Minneapolis, MN 55455,19 feb 2001.

[3] George Karypis, BadrulSarwar, Joseph Konstan, and John Riedlfsarwar,]Item-Based Collaborative Filtering Recommendation Algorithms,Department of Computer Science and Engineering University of Minnesota, Minneapolis, MN 55455, May 1-5, 2001.

[4] HangsapholynaSar ,SaokosalOum
A Model Of Recommender System For a Digital Library,Nov 22, 2012.

[5] Himan Abdollahpouri,Adel Rahmani,AlirezaAbdollahpouri,Is Always a Hybrid Recommender System Preferable to Single Technique,International Journal of Computer Applications (0975 8887) Volume 82 No4, November 2013.

[6] Handbook Francesco Ricci, LiorRokach and BrachaShapira,Introduction to Recommender Systems ,F. Ricci et al. (eds.), Recommender Systems Handbook , © Springer Science+Business Media, LLC 2011.

[7] Susanne Gottwald,Dr. Thorsten Koch,Recommender Systems for Libraries,ACM Recommender Systems 2011 Chicago, IL, USA.