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Integrating Collaborative Filtering and Association Mining for Online Book Recommendations

Mrs.T.V. Lavanya[1]., Bijjala Laasya Sri[2]
1 Assistant Professor, Department of CSE, Malla Reddy College of Engineering for Women., Maisammaguda., Medchal., TS, India
2, B.Tech CSE (20RG1A05C6),
Malla Reddy College of Engineering for Women., Maisammaguda., Medchal., TS, India

Abstract –

Typically, people turn to recommendation systems when they're looking for suggestions on what to buy or where to go next. They help shoppers choose products that will save money while still satisfying their demands. big data refers to a massive collection of information. Methods such as content mining, collaborative filtering, and association mining have all been developed to improve the quality of recommendations. Better performance was achieved by integrating collaborative-based filtering with association rule mining in this research, thereby resolving the issue of data sparsity. Data scarcity and scalability are only two of the problems that the suggested recommendation algorithms address, and the outcomes are shown to be superior.

I. INTRODUCTION

A recommendation system [11] is a sort of information filtering that makes purchasing decisions based on the predicted ratings and preferences of individual users. expectations and passions. The finest example of a recommendation system is the book suggestions on Amazon.com. The Recommendation System shows [11] users where to go for services and data that best suit their needs. Following are some of the technologies used by the recommendation system: Concepts like content filtering, collaborative filtering, and association mining are all in use today. By analysing a user's preferences and profile, content filtering may provide suggestions for content that the user is more likely to like. Collaborative based filtering is an approach to user behaviour analysis in which one user's preferences are analysed in light of those of other users with whom they have commonalities. The purpose of association mining is to establish causal connections between data elements. A rule of association has the form X Y, where X and Y are two groups of objects. If we purchase X, it determines that there is a good possibility that we will also buy Y.

The following is a disadvantage of collaborative filtering [7]:

a. Sparsity: a highly active user may only be able to rate a small subset of the database's total entries. Product ratings are available for widely-used products, by a small percentage of people, sometimes known as a "data sparsity issue."

A. Warm-up B. Cold Start It is also known as the "new user issue," and it describes the difficulty in making recommendations to a user who has never used the service before since the user has not yet given any ratings to any products. As a result, recommending an item to a new user is tough. The following is the outline for this paper: Section 2 will include the literature review. In Chapter 3, we identify the issues at hand. In section 4, we provide a comprehensive explanation of collaborative filtering. The outcomes of the experiments are presented in Section 5. In Section 6, we provide a short overview of the whole work.

II. LITERATURE SURVEY

Thanks to widespread adoption and an increased appreciation for the web's potential, a plethora of data is now accessible online [11]. Because of this [11] feature, the Internet is a a matter that needs further study. Using the prediction h MAE graph, Salwar et al. [10] introduced and examined the influence of various similarity algorithms, presented experimental data, and made the suggestion that the size of the neighbourhood affects the quality of the predictions they make. The initial stage in collaborative filtering is discovering a group of nearby neighbour, and Hongwu ye [7] presented a technique for doing so using a self-organizing map. An empty spot may be filled with the help of association mining. Thus, they suggested using a mixture of association mining and SOM to deal with the problem of data scarcity.

By fusing item categorization with an item-based collaborative approach, Hengsong Tan et al. [8] established a novel method for dealing with the issue of data sparsity. Using the item's characteristics as a basis for classification, this method makes predictions for products without ratings.

III. PROBLEM STATEMENT

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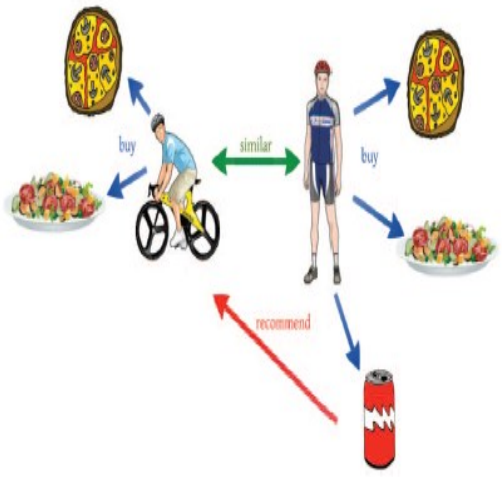
If you don't have enough firsthand knowledge to confidently evaluate all of the options shown on a Website, a recommended system may assist. In addition to, or as a result of, data that may aid in the selection of a buy As opposed to traditional recommended systems, which simply take user ratings into account, the suggested approach also takes into account other factors. If user reviews are not there, it will not provide a recommendation.
Both collaborative filtering and association mining are used in the suggested approach. Association mining is utilised to fill in missing ratings when required, and collaborative filtering is performed to uncover similarities between products that will assist the algorithm propose goods. The system then use item-based collaborative filtering to forecast which users will be interested in certain products. As a result, using both approaches may assist in solving the issues of data sparsity and cold start in recommended systems.

IV. COLLABORATIVE FILTERING

The purpose of collaborative filtering is to anticipate [11] a user's viewpoint by factoring in the opinions of similar users. It takes use of two distinct strategies:
Predicting associations using a rule-based approach.
Option B. Suggestion.
There are two distinct kinds of collaborative filtering:
1) Collaborative filtering based on user input: To forecast user ratings, this[10] algorithm uses similarity metrics to compute the degree to which users are similar to one another, as seen in Fig.1. [11]. Recommendations may be made after locating k closest neighbour and sharing common tastes.



as a means of handling the issues of cold starting a system and data sparsity.

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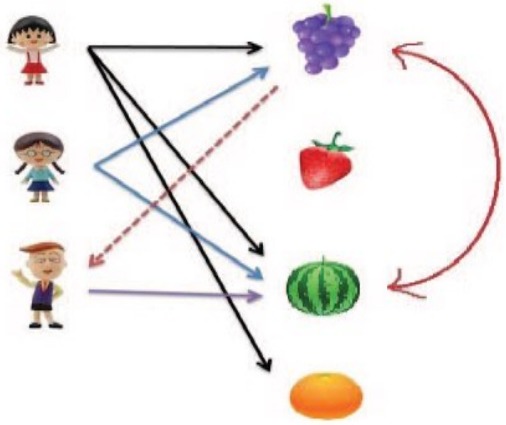

Fig.2. Item based Collaborative filtering [11]

A. A method for discovering commonalities between objects. Several different types of similarity algorithms are available, totaling [8]: Correlation (Pearson), Cosine (Similarity), and its Adjusted parallelism of cosine vectors. In order to account for the fact that different users would use different rating scales for the same item, this research employs modified cosine vector similarity [8].

$$sim_{(t,r)} = \frac{\sum_{i=1}^{m}(R_{it}-A_i)(R_{ir}-A_i)}{\sqrt{\sum_{i=1}^{m}(R_{it}-A_i)^2(R_{ir}-A_i)^2}} \quad (1)$$

where is the average rating of user I for all things rated together, is the rating of the remaining item r, and m is the total number of items rated by user i. user base for both t and r. Column 1 should have the ISBN number of item 1, and column 2 should contain the ISBN number of item 2. This is an example of things that are identical to one another, as seen in Figure 3.
The percentage of shared traits is shown in Column 3.

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Item1	Item2	Sim
0195153448	0002005018	0.7214943290316204
0002005018	0195153448	0.7214943290316204
0195153448	0060973129	0.07269361923005246
0060973129	0195153448	0.07269361923005246
0195153448	0374157065	0.024886350474708552
0374157065	0195153448	0.024886350474708552
0195153448	0393045218	0.5215209699163684
0393045218	0195153448	0.5215209699163684
0195153448	0399135782	0.5943545951630751
0399135782	0195153448	0.5943545951630751
0195153448	0425176428	0.36992982183974177
0425176428	0195153448	0.36992982183974177
0195153448	0671870432	0.8379692079362827

Fig.3. Similarity Matrix Table w.r.t item – item

Neighbors have been chosen [3]. Threshold selection is used to choose which nearby neighbour to show preference to. Users that have more than a threshold degree of similarity are considered to have used this method. Those whose scores are close to the threshold value are categorised as neighbour of the target user. A cutoff value of 70% was used in our study.

B. Collaborative Filtering Prediction for Individual Items Predicting how [8] u, the intended audience member, would rate [8] t, the intended product, may be done as

$$P_{ut} = \frac{\sum_{i=1}^{c} R_{ui} \times sim(t,i)}{\sum_{i=1}^{c} sim(t,i)} \qquad (2)$$

In this formula, t is the target item, u is the target user's rating of neighbour I sim (t, I is the similarity between t and I and c is the number of neighbour.

V. EXPERIMENTAL RESULTS

A. DATABASE TABLES:The tables we used in this project are:

i. Book information table: Table I gives the following information about table.

TABLE I: Book Information Table

Attributes	Explanation
ISBN	Unique id of book
BOOK TITLE	Book name
AUTHOR	Name of author
YEAR OF PUBLICATION	Year of publication
PUBLISHER	Name of publisher

ii. Book Rating Table: Table II provides the information about rating given to book by user.

TABLE II: Book Rating Table

Attributes	Explanation
User_id	Unique id of user
ISBN	Unique id of book
Book_rating	Rating of books

iii. User information table: Table III provides the information about the user.

TABLE III: User Information table

Attributes	Explanation
User_id	Unique id of user
Address	Address of user
Age	Age of user

B. Input

Whenever we create user ,the user is assigned with user_id ,which he uses that number while logging into system .

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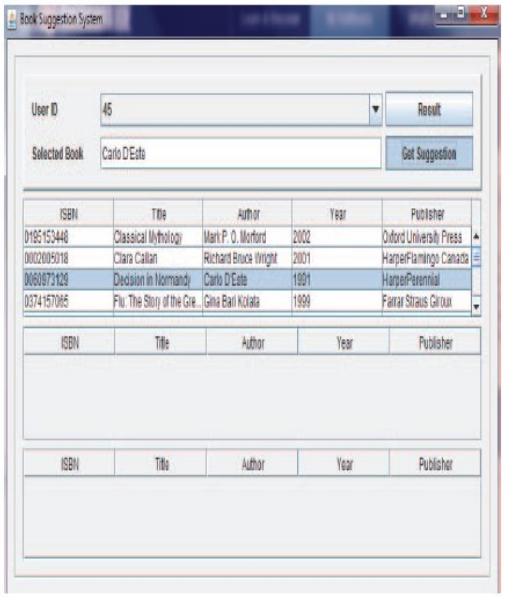
Fig.4. shows the input window

Fig.4. Input Screen

After logging in, we need to specify the book we want a suggestion on. The subsequent processing time frame is shown in Fig. 5.



5 The Processing Time Window

Three-letter-acronym-C: Output

The suggested action plan is shown in Fig. 6. The formula for the similarity computation is presented in eq1, as is the resulting list of recommendations. The author's preference in the recommended list is determined by the database.

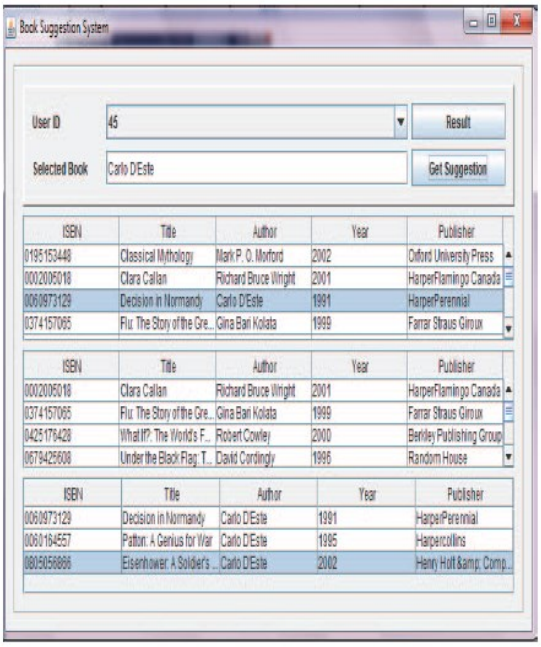


Fig.6. Output screen

D. Performance Measure :

In this study, we calculate the mean absolute error (MAE) using [8] statistical accuracy criteria. In order to calculate the MAE, one would use the following formula:

$$MAE = \frac{\sum_{i=1}^{n} p_{i-q_i}}{n}$$

The mean absolute error (MAE) is the average of the absolute differences of n pairings. Let's pretend predicted ratings (p1–pn) are more accurate than actual ratings (q1–qn). The more precise the [8th] MAE is, the would expect it to be. Results achieved may be predicted with high confidence, as seen by the graph below.

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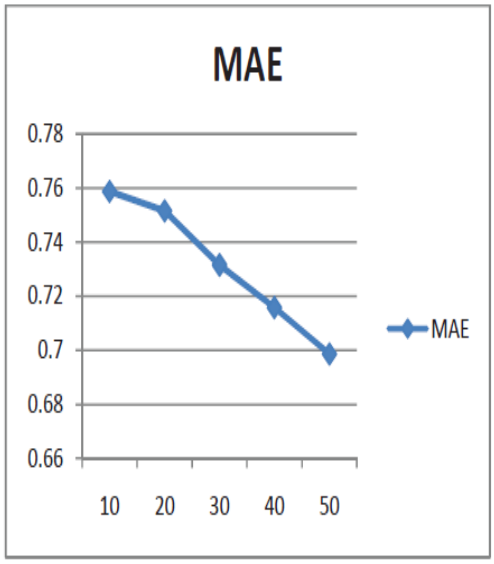

Fig.7. MAE with different no. of nearest neighbors

VI. CONCLUSION

New methods for ranking and displaying items of Users' Interests have emerged in response to the ever-increasing demand for online information. In the present study, we use a Collaborative Filtering. With the aim of generating rankings. Items-based collaborative filtering may solve the issue of sparse data and provide useful recommendations. When everything is said and done, the similarity calculation results show promising accuracy.

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