Research on the Application of Collaborative Filtering Algorithm in Mobile E-Commerce Recommendation System

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Abstract—**With the rise of e-commerce in the Internet industry, e-commerce recommendation system has been widely concerned. Electrical contractor recommendation system is based on the user's personal information such as features, historical behavior and items through collaborative filtering, content filtering, knowledge discovery, interactive and recommend recommendation technology, referring users to the items that may be of interest, in many recommendation algorithm, collaborative filtering recommendation technology is currently one of the most widely used recommendation algorithm, this paper test the collaborative filtering algorithm in the application of mobile electronic commerce recommendation system experiment, it is concluded that the realization of the collaborative filtering algorithm is better personalized recommendation.**

Keywords—Collaborative filtering, e-commerce, personal recommendation

I. INTRODUCTION

Based on the personalized features and needs of users, e-commerce recommendation system relies on collaborative filtering, content filtering, knowledge discovery, interactive and other recommendation technologies to recommend information to appropriate users in the right scene, at the right time and through the right channel, so as to provide customers with personalized shopping experience. Although the Internet has brought convenience to people's life, the problem of information overload has also come along. It is very difficult for users to find the information they like in the vast information network. Over time, users' interest in e-commerce sites will decrease until they lose interest completely. In order to solve the problem of information overload and guide users to find suitable products easily, recommendation system has become a new service mode in e-commerce websites. Compared with the traditional search engine, personalized recommendation can meet the needs of people with different backgrounds, purposes and interests in different periods. Moreover, this recommendation mechanism has changed the original traditional mode of "information seeking", created a new mode of "information seeking" and active push, and provided users with a new way of e-commerce website experience. Personalized recommendation technology is the core of personalized recommendation system, collaborative filtering is widely used in e-commerce recommendation system, and is the most successful recommendation technology. A wide range of applications used to predict users' interests and preferences. In daily life, when we choose goods, we tend to turn to our relatives and friends for advice, which helps us make decisions. Collaborative filtering is apply this idea to the personalized recommendation, based on similar interests of users for the evaluation of certain projects to target users recommend suitable project but based on collaborative filtering recommendation technology is not only itself there is a cold start, thin, big data processing and calculation of incremental, but with the development of Internet, the use of the technology to the field of electronic commerce, there is also the user interest changes over time and user trust. Therefore, it is of great significance to study and improve collaborative filtering algorithm to improve the effect of personalized recommendation on e-commerce websites.[1-2]

II. METHOD

The basic starting point of the user-based collaborative filtering algorithm is that all users' interest information is derived from users' ratings of different items, and the behavior of users can reflect their similarity to some extent, and all users' evaluation of items will be the same as that of users with the same interest.[3-5]

Collaborative filtering algorithm based on the user's basic idea is according to the users score calculation for the project, the similarity between the find and target users interests similar collection, collection is the nearest neighbors, and then through the collection of nearest neighbors of target project evaluation to predict the target users of the target project, finally will predict score the highest number of projects as a recommended list. The core of the algorithm is how to determine whether the user is similar or not, and how to select the set of neighbor users according to the similarity. Its steps are:[6-8]

(1) Data acquisition. Obtain the user's evaluation value of the project and construct the user's behavioral preference matrix. Per user the interest and preference are expressed by vector, which is composed of the user, the project and the score value of the project by the user. Then the information of all users forms a matrix, as shown in Formula (1) user-item score matrix:

$$R = \begin{bmatrix} R_{11} R_{12} ... R_{1n} \\ R_{21} R_{22} ... R_{2n} \\ ... \\ R_{m1} R_{m2} ... R_{mn} \end{bmatrix} \quad (1)$$

In user-based collaborative filtering algorithms, user

ratings are often regarded as vectors in n-dimensional space, and the similarity between users can be measured by the cosine Angle between user vectors. The higher the value, the more similar the two users are. Suppose the score of user U and user V in n-dimensional project space is expressed as vector UV respectively, then the calculation formula of the similarity SIM (U, V) between the two users is:

$$sim(u,v) = \cos\left(\vec{u},\vec{v}\right) = \frac{\vec{u} \bullet \vec{v}}{\|\vec{u}\| \bullet \|\vec{v}\|} = \frac{\sum_{j=1}^{n} R_{ui} * R_{vi}}{\sqrt{\sum_{i=1}^{n} R_{ui}^2}\sqrt{\sum_{i=1}^{n} R_{vi}^2}} \quad (2)$$

$$sim(u,v) = \frac{\sum_{i \in I_{uv}} \left(R_{ui} - \overline{R_u}\right)\left(R_{vi} - \overline{R_v}\right)}{\sqrt{\sum_{i \in I_{uv}} \left(R_{ui} - \overline{R_u}\right)^2}\sqrt{\sum_{i \in I_{uv}} \left(R_{vi} - \overline{R_v}\right)^2}} \quad (3)$$

The second step is to use certain rules to select the set of neighbors with the most similar interests and hobbies of the target user from the neighbor list U. The quantity selection of the nearest neighbor set has a great influence on the recommendation quality, and there are mainly two determination methods: One is to set the threshold value, and take the user whose similarity with the target user is greater than the threshold value as the nearest neighbor set (such as Ringo system); The third step is to generate recommendations. After determining the target user's nearest neighbor set, the items evaluated by the nearest neighbor set but not evaluated by the target user are found out, and then the target user's score of the target item is predicted based on the user's score of the target item in the nearest neighbor set. Finally, the appropriate item set is recommended to the target user according to the predicted score value of the item. The recommended formula is as follows[9-11]

$$P_{u_i} = \overline{R_u} + \frac{\sum_{(v \in N_u(j))} sim(u,v) * \left(R_{vi} - \overline{R_v}\right)}{\sum_{(v \in N_u(j))} |sim(u,v)|} \quad (4)$$

$$\overline{R_u} = \frac{1}{|I_u|}\sum_{j \in I_u} R_{uj}, \text{Among them} I_u = \left\{j \in I \text{ and } R_{uj} \neq \phi\right\} \quad (5)$$

After the target users have scored and predicted all the items that might be recommended, they can follow certain rules

Set of user recommendations. The result that the predicted score is greater than a certain specified value is recommended to the user. The optimized prediction scoring strategy is adopted to predict the project score of the target user and then a recommendation is generated for the target user, which can be derived as follows.

$$P_u(i) = \frac{\sum_{v \in N_u^k(i)} sim(u,v) * \left(\overline{R_u} + sim(u,v) * \left(R_{VI} - \overline{R_v}\right)\right)}{\sum_{v \in N_u^k(i)} sim(u,v)}$$

$$= \overline{R_u} + \frac{\sum_{v \in N_u^k(i)} sim^2(u,v) * \left(R_{VI} - \overline{R_v}\right)}{\sum_{v \in N_u^k(i)} sim(u,v)} \quad (6)$$

Finally, the nearest-neighbor set and complementary nearest-neighbor set of target user U are obtained according to the idea of timing update and trust, which are collectively called the total nearest-neighbor set to make project recommendations for target user U.

III. EXPERIMENT AND CONCLUSION

In terms of algorithm performance, user gender recommendation and age, the algorithm performance test is conducted, as shown in Figure 1-3. In this paper, the accuracy of the recommended results is evaluated by means of average absolute error MAE, which is the deviation between the actual value specified by the user and the predicted value generated by the algorithm. MAE values range from 0 to 5. When MAE is 0, it indicates that the predicted value of the algorithm is exactly the same as the actual score of the user, while when MAE is 5, it indicates that the predicted value of the algorithm is completely opposite to the actual score of the user (for example, the actual score of the user is 5, while the predicted value is approximately 0). The smaller MAE value indicates the algorithm.[12]

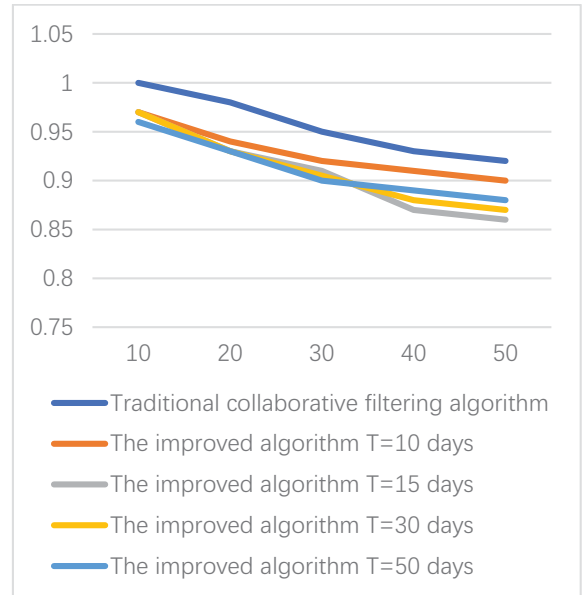The higher the accuracy of the score prediction.
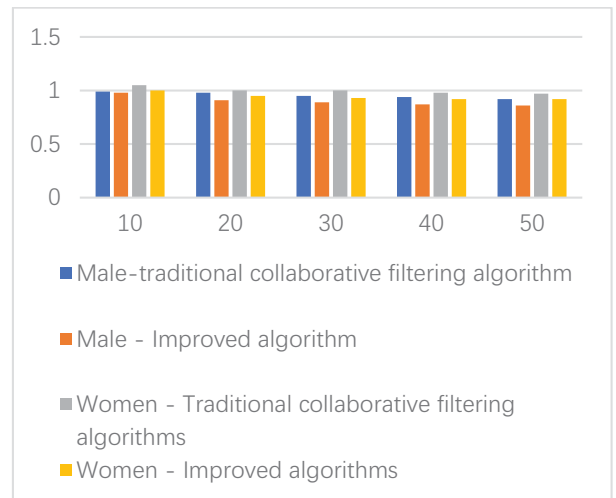

Fig. 1. Comparison of algorithm performance

Fig. 2. Comparison of performance of gender user algorithm
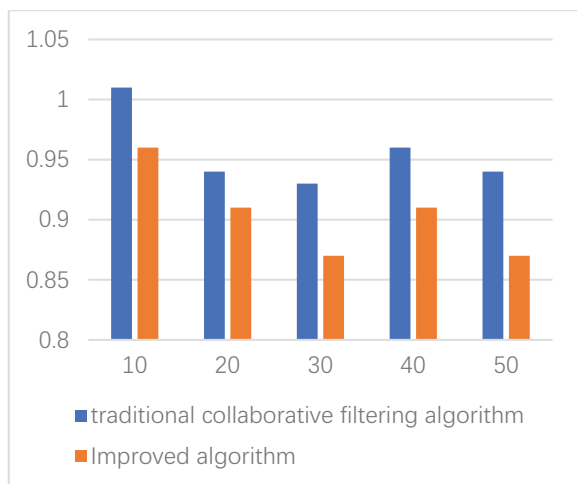
925

Fig. 3. Comparison of algorithm performance of age users

Therefore, whether it is to measure the MAE comparison between the improved COLLABORATIVE filtering algorithm and the traditional collaborative filtering algorithm, or the influence of user attributes or age on MAE, the collaborative filtering algorithm should be more accurate and effective

IV. CONCLUSION

With the development of e-commerce, the amount of data on the Internet grows at an amazing speed. In order to help users find the commodity information they need and improve their purchasing experience, personalized recommendation of e-commerce provides recommendations of different products and services for different users. Collaborative filtering technology is the most successful technology in the application of personalized recommendation and plays an important role in increasing the sales volume of e-commerce websites.

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