

Research on E-commerce Content Recommendation System Based on Fuzzy ART

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Abstract: With the popularity of the Internet and the improvement of people's needs, the problem of information overload corresponding to e-commerce is very prominent. In this context, an effective e-commerce recommendation system is developed to provide personalized recommendation services for users, so as to provide service guarantee for users to find the products they need. The wide application of recommendation system provides good technical support for convenient life, but there are many problems and challenges behind the rise of this technology. To improve these problems is to promote the development of recommendation system towards a more humane direction. On this basis, this paper focuses on the research of e-commerce content recommendation system based on Fuzzy ART, which provides basic ideas for the optimization of commodity recommendation services.

1. Introduction

The core of recommendation system is recommendation algorithm. The performance of the whole recommendation system depends on whether the algorithm is good or not. Therefore, the research of recommendation algorithm provides technical guarantee for the construction of the whole system. Classical recommendation algorithms mainly include content recommendation methods, collaborative filtering recommendation methods and hybrid recommendation methods [1]. The work process of content-based recommendation method mainly depends on information retrieval technology. To a certain extent, this method can recommend personalized commodity information for users according to their different interests [2]. However, this method still has some limitations in the use process. The main working principle of collaborative filtering recommendation method is to collect the information of customers with similar hobbies to form a set, so that they can recommend the same commodity information according to users' preferences, and form information association among users [3]. The hybrid recommendation algorithm based on Fuzzy ART is an important method to synthesize the Fuzzy system and ART algorithm. It can make full use of the corresponding advantages of the two algorithms to achieve a significant improvement in the overall recommendation performance, thus laying a good foundation for the construction of an efficient recommendation system.

2. An Overview of the Basic Content of E-Commerce Content Recommendation System

2.1. The Meaning of E-commerce Content Recommendation System

The definition of e-commerce content recommendation system came into being at the end of last century. The so-called e-commerce content recommendation system refers to that merchants or individuals use the Internet as a medium to push commodity information to customers according to their preferences and provide some suggestions for their purchases, so that customers can buy more easily [4]. Go to the goods you are interested in. For e-commerce content recommendation system, it has many advantages in the use process. One of the main advantages is that it can provide customers with personalized commodity push, that is, it can provide users with goods of interest according to the interests and needs of different customers, and users can see after they log in to the system. To these push messages. Furthermore, the product information recommended by e-commerce content

recommendation system for users is dynamic, that is to say, e-commerce content recommendation system dynamically recommends the products of current interest according to the changes of users' interests, which can improve the actual value of the product information for users and increase the purchase rate of users.

2.2. Classification of E-commerce Content Recommendation System

The main feature of the application of e-commerce content recommendation system is that it can provide different users with the information they are interested in pertinently and dynamically. Therefore, from the perspective of personalization degree of e-commerce content recommendation system, it can be divided into completely personalized recommendation system and semi-personalized recommendation system. And three aspects of non-personalized recommendation system. Among them, the fully personalized recommendation system will record the user's registration information, web browsing information and so on in the process of work, so as to recommend personalized products for users according to their information, which has the strongest degree of personalization. The main way of work of semi-personalized recommendation system is to recommend personalized products for users according to their current browsing information. Compared with fully personalized recommendation system, the personalized degree of semi-personalized recommendation system is slightly weaker. Non-personalized recommendation system is the same for each user's recommended commodity information [5]. It lacks personalized recommendation processing. Compared with the two recommendation systems mentioned above, the personalized degree of non-personalized recommendation system is the weakest.

3. Analysis of Traditional Recommendation Methods

3.1. Analysis of Content-based Recommendation Method

The work process of content-based recommendation method mainly depends on information retrieval technology. To a certain extent, this method can recommend personalized commodity information for users according to their different interests. However, this method still has some limitations in the use process [6]. For example, the content-based recommendation method has a limited scope in pushing commodity information, which is mainly manifested in recommending relevant commodity information for users based on information such as user's previous browsing and registration. Therefore, users receive similar information from the information they have browsed, so users cannot receive commodity information that has not been touched before; content-based recommendation method has insufficient ability to extract feature information. Current content-based recommendation method can only extract simple feature information, so it can basically process text information, but has no influence on information, video information and picture information. The method is effective in feature extraction.

3.2. Collaborative Filtering Recommendation Method Analysis

Collaborative filtering recommendation method is one of the commonly used information push processing methods. The main working principle of collaborative filtering recommendation method is to collect the information of customers with similar hobbies to form a set, so that they can recommend the same commodity information according to users' preferences and form information relations among users [7]. Unlike other recommendation systems, collaborative filtering recommendation methods do not attach importance to the content of information itself, solving the problem of attaching importance to the evaluation of information by different users. By collecting and classifying the evaluation information, users with similar preferences can be found to form small units, and then targeted promotion of commodity information for each unit. Collaborative filtering recommendation method can enable users to receive goods information that they have never experienced and may be interested in, thus expanding the scope of pushing commodity information.

3.3. Analysis of Mixed Recommendation Method

In addition to the above two points, hybrid recommendation method is also a common traditional

information recommendation method. Hybrid recommendation method is a recommendation method that combines content-based recommendation method with collaborative filtering recommendation method. Mixed recommendation retains the advantages of the two methods mentioned above, and achieves the effect of one plus one over two. Therefore, compared with the content-based recommendation method and collaborative filtering recommendation method, the hybrid recommendation method can achieve better results. There are three main types of hybrid recommendation methods [8]: first, the establishment of hybrid recommendation methods by using collaborative filtering fusion knowledge engineering; second, the simple combination of content-based recommendation methods and collaborative filtering recommendation methods to recommend relevant commodity information for users; third, the combination of transaction-related information. And for a single representation, it is mainly based on collaborative filtering recommendation method.

4. Analysis of Fuzzy-ART Algorithm

4.1. Fuzzy-ART Network Architecture

The structure of Fuzzy-ART network is shown in Fig.1, which adds the normalization of vectors on the basis of ART algorithm network framework. The F_0 layer represents the input vector a , while the F_2 layer is the category representation layer. Each node corresponding to the F_0 layer represents the class number of the input mode, which is used as a classifier. F_1 layer is the comparative layer, which mainly matches F_0 layer and F_2 layer data effectively.

The input vector a is pre-processed by F_0 layer to form sample X , and the corresponding similarity is calculated by comparing the patterns in F_1 layer. The pattern with the greatest approximation is taken as the matching criterion, and then the corresponding link weight vector W is adjusted by relying on certain learning rules, so that the maximum similarity can be obtained in matching, and the matching can be repeated until it reaches the top. The adaptive classification of vector a is realized by describing all input samples until they have been learned.

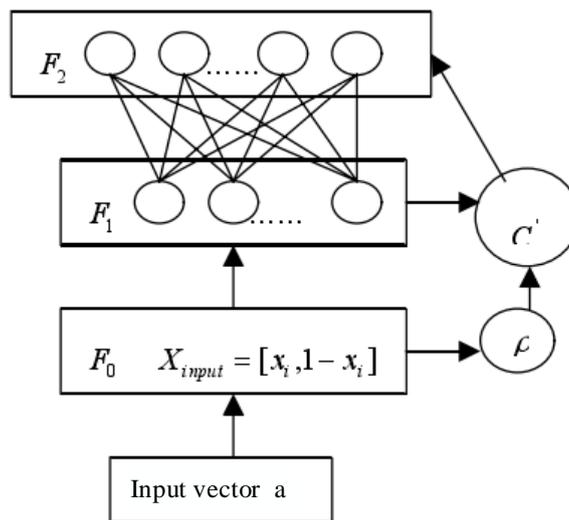


Fig.1. Network architecture of Fuzzy ART

4.2. Fuzzy-ART algorithm steps

For this algorithm, we first initialize the input vectors into the range of $[0,1]$, then fuzz these normalized vectors to get $X = [x_1, x_2, \dots, x_N]$, and then extend it to the $2N$ -dimensional vector $X_{input} = [x_1, x_2, \dots, x_N, 1-x_1, 1-x_2, \dots, 1-x_N]$ as the input.

Then the selection function is calculated as follows, which is used to calculate the compatibility

between vector X and classification C , where $W_{i,j}$ is the weight between X_i and C_j .

$$T(X_{input}, C_j) = \frac{\sum_{i=1}^N \min\{X_i, W_{i,j}\}}{a + \sum_{i=1}^N W_{i,j}} \in [0,1], j = 1,2,\dots,K \quad (1)$$

Next, the matching degree is calculated by using the following equation.

$$M(X_{input}, C^*) = \frac{\sum_{i=1}^N \min\{X_i, W_{i,j}\}}{\sum_{i=1}^N X_i} \geq \rho \quad (2)$$

After the above process is completed, the weight $W_{i,j}$ is adjusted by the following equation.

$$A(X_{input}, C^*) = W_{new} = (1 - \beta)W_{old} + \beta \min\{X_{input}, W_{old}\} \quad (3)$$

After that, we can determine whether we need to build new model nodes according to the specific situation. After completing the above steps, we can finish the algorithm and complete the classification under the condition of satisfying the end conditions.

5. Analysis of E-commerce Content Recommendation System Based on Fuzzy-ART Hybrid Recommendation Method

5.1. Overview of E-commerce Content Recommendation System Based on Fuzzy-ART Hybrid Recommendation Method

The recommendation algorithm used in this recommendation system is Fuzzy-ART, which relies on collaborative filtering technology to recommend. It has a small scope of use and is only for some specific commodities [9]. In order to expand the scope of application, content-based recommendation is a better choice. For this new algorithm, it can combine the feature information of commodities with user preferences, thus forming a user preference model, and then relying on Fuzzy-ART clustering to achieve classification, thereby realizing real-time recommendation. For this recommendation system, the corresponding basic framework is shown in Fig.2.

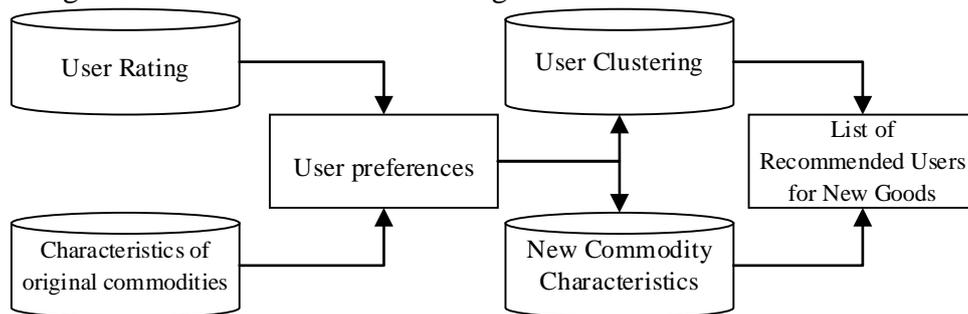


Fig.2. Structure of E-commerce Content Recommendation System Based on Fuzzy-ART Hybrid Recommendation Method

5.2. Advantages of E-commerce Content Recommendation System Based on Fuzzy-ART Hybrid Recommendation Method

Compared with the Fuzzy-ART method, the main advantage of this content-based recommendation method lies in the improvement of sparsity and new product recommendation [10]. For the former, users' preferences can be obtained from statistical information through content filtering, and classification transformation can be achieved through scoring matrix, thus effectively reducing the impact of sparsity. For the latter, it can match new commodities based on user preferences, which can predict the interest groups of new commodities and achieve effective new

commodity recommendation.

6. Conclusion

E-commerce recommendation system is the current trend of e-commerce development. Its purpose is to provide personalized recommendation services with characteristics for users, thus providing high-quality services for users to optimize commodity selection and purchase, thus promoting users to make appropriate consumption and further promoting the development of e-commerce business. Under this background, this paper first analyses the meaning and classification of e-commerce content recommendation system, and then analyses three typical traditional recommendation methods: content-based recommendation method, collaborative filtering recommendation method and hybrid recommendation method. On this basis, the specific content of Fuzzy-ART algorithm is discussed, and the construction process of content recommendation system for e-commerce based on Fuzzy-ART algorithm is analyzed, which provides technical support for promoting e-commerce business.

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