User Portrait Based on Artificial Intelligence

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Abstract. With the development of Internet technology, various applications of smart devices and mobile devices have appeared one after another, and people have been inseparable from the use of smart devices. The information generated in device applications has also grown exponentially, making it difficult for businesses to accurately deliver product information to users. Therefore, this paper uses artificial intelligence technology to build a user portrait recommendation system, analyzes user characteristics by intelligently mining user data, recommends information that suits users' needs, and applies the system to online shopping to recommend products to users according to their purchasing preferences, and introduce prediction algorithms to predict user needs, improve the accuracy of product recommendations, and help merchants achieve refined recommendations.

Keywords: Artificial Intelligence · User Portrait · Recommendation System · Prediction Algorithm

1 Introduction

With the rapid development of Internet technology, the Internet has become the most common way for people to obtain information. A large amount of information data is collected in the Internet network. How to quickly find the profiles of different user groups in the massive data and create user portraits. Matching different characteristics to individual needs has become an urgent problem to be solved at present. Therefore, this paper uses artificial intelligence technology to develop a user portrait recommendation system, and it is of great significance to recommend users' preferences based on user portrait information.

Many scholars at home and abroad have conducted in-depth discussions on the research and application of user portraits based on artificial intelligence, and have achieved good research results to a certain extent. For example, some scholars have proposed a multi-classification method, which collects and integrates user age, gender and other information, and then uses the classification result as the input part of user portrait recommendation. By means of multi-classification, it is possible to match the appropriate needs according to a feature of the user, which improves the accuracy of user identification [1]. A scholar applied artificial intelligence technology to the field of browser user portraits, and constructed user portraits according to the user's search word habits, text input style, etc. Since the user portrait recommendation system considers part-of-speech features, a feature extraction algorithm is introduced to achieve user

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feature classification [2]. Although there are many relevant literatures on the research and application of user portraits based on artificial intelligence, and there are also good results, the accuracy of recommending preferences for users based on user portraits still needs to be improved. It is hoped that artificial intelligence technology can be introduced into the recommendation system to analyze users data to improve the recommendation accuracy.

This paper firstly mines user behavior preferences based on user type tags to construct user portraits. In the research direction of designing user portrait recommendation systems, the basic structure of the system is designed according to the system design requirements. The system mainly includes three modules, which are the data collection module., data processing module and recommendation module. After the system is designed, in order to verify whether the system meets the normal operation requirements, the system's integratability, stability and scalability are tested, and the performance of the system is confirmed to meet the standards. Finally, the system is applied in online shopping, analyzing the accuracy of the artificial intelligence prediction algorithm and the traditional prediction algorithm recommending products for users also shows the reliability of the artificial intelligence prediction algorithm in this paper.

2 User Portrait Label and Recommendation System Design

2.1 Label Source and Classification of User Portraits

User portrait is a process of tagging modeling based on massive user information data. Different tags describe user characteristics from different angles .(1) User information: It includes basic user personal information, such as gender, age, height; it also includes user behavior and preference information. User behaviors such as collection and subscription of certain information belong to user behavior, and user customized information belongs to their preferences [3]. (2) Resource information: The resources here may include products, advertisements, news and other user-related information. For example, in the field of skincare product recommendation, information such as product influence, price, and brand can be regarded as label information [4].(3) Contextual information: The context in the user portrait refers to the scene where the user's behavior occurs, such as time, location, which can be used as contextual information. User interface information is one of the most important pieces of information in user personas. Because in different business scenarios, user characteristics will also be different. For example, in terms of time, users' preferences for buying clothes in different seasons will change accordingly. However, if the user is recommended to go to a scenic spot with a long distance according to the user's preference, it is basically impossible for the user to go [5, 6].

The process of creating personas is the process of "tagging" users. Some labels come directly from explicit data, such as contextual information about users, resources, while others come directly from implicit data, which are predicted or classified by data mining algorithms. In the process of predicting a new user label based on the existing user portrait label, a lot of abstract feature information will be displayed in the middle, which will inevitably affect user behavior. It is therefore possible to make predictions based on the user preference tab, and then update and improve the user persona [7]. The labels obtained by analyzing the data mining algorithm can be understood as: For example,

based on the massive historical data of bus cards, a model is developed to judge people's travel habits and preferences, predict the bus service of the next week, and use the data to provide smart travel and directions [8].

2.2 Analysis of Design Requirements of User Portrait Recommendation System

The recommender system will recommend based on the user portrait tag model of the target user, and the recommended elements should be similar to the elements of user behavior and interest characteristics. During the operation of the recommender system, the users in the system are not static, and their browsing behavior and interests are constantly changing [9]. (1) Integrability.System integration means that the system does not depend on other projects and can run independently or in combination with other projects to become subunits of other systems. Recommender systems usually have no interfaces, are interconnected with other systems, and can operate independently or together. (2) Scalability.System scalability means that the development of future new functions should be considered at the beginning of system design, and some common interfaces should be designed to lay the foundation for the launch of new projects. In the case of changing user behavior, the data used for quantification will also continue to grow, so the basic model used for recommendation should have good scalability [10].(3) Stability.Stability refers to the quality of the system. The demand for stability of the recommendation system is mainly reflected in the accuracy and speed of the recommendation. The accuracy of recommendation requires the system to provide users with information that the user is interested in or will use, while the speed of recommendation means that the system must quickly find objects of interest in a specific scene and provide users with needs, and the system can quickly respond to current information [11].

2.3 User Interest Prediction Model

User interest data has certain validity. Past data may not represent a preference for a user's recent interests. After an in-depth study of the vertical user model, according to the browsing behavior of network users, an exponential alignment method is used to calculate user portraits [12]. The derivation formula is given below, and the predicted value F_{t+1} is calculated according to the moving average method formula. The formula is as follows:

$$F_{t+1} = \frac{1}{T}(H_t - H_{t-T}) + F_t \tag{1}$$

Among them, the predicted value F_{t+1} is estimated from the predicted value F_t at time t, F_t is the estimated value of H_{t-T}, and F_t is substituted into formula (1) to get:

$$F_{t+1} = \frac{1}{T}H_t + (1 - \frac{1}{T}) + F_t \tag{2}$$

Let the smoothing constant $\alpha = 1/T$, and substitute it into Eq. (2) to get:

$$F_{t+1} = \alpha H_t + (1 - \alpha) + F_t \tag{3}$$

α is a smoothing constant. It is clear from the formula that only the observed value and the most recent predicted value in the formula, without all the previous data, can make demand prediction by using the exponentially aligned prediction model to predict the size of the user's interest label.

3 System Design

3.1 System Structure Design

As shown in Fig. 1, the user portrait recommendation system based on artificial intelligence is divided into the following three modules. (1) Data collection module. The level below the data collection unit is implemented based on WebMagic web crawler, and the entire recommendation system is constructed based on the Internet experience function. All data input to the system comes from the actual network environment, which is more convincing. (2) Data processing module. The data processing unit is divided into three sub-sections: a user portrait creation unit, a word processing unit and a data storage unit. The user portrait creation part will process the text data collected by the user by filling in the text data according to the defined vertical user model. The vector text element module is a module that quantifies text elements, processes the exported text, and quantifies it with VSM. The data storage unit is the permanent storage of vector and item data. (3) Recommended modules. The recommendation module uses the user portrait as the main model for user recommendation, calculates the similarity between the target user and the text vector defined in the system, and provides elements with higher similarity values for the user.

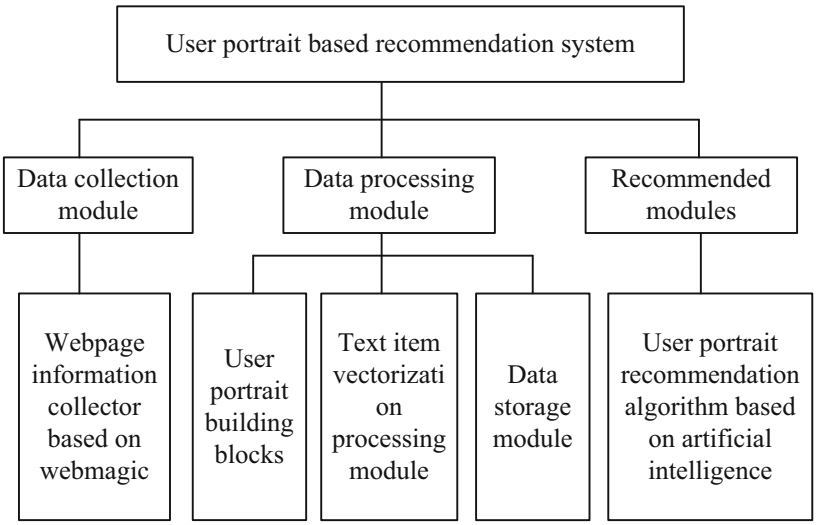

Fig. 1. System Architecture

The first part of the system running is a web crawler based on WebMagic. It is determined that the web search engine extracts the text information of the web page, and

the derived text information consists of two parts. The first part is used to create user text information to build a user portrait model. The second part is the product information as details of the proposed candidate. After collecting the user text information, the data processing unit starts to process the user and hardware data accordingly, constructs the user model and space vector material, and stores them in the database accordingly. For the sentence algorithm based on user tags, the system will traverse all the text directly input by the user to establish a vector space model, while for the vertical sentence algorithm based on artificial intelligence, a longitudinal timestamp must be added, and a dynamic prediction model will be used for prediction later. The recommendation part takes the cosine similarity as the calculation type, calculates the similarity between the vertical user model and the hardware, and then provides the most similar elements for the target users.

3.2 Database Design

Table 1. Database field lengths

Field item	Field length
Gender	5
Age	3
Preference	50
Area	25
Cultural level	20
Wages	10

As shown in Table 1, according to different information of users, it is necessary to build user portraits to recommend the content they need. By collecting basic information of users, such as gender, age, preference (color preference, brand preference), region, cultural level, Salary level and other information, the input length of each item is set in the database in the user portrait recommendation system, which are 5, 3, 50, 25, 20 and 10 respectively.

4 Testing and Application of User Portrait Recommendation System Based on Artificial Intelligence

4.1 System Test

As shown in Fig. 2, the integration, stability and scalability of the system design requirements were tested. The three theoretical performance values set during the system design were 90%, 92%, and 87%, respectively. After the system is designed, test whether the Samsung performance meets the design requirements, if the test value exceeds the theoretical setting value, it means that the system design is successful. According to the test

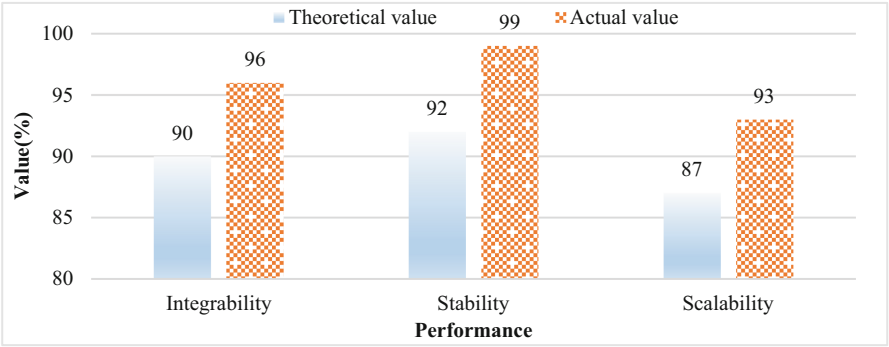

Fig. 2. Performance test results

results, the actual values of the three performance tests are 96%, 99%, and 93%, respectively, which are greater than their theoretical values, indicating that the performance of the system meets the design requirements and can ensure the normal operation of the system during the system operation.

4.2 System Application

The recommendation system is used in online shopping, and the suitable products are selected according to the user's portrait. If the user is a student, they can recommend affordable products; if the user is a middle-aged and elderly person, they can recommend health products, which is recommended based on the user's purchasing power, age and other basic information. As shown in Fig. 3, it is the accuracy rate of using the system to recommend the same user within a period of time, comparing the prediction and recommendation accuracy rate of the system's artificial intelligence prediction algorithm and the traditional algorithm.

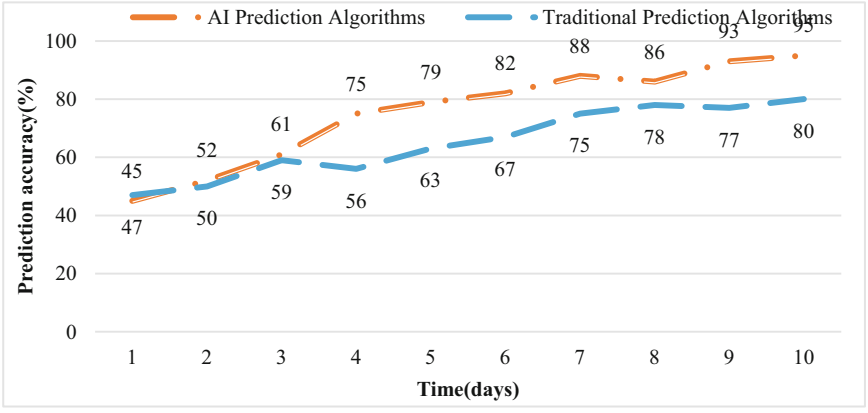

Fig. 3. Purchased product recommendation accuracy

As can be seen from the results in Fig. 3, within 10 days of the user using the system, the first 3 days, since the system is still analyzing the user's purchase direction based on the basic information of the user's purchase preference, therefore, these three days, regardless of whether the artificial intelligence prediction algorithm is used. It is still a traditional prediction algorithm. The accuracy rate of recommending products for users is not high, and it is basically the same. As users use the system for a longer time, the system can recommend products for users according to their preferences. Therefore, it can be seen that the two prediction and recommendation algorithms On the whole, the recommendation accuracy rate is on the rise, and the recommendation accuracy rate of the artificial intelligence-based prediction algorithm used in this paper is higher than that of the traditional prediction algorithm. When the user uses the 10th day, the recommendation accuracy rate reaches 95%. According to The artificial intelligence prediction algorithm calculates that if the time of using the system continues to increase, the recommendation accuracy will continue to rise and approach 100%. The advantage of the artificial intelligence-based user portrait prediction algorithm is that it can predict changes in users' interests to a certain extent, and the prediction accuracy will gradually improve with the continuous increase of data.

5 Conclusion

This paper studies the user portrait recommendation system based on artificial intelligence, and designs the basic structure of the recommendation system according to the system requirements. Using this system, the relevant information of the user portrait can be collected, and the user's preference can be analyzed through the artificial intelligence prediction algorithm to recommend it. Therefore, the system is applied to online shopping, and it is found that as the number of days that users use the system increases, compared with the traditional prediction algorithm, the artificial intelligence-based prediction algorithm adopted in this paper has higher accuracy in recommending products to users. User information efficiently recommends the accuracy of products for users.

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