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# Personalized Clothing Recommendation System Based on Customer Preference

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**Abstract:**Nowadays,with the rapid development of the Internet,online shopping is becoming more and more convenient. At present,the income of online shopping is far more than that of offline physical stores. A good clothing recommendation system can help sellers sell clothes better and buyers choose suitable clothes faster. This paper firstly describes the big data technology. Then,it introduces the advantages of using springboot technology and big data analysis,and focuses on the collaborative filtering recommendation algorithm used in this paper. Finally,the personalized clothing recommendation system is realized through these technologies. The system can use the identity of user,stylist and administrator to log in,and provide functions such as comments and clothing collocation,and establish a clothing forum for information release and exchange. According to the test results,the system can basically meet the needs of most users,and the system security and performance are also ideal.

**Keywords**:Preference; Clothing personalization; Springboot; Collaborative Filtering recommendation algorithm

## 1. INTRODUCTION

With the arrival of information technology, shopping online has undoubtedly become the mainstream way of shopping at present.But there is too much information on the Internet, and users are easily confused and have no idea where to start when they choose the clothes they want to buy online.How to provide buyers with interesting clothes is the key to profitability for sellers;in addition, users have their own preferences for clothes and care about the personalized needs of clothes.Therefore, it is very necessary to study the customer preference algorithm to improve users' purchasing power and provide users with better shopping experience.The design of the personalized clothing recommendation system based on customer preference is to cater to the era of rapid development of information.Now all kinds of platforms have begun to improve the efficiency of doing things by connecting to the Internet and using intelligent management systems.The traditional clothing recommendation system can no longer meet people's needs because of the high personnel cost and low management efficiency. The personalized clothing recommendation system based on customer preference is upgraded and transformed on the traditional platform information management, and makes it intelligent.

Because all kinds of data information change quickly and frequently, if the corresponding data management is still carried out through the traditional paper record selection method, a lot of manpower and material resources will be wasted.[1] At the same time, in the process of manual statistics prone to errors. Based on customer preference clothing personalized recommendation system to solve the problem of information record data, in addition to meeting a large number of constraints, but also to solve many conflicts and contradictions, so let the user through the corresponding online management system to change the traditional manual operation, but also convenient for managers to a large number of users corresponding to the system management data for inspection and statistics, greatly improving the efficiency of the administrator.

## 2. Key technologies of the System

### 2.1 Springboot Framework

SpringBoot is a free, lightweight, open source system framework developed by the development team of Pivotal in 2013.[2] The main design idea of SpringBoot is that convention is greater than configuration, so SpringBoot almost achieves zero configuration at the time of design. SpringBoot is a verypowerful backend framework, because SpringBoot development basically does not need to write configuration files, so use SpringBoot to build the backend environment of the website, write the project start port in the SpringBoot YML configuration file, and the project can be started. The Java code and static files of the project are managed by SpringBoot. Users can use all SpringBoot components while using SpringBoot. In other words, SpringBoot has many mature frameworks, so that users do not have to create a large number of XML configurations by hand.[3]

### 2.2 MySQL database

Database system is a system for data storage, database is the library of the system, used to store data through the system, database in the daily life of developers, occupies a large position.Because the use of database can make their system storage data more convenient and fast [4].

MySQL is popular among developers, mainly because the use of database is free.The initial database research and development, is required to charge, but with the emergence of MySQL and constantly updated, more and more users to use this software [5].MySQL uses SQL (structured query language) as its main query language.SQL is a standard relational database language, which can be used to create, modify and manage tables, indexes and stored procedures in the database.MySQL supports the relationship between multiple data tables, and can easily perform advanced operations such as join and nested query.MySQL also provides a variety of data types, such as integer, floating point, date and time type.First of all, it is open source and free, which greatly reduces the cost of development;MySQL can be used on multiple platforms, in

MAC, Windows and Linux can be used.Secondly, its performance is very powerful, cost-effective. Finally, MySQL is easier to learn than other database languages, and it can be easily integrated with many platforms, such as Java, which is used in this article.

## 2.3 Collaborative Filtering recommendation algorithm

Collaborative filtering recommendation algorithm is one of the most common recommendation algorithms at present, which mainly predicts users' future behaviors based on users' historical behavior data.The basic idea of the algorithm is to find the intersection and similarity points between users by analyzing the similarity between different users, and then use this information for recommendation.

The collaborative filtering algorithm in this paper mainly includes two categories: user-based collaborative filtering algorithm and item-based collaborative filtering algorithm [6].The user-based collaborative filtering algorithm recommends products by calculating the similarity between users, while the item-based collaborative filtering algorithm recommends products by calculating the similarity between products.The following two algorithms will be introduced respectively.

### *2.3.1 User-based collaborative filtering algorithm*

User-based collaborative filtering algorithm [7]: this algorithm recommends products by analyzing the similarity between users.The basic idea of the algorithm is that if two users have purchased similar products in the past purchase history, then the two users are similar.Therefore, users can determine which products are most suitable for users by calculating the similarity between users.

Algorithms such as cosine similarity [8] or Pearson correlation coefficient are usually used to calculate user similarity. Cosine similarity refers to the cosine of the angle between two vectors in space, while Pearson correlation coefficient measures the strength and direction of the linear relationship between two variables.

The disadvantage of user-based collaborative filtering algorithm is that it needs to calculate the similarity between each pair of users, which requires a large amount of computing resources and time.In addition, the algorithm also has the problem of "grey sheep effect", that is, when recommending, it only recommends the goods that users have purchased, while ignoring the users' other preferences.

### *2.3.2 Item-based collaborative filtering algorithm*

Item-based collaborative filtering algorithm[9]: this algorithm recommends goods by analyzing the similarity between goods.The basic idea of the algorithm is that if two goods are purchased by the same user, then these two goods are similar.Therefore, users can determine which goods are most suitable for users by calculating the similarity between goods.

# 3. System Design

## 3.1 System Structure Design

This system uses Java and big data analysis technology, suitable for wide area network, without any network speed limit, mainly attached to the browser work form to access data, Figure 1 is the system working principle diagram.

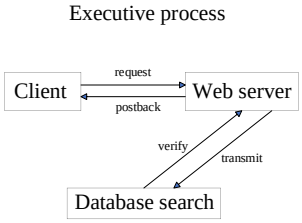


Figure.1 Schematic diagram of how the system works

## 3.2 System Function Design

The implementation of this system is based on the fusion of many functional modules divided into various user roles in order to manipulate information and receive data information. The content of a functional module has to be created and developed according to the requirements of different licenses. Figure 2 shows the overall functional structure diagram of the system.

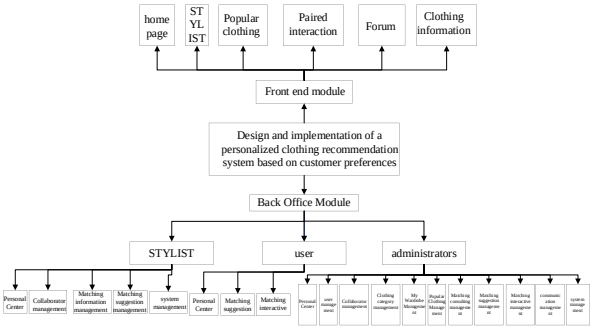


Figure.2 Overall function structure diagram of the system

## 3.3 Database design

Database design refers to the initial stage of database design, through the analysis and abstraction of business requirements, the establishment of the conceptual model of the database, including entities, attributes and relationships, etc., so as to design the structure of the database. The main tasks of database conceptual structure design include the following aspects:

### *3.3.1 Data requirements analysis*

Through the analysis of business requirements, determine the entities, attributes and relationships that need to be stored in the database.

### *3.3.2 Data dictionary definition*

For each entity and attribute, define its name, data type, length, constraints and other information to ensure the consistency and integrity of the data.

### *3.3.3 Relational normalization*

Through the normalization technology, the data in the database is decomposed into multiple tables to eliminate redundant data and data dependence, improve the storage efficiency of data and the speed of data operation.

### *3.3.4 Integrity constraint definition*

In the design stage, the data in the database is constrained and standardized to ensure the correctness, consistency and integrity of the data. The design of database conceptual structure is the first step of database design, which is the basis of the entire database design. When designing the conceptual structure, it is necessary to deeply understand the business requirements, adopt appropriate modeling methods and tools, and accurately define and describe entities, attributes, and relationships, so as to

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ensure that the design of the database meets the business requirements and has efficient data storage and operation capacity.

# 4. Implementation of the System

## 4.1 User function module

Users can view the personal center, collocation suggestion management, collocation interaction management and other contents by logging into the system background. Collocation interactive management, users can view collocation title, cover, color collocation, collocation style, suitable scene, user account, nickname, release time and other content in the collocation interactive management page. Users can also add, delete, change, view comments and other operations in the collocation interface.


Figure.3 User background function interface diagram

## 4.2 Collocation division function module

Collocation division by logging into the system can view the personal center, collocation division management, collocation consulting management, collocation advice management, system management and other content.

Collocation division management: Collocation division can view the account number of collocation division, collocation division name, collocation style, collocation consultation, collocation advice and other content in the collocation division management page, you can also click to view the details of the operation.

Collocation consulting management: the collocation division can view the consulting title, collocation division account, collocation division name, consultation time, user account, nickname, age, skin color, height, body size ratio, dressing preference and other content in the collocation consulting management page, and can also carry out collocation suggestions and other operations.

Collocation suggestion management: Collocation division can view the consulting title, suggestion reason, user account, suggestion time, collocation division account, collocation division name and other content in the collocation suggestion management page, and can also delete and other operations.


Figure.4 Collocation division management interface diagram

## 4.3 Administrator function module

Administrators can view personal center, user management, collocation division management, clothing category management, hot clothing management, my wardrobe management, collocation consulting management, collocationadvice management, collocation interaction management, communication forum, system management and other content by logging into the system.

User management: The administrator can view the user account, user name, nickname, avatar, gender, contact information, age, skin color, height, body size ratio, dressing preference and other content in the user management page, and can also add, modify and delete commonly used operations in the system.

Popular clothing management: administrators can view clothing number, clothing name, cover, clothing category, brand, market price, purchase link, click times and other content in the popular clothing management page, and can also add, modify, view comments or delete operations.

My wardrobe management: Administrators can view clothing name, pictures, clothing category, clothing material, brand, style, size, color, purchase time, user account and other content in my wardrobe management page, and can also modify or delete operations.

Communication forum: Administrators can view the title, user name, status and other content in the communication forum page, and can also add, modify, view comments or delete operations.


Figure.5 Communication forum interface diagram

## 4.4 Implementation of collaborative recommendation algorithm

The main idea of collaborative filtering recommendation method is to use the past behavior or opinion of the existing user group to predict which things the current user is most likely to like or interested in. The actual application in this system is shown in Figure 6:

Figure.6 Collaborative Filtering recommendation algorithm

## 4.5 System test

After the software development, it needs to be repeatedly checked to see whether it runs smoothly, whether there are system defects and faults, and whether its performance achieves the expected use effect. After the system was completed, several problems could not be solved when the system was tested. First, there was a syntax error near the user in the database. Secondly, when creating a new user table, the software will add a "[]" outside the table name, resulting in table name always wrong query failure. Finally, the query/modification function of information push also encountered a lot of problems, the query information that the database will refresh the original value in the database after the operation, by adding the if (!IsPostBack){} method in the page loading method, so that the problem of page update is solved.

The results show that the reaction delay is less than 0.1 second, and the corresponding data information obtained is consistent. After the function test and performance test of the system are accurate, the personalized clothing recommendation system based on customer preferences is successfully tested and can be delivered to the user.

# 5. CONCLUSION

The personalized clothing recommendation system based on customer preference integrates the intelligent recommendation function of clothing. This paper uses the collaborative filtering algorithm to realize the collection and statistics of user preference data,and then presents the sorted results in the corresponding interface. The results show that this method can quickly and accurately get the recommendation results,achieve more attractive recommendation results,and effectively improve the user's purchase rate. However,in some cases,if the user only browses the product but does not put the product in the favorite list,the identification may not be possible. The system realizes the intelligent recommendation of clothes,and effectively improves the user's consumption power of clothes. Through the intelligent recommendation of clothes,the user does not need to search for clothes everywhere at his own expense,and through the background calculation of the correlation of clothes data,it provides the user with a more convenient and efficient shopping experience.

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