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Research Article

Application of Mirror Materials in Wood Furniture Manufacturing Process Based on Big Data Analysis

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With the development of the national economy, the interior decoration work has received extensive attention, and the traditional decoration methods have been unable to meet its actual work needs. The application of mirror materials in interior decoration can not only enrich the technical methods of interior decoration, but also improve the decoration quality and comfort, so as to meet people's growing decoration needs, achieving the purpose of promoting the sound development of interior decoration. Mirror material is one of the decorative materials widely used in modern indoor environment. It not only has decoration, but also can expand space. In recent years, the advent of the era of big data has promoted the reform of the design industry. Using big data thinking to assist the innovative design of furniture products will also become an important trend in the development of the furniture industry. According to the characteristics of customer demand in the era of big data, this paper designs and develops a set of customer demand analysis system based on big data by using cloud computing and big data mining technology. By collecting the behavior data of users when using products, this paper combines the mirror material with the manufacturing process of wooden furniture. The mining algorithm is applied to find out the improvement goal and direction of wood furniture manufacturing process based on mirror material, so as to enhance the competitiveness of furniture enterprises. The method proposed in this paper can obtain the furniture design elements according to the functional zoning and theme information and input the furniture design elements and zoning elements into the design element matching evaluation model to obtain the design matching element information.

1. Introduction

With the rapid development of economy and the improvement of material and cultural living standards, people have higher and higher requirements for the decoration of space environment. Mirror materials are widely used in indoor space decoration because of their smooth surface and high reflectivity, which can produce visual space extension effect in limited space and improve daylighting effect [1, 2]. Furniture is an important part of space environment and an indispensable appliance for people's life, work, and social activities. The diversification of furniture materials has also become the development trend of modern furniture design.

For such materials, it includes not only traditional mirror materials, but also advanced technology and artistic elements. Under the condition of comprehensive treatment, the surface can be in a bright state, and the three-dimensional photographic images can be reflected more clearly, such as silver mirror materials, vehicle side mirror materials, and aluminum plate type mirror materials. At present, mirror materials are widely used in China. They can be used not only in cosmetic mirrors and fitting mirrors, but also in the construction of background walls and partitions, which can comprehensively improve the level of indoor decoration and enhance its use effect [3, 4]. Although the mirror material only compresses the three-dimensional space into a two-dimensional plane during practical application, it can better stimulate people's curiosity, produce spiritual influence, stimulate people's interest, and achieve certain excitement during practical use. For mirror materials, it belongs to the structure of modern special materials, which has a good decorative effect and will have an impact on

people's psychology. It can comprehensively improve the decorative effect and meet the application requirements of current mirror materials [5–7]. The development trend of the diversification and novelty of materials in the furniture industry drives the continuous renewal of the forms and methods of furniture design.

The research and development of furniture design method is an arduous and basic scientific work. For nearly a century, the methodology in the field of design has been evolving, which is closely related to social changes, changing in production methods, scientific and technological progress, etc. In the past, European and American scholars have been in the leading position in the establishment of rules. With the continuous accumulation of big data, China has top technology and huge database. Only by constantly exploring new design rules can it comply with the development of the times.

In the traditional furniture product design research, large furniture enterprises may outsource to market research institutions to investigate and study the market data, so as to understand the development direction and trend of the market, analyze the competitive furniture products of the same type in the target market, and study the different needs of furniture consumers. Some furniture enterprises may have their own marketing department to conduct a questionnaire on the above contents to obtain the information they need. Some furniture enterprises may be more unscientific in the part of design research, and the design concept of products will even be patched up [8, 9]. Designers may not design from the real needs of consumers, but collect and use the concept of formed products to guide the new design. In any case, the results are related to the personal situation of the analysts who carry out this work, such as their personal experience, background, experience, and way of thinking. This is mainly because it is impossible to organize, classify, analyze, and summarize the data in a man-made way, and this process will generally take a long time. In the era of big data, the change of market trend, consumers' purchase behavior, demand mode, and other changes are too fast, so that the accuracy and timeliness of these data methods are obviously not ideal. Therefore, it is not difficult to see that these methods are no longer applicable in the era of big data [10–12]. American furniture pursues retro, follows nature, and returns to nature, modelling is elegant but does not pay attention to excessively grandiose decoration; it pays attention to practical function.

Around 2010, new concepts such as cloud computing, Internet of things, and big data were put forward, and a structured knowledge system was rapidly formed, which marked the arrival of the third information wave. In the era of big data, data is the most valuable asset, which contains great opportunities and challenges. Big data is having a far-reaching impact on society and human way of thinking. The close combination of big data technology and all walks of life provides unlimited possibilities for the development of enterprises. It is of great theoretical and practical significance to analyze the personalized needs of customers in the context of big data. First of all, the performance of big data can better, comprehensively, and truly reflect the characteristics of customer behavior, so that enterprises can accurately portray and cluster customers [13–15]. Secondly, although data mining technology has been widely used in the field of customer demand analysis, the existing technology can not adapt to the scale of big data processing. Therefore, we must study and apply new ways to analyze customer information [16]. With the proportion of American furniture market increasing year by year, how to apply the diversification and novelty of materials into the design of American furniture is worth people's in-depth thinking and research.

The furniture design method under the background of big data (see Figure 1) makes people's thinking not limited to the machine of data processing. In fact, what really matters about big data is new uses and new insights, not the data itself. Because the information flow and value flow in product ecology are invisible, they are ignored by many people. In recent years, while data resources have become an important social production factor, they have penetrated almost all sectors of the national economy, sweeping many industries and business functional fields, such as information services, smart cities, finance, manufacturing, national security, and scientific research. In China, consumers are used to compare and purchase furniture in stores. The replacement frequency of furniture is low. In addition, affected by the factors of large volume of furniture and high after-sales cost, the accumulation of data related to furniture is slower than that of other industries, but with the change of users' consumption habits, more and more small and medium-sized consumers purchase furniture online and frequently replace some small pieces of furniture. The network data information related to furniture procurement has been generated and has reliability [17–19]. Traditional data analysis is often about finding cause and effect behind things. For example, if the sales of a product is not good, the enterprise will find out the reason for the low sales through data analysis.

In general, the rational application of mirror materials can not only save the indoor decoration space, but also improve the variability and interest in the unit space, so as to extend the area visually and meet people's inner feelings of indoor space. For example, the decoration of mirror materials on the whole wall that does not directly reflect the natural light source indoors can improve the visual space feeling under the influence of the interaction of two-dimensional and three-dimensional imaging modes and enhance the brightness of indoor decoration, making the decoration more scientific and efficient. In addition, the application of integral mirror materials can also be used in separate and narrow dressing rooms, which not only saves the cost of adding relevant mirrors, but also effectively improves the brightness of narrow spaces and optimizes people's spatial visual perception, so as to improve the decoration effect. In addition, the rational use of big data can make it easier, faster, and more effective to grasp the information of consumers [20–22]. The design research process under big data thinking can refer to Figure 2, which can be transformed from data sorting and analysis to descriptive language that can be used for design. The formation

Figure 1: Big data analyses.

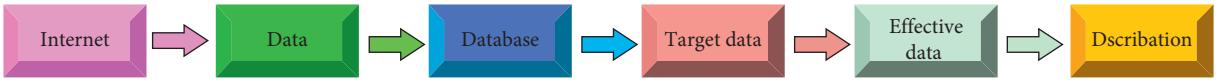

Figure 2: Research process under big data.

of big data is the beginning of design research. Various information contained in big data provides basic elements for furniture product design research and analysis. On the basis of data, data screening and sorting are carried out for the information obtained in the early stage according to specific needs. That is to say, target data is used to analyze the potential information hidden in the data (such as user behavior, hobby needs, product modelling characteristics) to obtain effective data. Finally, these effective data are transformed into descriptive language that can be directly used by the design to guide the development of subsequent design [23–25].

2. Corresponding Model Analysis of Furniture Design Demand Based on Big Data

Mirror surface material is a common material for modern interior decoration, but it is seldom used in furniture. The mirror material is taken as the object of study. In the era of big data, we should first solve the problem of data storage. Compared with the traditional way of storing data in a single computer node, cloud storage has obvious advantages in solving big data storage. The key technology of cloud storage is distributed file system. Google's distributed file system (GFS) is used to solve this problem. Distributed file system stores files on a computer cluster composed of a large number of computer nodes. The computer nodes used in the cluster are ordinary hardware with low price and do not need the parallel processing device of multiprocessor or special advanced hardware, which greatly reduces the hardware cost. For different types of data, the system adopts different technologies for storage. For user information, equipment models and parameters, user operation records, and other structured data, the system uses MySQL database for storage. For the structured real-time data collected by the sensor, the system uses HBase for storage. For unstructured data such as videos, pictures, logs, and logs, the system uses HDFS to store them and saves their paths to MySQL database. In this way, the classified storage of different types of data can improve the reading and writing efficiency of the database and reduce the maintenance cost. Define the support of itemset x as its support count $\sigma(X)$ ratio to the total number of transactions n, namely:

$$s(X) = \frac{\sigma(X)}{N}. \tag{1}$$

In the process of classifying requirements according to the principle of "relative majority," for the same requirement, there may be similar or even equal occurrences of several category options. In order to prevent the demand from being classified into wrong categories, this paper uses "relative customer satisfaction coefficient ratio" to classify this demand. The specific method is to calculate the increasing satisfaction coefficient and eliminating dissatisfaction coefficient, respectively. The calculation formulas of the two are as follows:

$$k_1 = \frac{A + O}{A + O + M + I},$$
$$k_1 = \frac{M + O}{A + O + M + I}, \tag{2}$$

where k_1 and k_2 are the increasing satisfaction coefficient and eliminating dissatisfaction coefficient, respectively. The ratio of increasing satisfaction coefficient to eliminating dissatisfaction coefficient is calculated. If the ratio is greater than 1.1, the demand belongs to charm demand; if the ratio is between 0.9 and 1.1, it is a necessary requirement. In the process of classifying requirements, if there is a requirement and the percentage difference between two types is less than 5%, you can use this method to classify requirements.

An adjustment coefficient k is introduced into the model. User satisfaction S can be expressed as a function of user demand p and adjustment coefficient k:

$$S = f(k, p). \tag{3}$$

As can be seen from the above, the demands for charm, expectation, and necessity are, respectively:

$$\frac{\Delta S}{S} > \frac{\Delta p}{p},$$
$$\frac{\Delta S}{S} = \frac{\Delta p}{p}, \quad (4)$$
$$\frac{\Delta S}{S} < \frac{\Delta p}{p}.$$

Using the adjustment coefficient k, these three relationships can be expressed as linear relationships:

$$\frac{\Delta S}{S} = k\frac{\Delta p}{p}. \quad (5)$$

As can be seen from formula (5), the demands for charm, expectation, and necessity, are respectively:

$$k > 1,$$
$$k = 1, \quad (6)$$
$$k < 1.$$

Therefore, the relationship between S and p can be further expressed as

$$S = cp^k, \quad (7)$$

where c is a constant. According to experience, for charm demand, the value of k is 2; for the expected demand, the value of k is 1. The final weight w of item i personalized demand and its initial weight meet the following relationship. The corresponding weight is compared in Figure 3, where R_j means the predicted values. As can be seen, the final one is different compared with the initial one.

$$w_i' = \frac{w_i k_i}{\sum_{i=1}^{n} w_i k}. \quad (8)$$

Furniture design should adapt to the development and changes in the era of big data. First, we should change our thinking, establish a correct awareness of big data, apply big data thinking to the innovative design of furniture products, and pay attention to the impact of data on furniture product design innovation, so as to make correct design decisions and give full play to the value of big data. The ultimate purpose of design is to serve users. Only by understanding users can we make better design. In the era of big data, user research and experience, as well as new design and development modes, should run through the whole design process. The designer should form a design thinking centered on user experience and integrate the users of the product into the product design for design interaction, so as to assist the designer to make correct design decisions. In this regard, how Guangdong Shangpin Home Furnishing Furniture Co., Ltd., applies the big data platform to mine useful data, how designers carry out design and development through big data, and how to take user experience as the core to obtain design decisions are valuable reference cases in the industry. Shangpin home distribution is a well-known mass customization furniture enterprise in China. In the application of big data, on the one hand, Shangpin home distribution relies on the information power of big data platform to improve the information service ability of designers to consumers. Through the combination of online stores and physical stores, consumers can experience products. In this process, designers can guide and help consumers make purchase decisions. On the other hand, the big data platform provides the order information provided by the designer to the subsequent production departments for production scheduling and brings the production into a reasonable and orderly process. Shangpin home distribution can be described as an excellent integration of the big data platform and design. Facts have proved that the design and development thinking of experience first is an important part of furniture innovative design in the era of big data. In the process of product design guided by information technology, obtaining consumers' input and contribution through a large number of consumer information resources is an important means to complete product development. After any product is developed and put into the market, it does not mean that the whole process is over. The design process is a process of continuous market inspection, continuous correction, and continuous improvement. Designers need to constantly track the market and study the response and perception of different consumers to their new product design, so as to continuously optimize the design. Through the big data platform, the follow-up tracking of designers is easier to realize. Designers can mine relevant data through the big data platform. In the evaluation of users, they may find some valuable hidden needs, which may not be known at the beginning of design, and such hidden needs play an important guiding role in the innovation and upgrading of furniture products. At the same time, this approach can also enable the developed new products to maintain and continuously improve the market vitality, gain insight into the potential competitive threats, and avoid the potential hidden dangers of customer loss, so as to ensure the sustainable vitality of the products. The demand item R_j is shown in Figure 4, where it can be found that R_j varies in a small zone. This paper summarizes its application forms and methods in American furniture and uses examples to verify the application principles and ideas of mirror materials.

3. Implementation of Furniture Design System Based on Big Data

Customized furniture refers to personalized furniture configuration that can be customized according to personal preferences and space details. Each customized product can be unique. On the basis of mass production, furniture enterprises regard each consumer as a separate market segment. Consumers design the furniture they want according to their own requirements, and enterprises manufacture personal exclusive furniture according to the design requirements of consumers. The real sense of "customization" not only is the production of furniture style, but also covers the customization of design, layout, production technology, logistics, and other aspects. Such customized services have long been popular in Europe, America, and Japan. There are

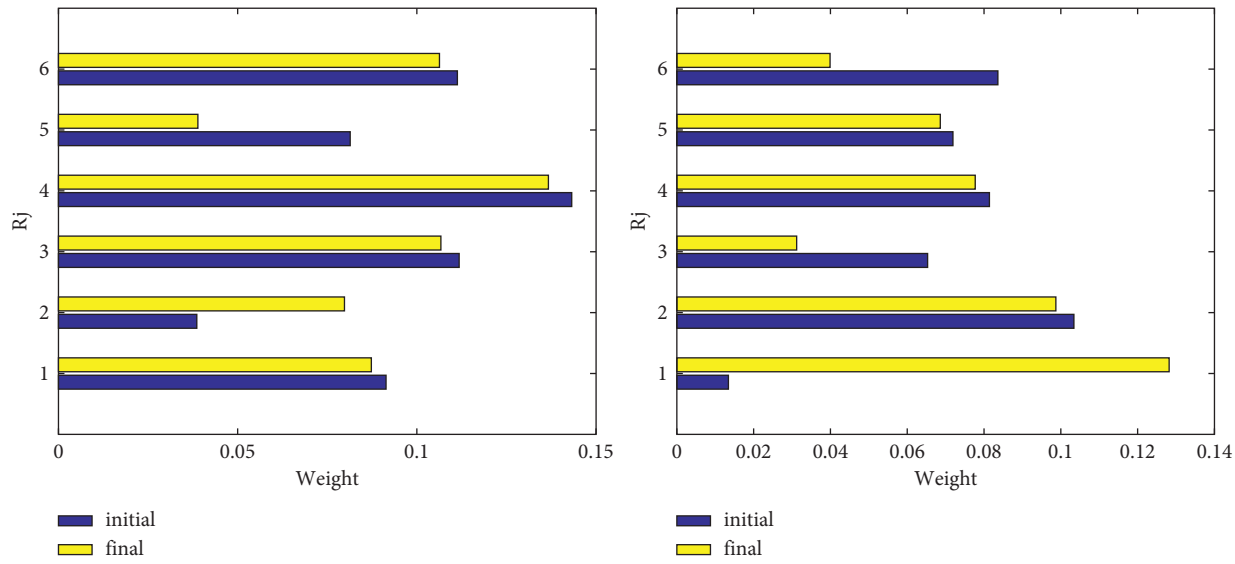

Figure 3: Weight comparison.

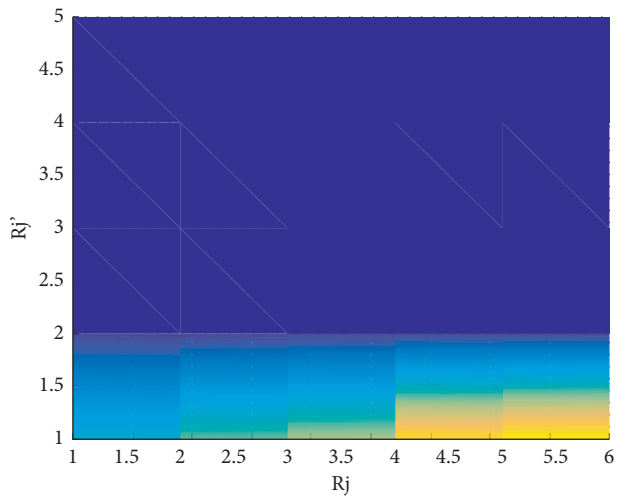

Figure 4: The predicted R_j.

three methods of furniture customization: first, according to the requirements of customers or home decoration designers, cooperate with the decoration style to design furniture styles. In order to achieve the effect of every thread, this design is completely personalized and can even be refined to every data and detail of home space. Combine existing elements; that is, find the feeling in the furniture store, and integrate the favorite materials, fabrics, and styles into new works by professional designers. Copy the original version and make the real shape according to the furniture pictures in magazines or on the Internet. However, in the prior art, for the furniture customization without comparison reference, there is a lack of grasp of the user's preference, so it is difficult to design the technical problem of furniture that meets the user's personalized customization needs. The predicted value is shown in Figure 5, where it can be found that the value changes from 0.5 to 4.5, while R_j varies from 1 to 6. The purpose of this paper is to play a certain role in promoting the innovation and development of mirror materials in the application of American furniture and to bring new ideas and methods for furniture design for American furniture enterprises.

According to the matching element information of this design and the furniture design elements of this paper, the furniture design scheme is obtained. It can analyze the user's preference characteristics by using the purchase style in the member's big data, reflect the member's personal preferences in detail based on the theme style, which can better fit the user's personality characteristics without losing the overall unity and coordination, and improve the technical effect of the personal characteristics of furniture design. The predicted weight is shown in Figure 6, where it can be seen that the weight varies from 0.05 to 0.13. When $x = 1$ and $y = 4$, it reaches its maximum.

Specifically, in order to understand the user's preference characteristics, this paper uses big data to analyze the user's preference according to the style characteristics of the goods in the user's usual shopping orders and master the user's preference characteristics, such as color, style, and graphics; for example, some people like a cartoon character; they will reflect the cartoon character in shopping, or the color they like can be presented according to the color characteristics of shopping goods. In particular, when users give a concept or idea when customizing furniture, they can not directly reflect the characteristics of furniture. By analyzing users' preferences, they can extract elements. At the same time, they can use big data to extract and analyze users' historical purchased goods according to the subject information set by users and determine the style of furniture according to the subject information; it is divided into two parts. One part is the necessary features corresponding to the theme element, such as the line outline of furniture. There is no room for modification. The second part is the modified part that can be added at will according to personal preferences or the part with multiple selectivity. The corresponding search is carried out according to the content of the second part and the member's big data order data. Determine the style elements,

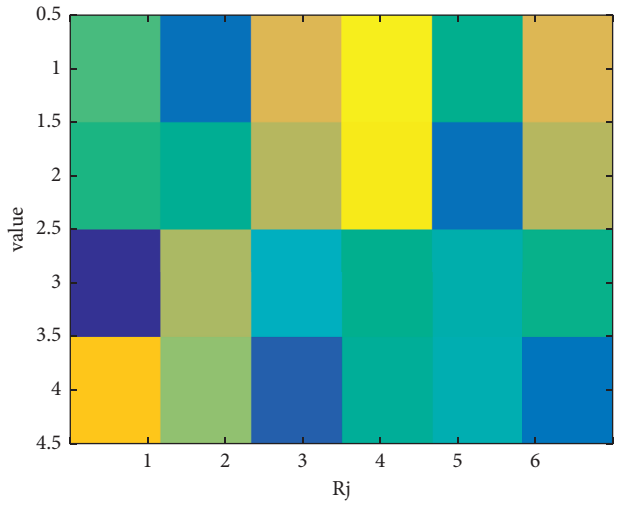

Figure 5: Predicted value of R_j.

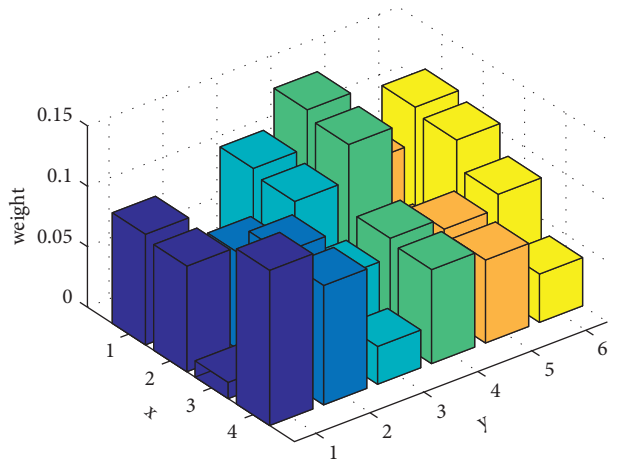

Figure 6: Predicted weight.

such as color analysis, graphic analysis, pattern analysis, and character analysis. After finding the order content matching or related to the second part, then you can filter according to the frequency of occurrence to find the favorite style elements related to this element. Through the preference analysis of the user's order purchase, we can master what the user pays attention to daily, such as aviation knowledge, legal knowledge, environmental protection, and what color and style the user likes. Through the observation of users' daily life and the extraction and analysis of relevant factors, we can better understand users' internal needs and preferences. Therefore, we can combine furniture design with personal personality, hobbies, and personal characteristics. That is, it is more in line with users' personal style, truly regards each user as a separate market segment, and respects each user's personality characteristics, meeting the user's furniture design requirements. As for the commonly used mirror material for tan glass mirror, in the form of porch furniture or living room furniture door frame core plate decorative role, silver glass mirror is generally only used for dressing mirror.

For the customization of the whole house, if there are multiple partitions and multiple members in the house, partition analysis shall be carried out according to the big data orders of the main members of each partition to meet the needs of different users. Due to different opinions and preferences of different members, there are often differences during decoration. In order to weigh the preferences of each family member, divide the room into functional and use sections. When facing multiple members, multiple members are taken into account together. For example, multiple elements in a piece of furniture are the preferences of different members, or separate different furniture to correspond to different member preferences, so as to balance the different needs of families and meet the preferences of different users in their respective use environment. Realize the effect of comprehensively considering the preferences of all members and balancing the needs of all members of the family. In order to verify above analyses, the prediction is plotted in Figure 7. As can be seen, the prediction of values is different from 0.08 to 0.14. On the other hand, through the analysis of past and present data, it can predict what may happen in the future. For example, investors will infer the future trend of a stock according to its past performance.

Furniture design elements are the main furniture design elements determined according to the requirements of the functional partition and the corresponding needs of the subject information. For example, the furniture design content is determined according to the size of the partition, the furniture design content is determined according to the use needs of the partition, and the corresponding furniture type and overall specification in the partition are determined according to the subject information. For example, the functional partition is a study. The area must have bookshelves, desks, and chairs according to the function. Combined with the size of the section, the corresponding functional zoning is designed. According to the determined furniture function and zoning space characteristics, the design elements of furniture are determined. The furniture design elements are the bookshelves or bookcases with what function and size and the desks with what function and size; for example, if the size in the functional partition information is small and there are many functional requirements, it can be determined according to the partition information that the study needs to combine the desk and bookshelf to make a desk with bookshelf function. Determine the structure and overall characteristics of the desk and bookcase according to the theme information. If the theme information is European, the corresponding hollowed out European pattern structure needs to be designed on the outside of the desk, and these basic design elements constitute the furniture design elements of the partition. At the same time, when analyzing the furniture design elements, you can also use big data to extract the theme information and partition information, extract the corresponding features according to the data set collected by big data, and extract the data conforming to the partition information and theme information according to the occurrence probability of feature elements, so as to determine the furniture design elements. The evaluated data is plotted in Figure 8, as can be

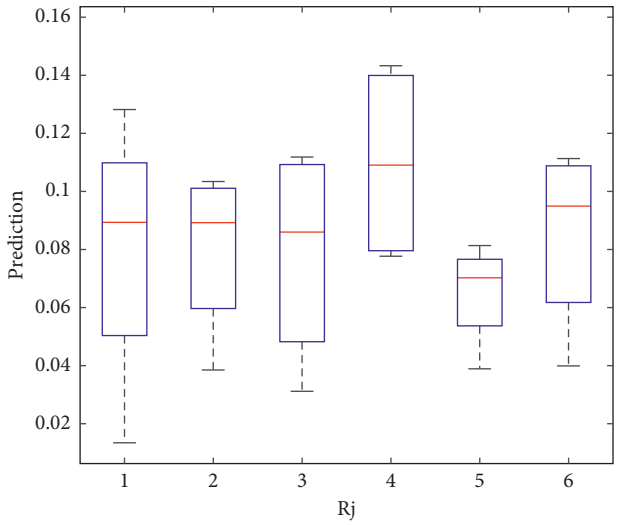

Figure 7: The prediction of values.

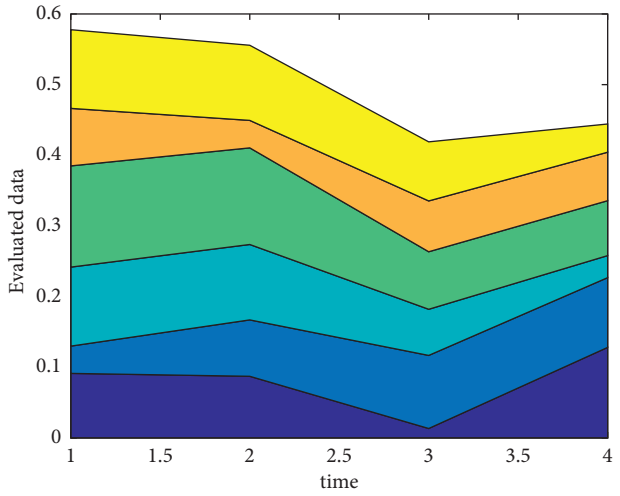

Figure 8: The evaluated data.

seen that the evaluated data varies from 0 to 0.59. Besides, the data reaches its minimum at 3s.

Match the element information that can be used according to the furniture design elements and partition element information. For example, if the furniture design element is a two-meter-long desk with storage function, determine which elements in the partition element information can be used in the furniture design elements according to the characteristics of the desk and the matching between the desk and storage, such as shape factors (straight line or arc), color factor (white or gray), the logo of animation characters, etc. This partition element information can be used in the furniture design elements, but some partition elements cannot be applied to the furniture design elements. According to the characteristics and needs of the furniture design elements, the corresponding partition elements are matched, and the design elements used in the function partition are determined as the design matching element information. In order to improve the accuracy of calculation and processing results in the matching process, this paper constructs the design element matching evaluation model according to the characteristics of furniture design elements and partition element information and uses the mathematical model for operation and processing, so as to improve the operation speed and the accuracy of matching results. The purpose of big data analysis is not to reveal the causality of things, but to discover the correlation between things.

Combine the determined design matching element information that can be used in the partition with the furniture design elements to determine the furniture design scheme of the partition. Similarly, continue to analyze and determine the furniture design scheme corresponding to the partition according to this method. Since the whole furniture setting is based on the theme information to determine the corresponding basic elements, the whole house is unified, but at the same time, the preference elements are selected according to the use frequency in different partition spaces and the preferences of leading members, so it has the characteristics of taking into account the preferences of members. Therefore, it can analyze the preferences of users by using the purchase style in members' big data and reflect the personal preferences of members in detail on the basis of theme style. It can better fit the user's personality characteristics without losing the overall unity and coordination and improve the technical effect of the personal characteristics of furniture design, so as to solve the technical problem that, in the prior art, it is difficult to design furniture that meets the user's personalized customization needs due to the lack of grasp of the user's preference for furniture customization without comparison and reference.

4. Conclusion

With the development of Internet, mobile Internet, and Internet of things technology, the era of big data has come. Enterprises have collected a large number of products and user data through various channels. How to mine the customer demand information hidden behind big data to guide enterprise production and improve user satisfaction has become an urgent problem for each enterprise. Based on the analysis of the characteristics of user demand in the era of big data, this paper proposes a set of user demand analysis system based on big data. It uses big data mining technology to analyze the behavior data of users when using products, mine the functions and combinations most frequently used by users, and then use the model to analyze the correlation between these functions and combinations and user satisfaction, so as to find out the direction of product improvement.

Combine big data analysis technology with user feedback to comprehensively collect user demand information. In order to reduce the amount of computation and improve the accuracy of the result, a general method to determine the threshold of support degree is studied.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The author declares that there are no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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