Optimization of e-commerce platform network marketing strategy based on data mining

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Abstract：In order to solve the problems of high cost investment in e-commerce platform, low efficiency of online marketing and improve the sales performance of e-commerce platform, this paper aims to conduct a detailed study on the optimization of e-commerce platform online marketing strategy based on data mining. First, the e-commerce platform network marketing system based on B/S architecture is designed, and the system is divided into interface layer, functional layer and support layer. The functional layer includes network marketing management, service supervision and management, basic information management and other modules, and the support layer includes various interfaces of the system to achieve data exchange between various functions within the network marketing channel. Then, the online marketing strategy optimization method of e-commerce platform based on decision tree algorithm is adopted to screen the data in the e-commerce platform, and then the data structure and dissimilarity matrix in the e-commerce platform are calculated to obtain the closest data class distance. The online marketing strategy of e-commerce platform is optimized through the decision tree data mining algorithm. And through experimental verification, the method proposed in this paper has a strong data throughput capacity, can effectively improve the efficiency of online marketing, and the system designed in this paper can improve the economic benefits of e-commerce platform.

1. Introduction

The 21st century belongs to the era of rapid development full of information, and different types of data fill all aspects of our daily life. With the advent of the big data era and the continuous updating of data storage technology. On this basis, massive data has accelerated the development of the Internet. At present, e-commerce has gradually entered the stage of comprehensive competition, and the network marketing method is closely related to data mining technology. In short, whoever has advanced data mining technology can better play the advantages of network marketing and occupy the market share. The effective application of data mining technology helps e-commerce platforms to see the changes in consumer consumption structure, the differences between the level changes of consumer groups and consumption levels, thus optimizing online marketing strategies and bringing greater benefits to enterprises [1-2].

The combination of data mining technology and online marketing strategy, the application of big data technology to the optimization of online marketing strategy, and the realization of personalized recommendation of goods through data analysis can overcome the shortcomings of blind promotion of traditional online marketing model, and solve some problems such as high cost investment and low efficiency of online marketing. It is extremely urgent to apply data mining to e-commerce platforms. In order to adapt to the market and meet the consumption level and habits of different consumer groups, e-commerce platforms focus on management and accurate decision-making, and gradually design and develop new products. The accuracy and pertinence of the traditional online marketing strategy are poor, and the sales volume is low, because the traditional marketing model only relies on the decision-making experience of the managers themselves and the market feedback of similar products, and no real research has been carried out. Applying data mining technology to e-commerce platform can analyze and predict the data in e-commerce platform. Therefore, this paper studies the optimization of e-commerce platform online marketing strategy based on data mining [3]

The innovations of this paper are as follows: (1) Design the e-commerce platform network marketing system based on B/S architecture, divide the system into interface layer, functional layer and support layer. The functional layer includes network marketing management and service supervision management, basic information management and other modules, while the support layer includes various interfaces of the system to achieve data exchange between various functions within the network marketing channel. Then, the online marketing strategy optimization method of e-commerce platform based on decision tree algorithm is adopted to screen the data in the e-commerce platform, calculate the data structure and dissimilarity matrix in the e-commerce platform, thus obtaining the closest data class distance, and optimize the online marketing strategy of e-commerce platform through the data mining algorithm of decision number. (2) Compared with other data mining methods, the method proposed in this paper can effectively reduce the cost of e-commerce platform online marketing, improve the efficiency of online marketing, and thus improve the sales performance of e-commerce platform.

2. Related work

With the rapid development of e-commerce platforms, more and more people are shopping online. In order to more accurately analyze the purchase demand of buyers, relevant experts have conducted in-depth research on the optimization of online marketing strategies. With the rapid development of China's economic construction, online shopping has gradually been accepted by more people and effectively used, gradually becoming the main form of daily consumption for young people. Under the development background of the new era, e-commerce has gradually become a field where many people start their own businesses. The rapid development of e-commerce industry can provide a broad development platform for the application of big data technology, and big data analysis can bring new development ideas for the economic model of e-commerce platform. The wide application of big data analysis can help

major e-commerce platforms to effectively manage electronic goods, comprehensively analyze the main trends of market development, provide data analysis for relevant personnel of enterprise management, and recommend relevant goods more suitable for their own needs for users, so as to reduce the cost of e-commerce platforms, but this method does not improve the efficiency of online marketing [4].With the rapid development of e-commerce platforms, the number of users has increased dramatically. It has gradually become a hot application technology in the development of e-commerce industry to conduct a comprehensive analysis of users' behavior through users' browsing records on the platform and realize personalized recommendation of goods. The comprehensive analysis of user behavior can effectively depict the specific attributes and behavior of users. However, in terms of current online marketing strategies and related technologies, there will be more challenges in the performance of data models and the processing efficiency of data recommendation algorithms. Using concepts such as data description and data probability distribution model, this paper proposes a prediction and recommendation method for online marketing strategies of e-commerce platforms based on data mining, uses a priori probability to establish user behavior to calculate the user's possible subsequent consumption probability in detail, and tests the real data to verify the effectiveness and feasibility of the method proposed in this paper through experiments. The verification results show that the proposed method can effectively improve the efficiency of online marketing, but does not reduce the cost input [5]. Zhu fan focused on the clustering and prediction of information in e-commerce platform based on machine learning method, which attracted the attention of relevant experts. He took customer information in an e-commerce platform as the research object to establish k-means and BP neural network models, and carried out data clustering and prediction for users in e-commerce platform to achieve users' online marketing. Data preprocessing is carried out for the relevant customer information in the e-commerce platform, and the k-means customer clustering model and churn prediction model are constructed according to the theory of information clustering and information prediction. The experimental results show that in the clustering model, the data clustering algorithm divides the users in the e-commerce platform into five types to complete the differential identification of customers with different values. In the prediction model, the accuracy of BP neural network is high. However, the introduction of this model into the user clustering model will result in some limitations in the generalization ability of the model, which shows that this method is less practical [6].Liu junran proposed the e-commerce platform network marketing strategy based on the 4I theory. Specifically, we will focus on literature research and case analysis, and establish an e-commerce platform network marketing model that focuses on content and win-win benefits and optimized experience. Based on the problems in the online marketing strategy, explore the optimization of online marketing strategy of e-commerce platform. The current problems of online marketing in e-commerce platforms generally include too single marketing content, relatively few marketing interactions, and the lack of personalized services in the marketing model. Therefore, based on the 4I theory, we propose online marketing

optimization strategies, deeply tap the needs of users, guide them with interesting knowledge, and deepen the win-win consciousness of interests, so as to realize the user value oriented user interaction mechanism, Carry out personalized services and strengthen the effect of e-commerce platform online marketing, but this method is too complex and less practical [7].

3. Network marketing strategy optimization system based on e-commerce platform

3.1 Overall structure of network marketing strategy optimization system

The online marketing strategy optimization system of e-commerce platform is mainly designed with B/S architecture, which divides the system into interface layer, functional layer and support layer. The detailed structure is shown in Figure 1.
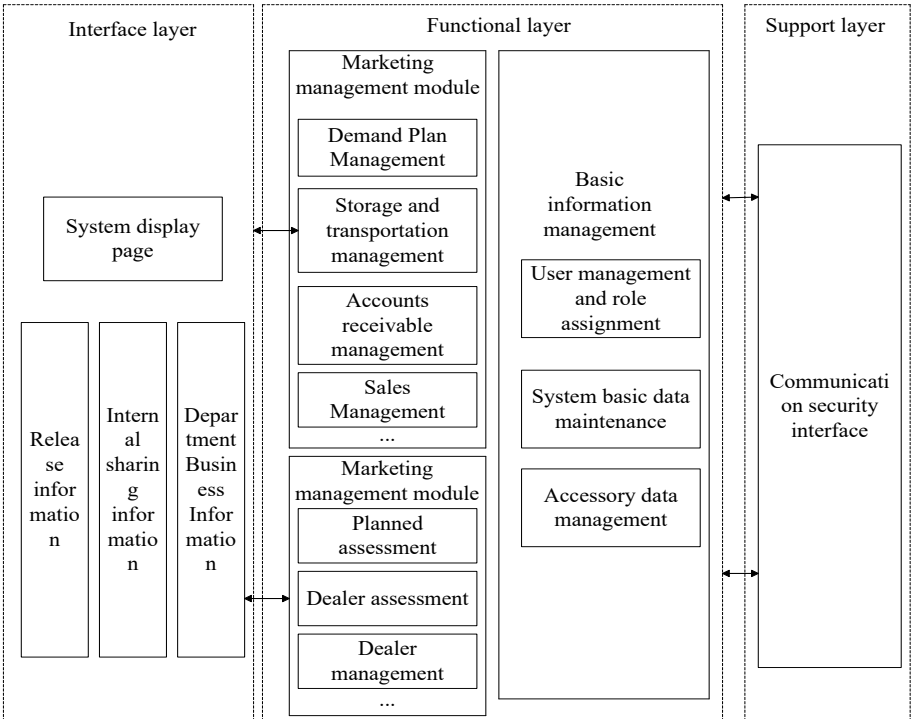
Figure 1 Overall structure of online marketing strategy optimization system based on e-commerce platform

In Figure 1, (1) the main function of the interface layer is to present relevant content in the network marketing system to users, including industry, customer center, detailed commodity information, etc. Among them, the customer information and the relevant information in the comprehensive report mainly represent the sales service and technical support related information and enterprise business information that users care about. It can also be understood as external public information and internal shared information. (2) As the core function of the network marketing system, the function layer mainly includes the relevant functions to be realized in the system, network marketing management and service supervision management, basic information management and other corresponding modules. Online marketing and service is an important way for enterprises in e-commerce platforms to enhance their comprehensive market competitiveness. By using real-time and accurate feedback of market information, they can timely respond to system managers, thereby improving

the quality of products in e-commerce platforms and providing effective basis for enterprises in e-commerce platforms to formulate online marketing programs [8-9]. The service supervision and management function is the expansion of online marketing services. The level of management quality will have a direct impact on the quality of enterprise after-sales service and customer satisfaction in the e-commerce platform. Basic information management is mainly aimed at the management of the construction, maintenance and sharing of various basic information in the network marketing system, which is the basis for the application of various modules in the system. (3) The support layer includes the security and communication of the network marketing system, and the interfaces of other information within the enterprise in the e-commerce platform. These interfaces can realize the data exchange between various modules and levels within the system.

3.2 System function module design

(1) Design of Network Marketing Management Module

The integrated data information and business approval process in the network marketing management function can realize many functions such as demand planning management, storage and transportation management, sales management and account management. The overall structure of the network marketing management module is shown in Figure 2.
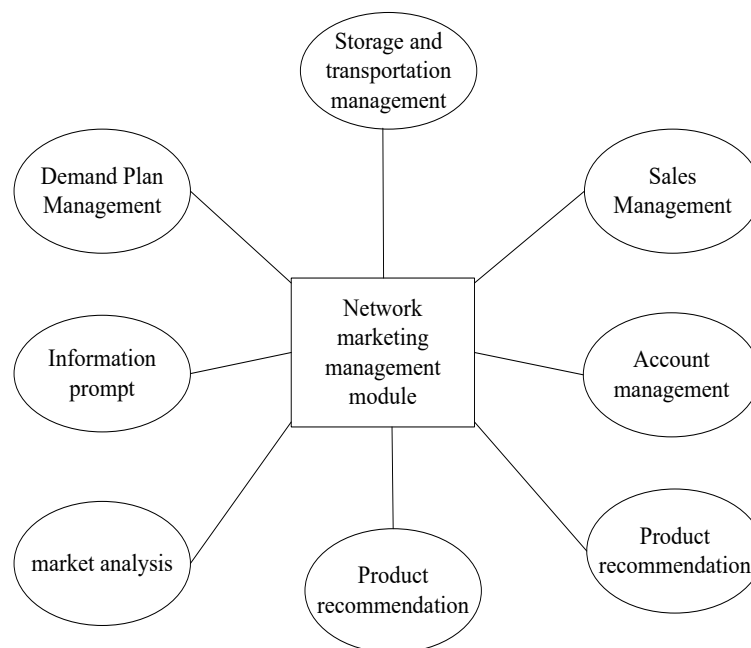

Figure 2 Functional Structure of Network Marketing Management Module

In Figure 2, the network marketing management module mainly uses demand plan management to carry out production marketing plan declaration, maintenance and query. Through sales management, it can realize many functions such as commodity sales, contract management and sales query. Using statistical analysis, it can compare commodity marketing trends, indicators and resources. Use various management functions in the network marketing management module to cover and support the specific business of the enterprise [10-11]. Based on the real-time requirements of network marketing management service, the network marketing

management function adds the information prompt function, which effectively shortens the response time in the process of information transmission and business implementation between departments.

(2)Design of Network Marketing Management Module

Sales management is an important part of the network marketing management function. It specifically aims at the control of the commodity sales process in the process of network marketing, such as commodity sales and sales query. The specific process of user shopping in the process of online marketing is shown in Figure 3.
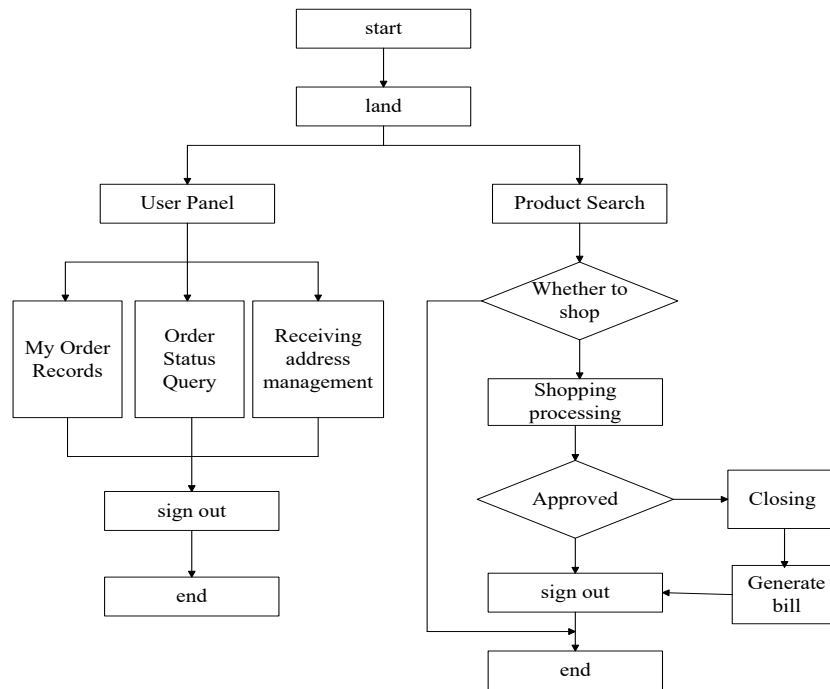
Figure 3 Process of online marketing and shopping on e-commerce platform

According to the different needs of different users, the main purpose of designing the network marketing system is to establish systems with different styles. The online marketing system of e-commerce platform is designed to meet the needs of users as a service tenet, support search in different languages, and set some engine tools such as built-in promotions and discounts [12-13]. The network marketing management function is to provide a stable and diversified marketing platform for the managers in the background of the enterprise, and provide the enterprise with marketing plans through the secondary development of the system and template technology, so as to optimize the network marketing system.

(3)External interface function design

The support layer of the network marketing system specifically includes communication and security and system interfaces, which can effectively complete the external service invocation function. After receiving the call command sent, the network marketing system will perform security verification on the sent call command. If the security verification results meet the relevant standards, the interface information can be directly returned.

3.3 Database design

The main task of database design is to take the basic data items listed in the data

dictionary as the original data, and design the logical model and physical model of the structure optimization database. The database specifically includes user information table, business information table and administrator information table. This article onlydescribes user information table and business information table.

(1) The user information table is used to save the user registration information, and the detailed structure is shown in Table 1.

Table 1 User Information

Field Name	data type	length	Primary key or not	describe
ID	int	50	Yes	Serial No
username	varchar	50	no	user name
password	varchar	50	no	password
realname	varchar	10	no	Real name
phone	varchar	20	no	contact number
sex	varchar	2	no	Gender
age	varchar	3	no	Age
regtime	date		no	Date of registration
state	varchar	500	no	state

(2)The business information table is used to save user business information in the system. The specific structure is shown in Table 2.

Field Name	data type	length	Primary key or not	describe
ID	int	50	Yes	Serial No
name	varchar	50	no	Business name
category	varchar	50	no	category
realname	varchar	10	no	Real name
adduser	varchar	50	no	Added by
state	varchar	500	no	state

4. Optimization of e-commerce platform network marketing strategy based on decision tree algorithm

4.1 Clustering Analysis of Network Marketing Data

The decision tree algorithm is used to optimize the online marketing strategy of e-commerce platform. Clustering analysis algorithm is used to screen the data. Suppose that the online marketing data class in the clustering space is divided by low-density regions. The regions of low-density objects are:

$$n_d = (v - b_1)n_r \quad （1）$$

In formula (1), v represents the number of the given numerical space of the online marketing strategy in the e-commerce platform, b represents the number of areas of low-density objects, n_r represents the value range of the current network node attribute [14-15].After the segmentation of the network marketing data in the clustering space, the high-density areas are presented to a corresponding extent. The

data attribute value of the high-density area is p, and the area of the high-density object is:

$$n_g = (v - a_1)n_r \quad （2）$$

In formula (2), a_1 represents the number of sub regions of high-density objects, and combined with the expression of low-density object regions and high-density object regions, the clustering analysis of online marketing data of e-commerce platforms is shown as follows:

$$n_i = p(n_d + n_g) \times i \quad （3）$$

In formula (3), p represents the number of sub regions divided, i represents the density of the attribute value sample. Get the screening value of clustering analysis data of e-commerce platform network marketing strategy, and screen out the data sample density with high frequency in data attribute values. The higher the frequency, the higher the sample density of attribute values.

4.2 Cluster analysis of e-marketing data

According to the basic principle of the above clustering analysis, the online marketing data in the e-commerce platform is screened. In order to obtain the distance of network marketing data clustering, it is necessary to cluster the network marketing data objects and calculate the distance dissimilarity between each data object [16-17]. The representative network marketing data structure and dissimilarity matrix are adopted. The attribute structure of the e-commerce platform network marketing data matrix is shown as follows:

$$\begin{bmatrix} x_{11}, & \cdots, & x_{1f}, & \cdots, & x_{ip} \\ x_{i1}, & \cdots, & x_{if}, & \cdots, & x_{ip} \\ x_{n1} & \cdots, & x_{nf}, & \cdots, & x_{np} \end{bmatrix} \quad （4）$$

The $n \times p$ matrix is selected to represent that the dissimilarity matrix of the clustering analysis of online marketing data belongs to the object structure, which is specifically responsible for storing the differences between the data. In formula (4), n represents the object of e-commerce platform data matrix, p represents the attribute, i and f represent differences between data objects. When the specific values of f and i are non negative, If the values of f and i are close to 0, The value of p will be larger, In this case, f is not similar to i.

After completing the construction of e-commerce platform clustering analysis matrix, clustering algorithm is adopted to calculate the dissimilarity of data types in

the platform [18]. The measurement value of a given variable is standardized and expressed as:

$$s_f = \frac{1}{n_i}\left(\left|x_{1f} - m_f\right| + \left|x_{2f} - m_f\right|\right) \quad (5)$$

In formula (5), s_f represents the absolute deviation value, and m_f represents the absolute average value of f.

After the standardization of measurement values, the dissimilarity of e-commerce platform data types is calculated and expressed as:

$$d(i,j) = \sqrt{\left|x_{i1} - x_{ji}\right|^2 + \left|x_{if} - x_{j2}\right|^2} \quad (6)$$

In formula (6), $d(i,j)$ represents the distance between data objects. The distance function between data objects is symmetric based on the optimization algorithm of e-commerce platform online marketing data strategy based on data mining. However, to a large extent, the data types of cluster analysis are different, indicating that:

$$W = d(i,j) \times k_1 \quad (7)$$

In formula (7), k_1 represents the data volume of e-commerce platform cluster analysis obtained by scanning.

According to the dissimilarity calculation of e-commerce platform data types, the potential information contained in the data is discovered. The data mining algorithm flow of e-commerce platform cluster analysis is shown in Figure 4 [19-20].

First, input the e-commerce platform data, and use the decision tree to discover data is mainly achieved in two steps: (1) acquire knowledge from e-commerce platform network marketing data, and (2) input relevant data through the generated decision tree classification. Test the data attribute values entered by the record until the category of the record is found, so as to discover the information contained in the data, and complete the research on optimization of e-commerce platform online marketing strategy based on data mining.
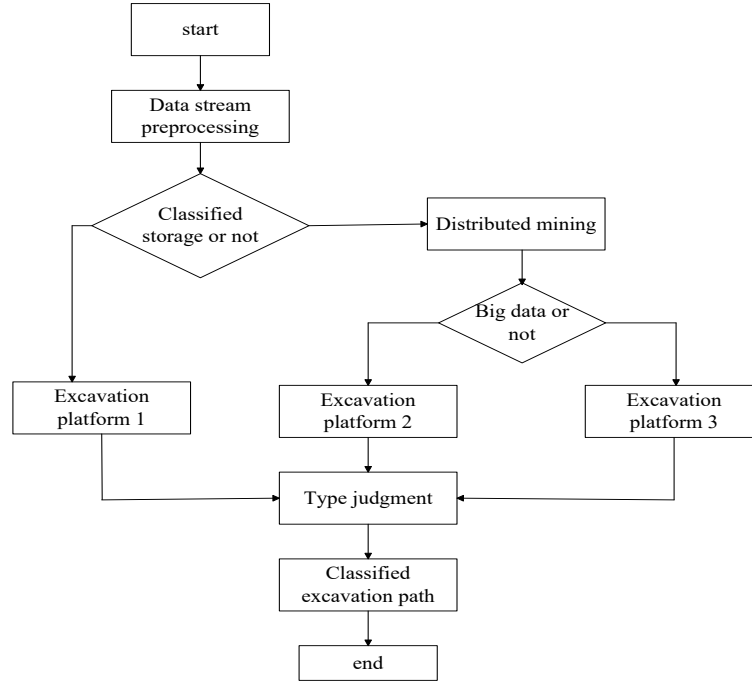
**Figure 4 Data mining algorithm flow chart of e-commerce platform clustering analysis**

5. Experimental result

In order to verify the effectiveness of the research on online marketing strategy optimization of e-commerce platform based on data mining proposed in this paper, experimental verification was conducted in Matlab environment. Table 3 shows the experimental parameter environment.

**Table 3 Experimental Parameter Environment**

Experimental parameters	experimental data
processor	intel core i7
Dominant frequency	3.6 GHz
Operating system	Window 10
Running memory	8GB

In the experiment, we mainly take an e-commerce platform as the research object, and compare the difference between the method proposed in this paper and the method proposed in [4] and [5] in the data throughput of e-commerce platforms. The results of online marketing data statistics are shown in Figure 5.
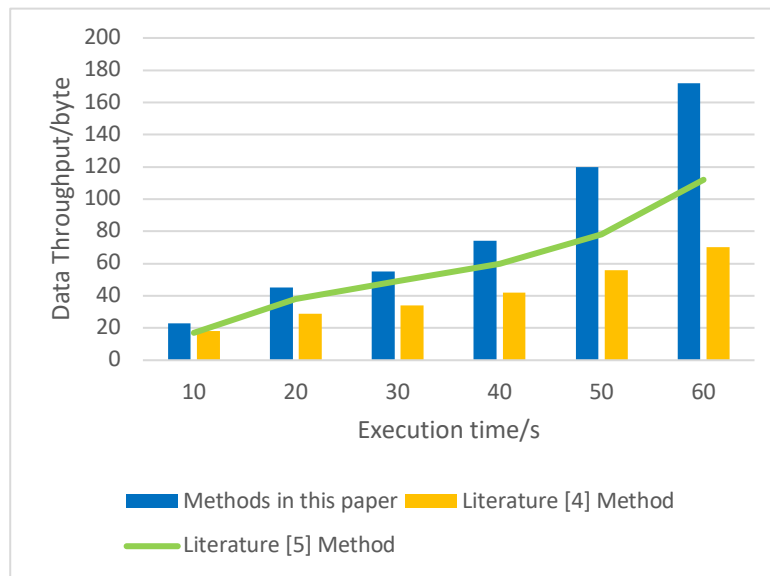
Figure 5 Comparison of data throughput of e-commerce platforms using different methods

It can be seen from Figure 5 that the data throughput of the e-commerce platform after the optimization of the online marketing strategy by the method proposed in this paper is better than the method proposed in the other two documents at the execution time point. Data throughput is an important indicator to verify the performance of data classification algorithms. The data mining method proposed in this paper has strong generalization ability and global optimization ability. This shows that adopting the method proposed in this paper to optimize the online marketing strategy of e-commerce platform can effectively reduce the advertising investment of the platform, thus reducing the cost investment. Figure 6 shows the time comparison of e-commerce platform online marketing data mining using the method proposed in this paper and the method proposed in literature [6] and literature [7].
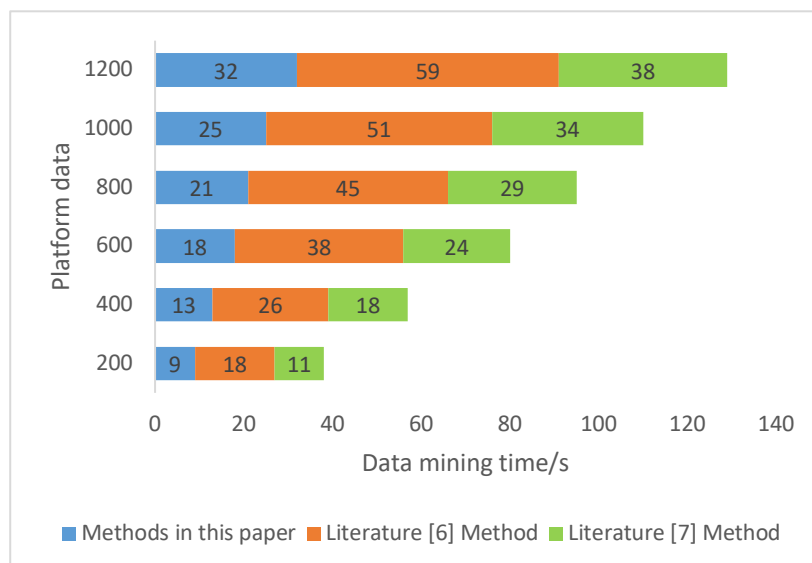
Figure 6 Comparison of data mining time of e-commerce platform online marketing by different methods

It can be seen from the analysis of Figure 6 that the data mining method proposed in this paper takes a faster time to explore the data in the e-commerce platform, while the data mining time in the e-commerce platform using the method proposed in literature [6] increases with the gradual increase of experimental data, and the data mining time is relatively slow. Although the method proposed in literature [7] is slightly lower than the method proposed in literature [6], it is compared with the method proposed in this paper, It is still slightly higher, which shows that the method proposed in this paper can effectively improve the efficiency of e-commerce platform network marketing, thereby increasing the turnover of e-commerce platform. Figure 7 shows the comparison between the e-commerce platform online marketing system using the data mining proposed in this paper and the platform sales before the adoption of the online marketing system proposed in this paper (half a year).
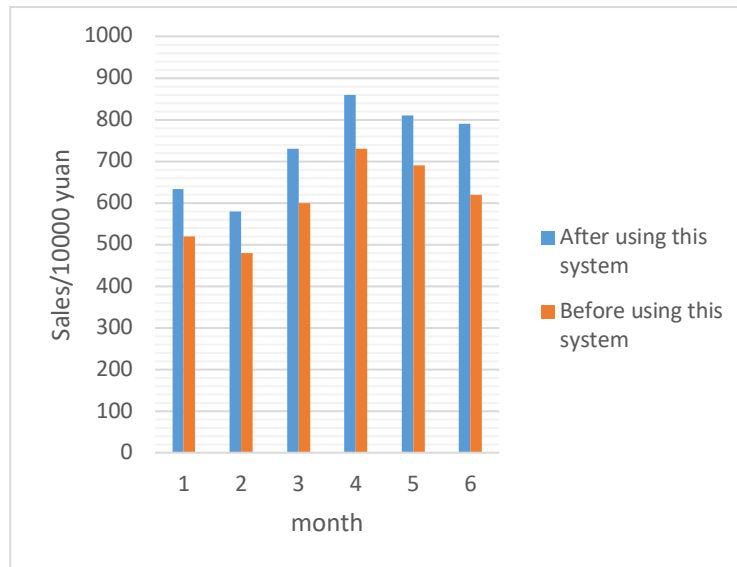
Figure 7 Comparison of sales of e-commerce platforms using this system and those not using this system

As can be seen from Figure 7, compared with the e-commerce platform before the system proposed in this paper, after the application of the online marketing system proposed in this paper, the monthly sales of an e-commerce platform show a trend of increase, and the increase can be guaranteed to be more than 10%, because the e-commerce platform online marketing system designed in this paper adopts B/S architecture, divided into interface layer, functional layer and support layer, and each functional layer performs its own duties, Therefore, the economic benefits of the electric commodity station will be improved.

6.Conclusions

The clustering algorithm of traditional e-commerce platform network marketing strategy is slow in data mining, and the precision of data mining is poor. Therefore, this paper proposes an e-commerce platform online marketing strategy optimization based on data mining, which can improve the classification of data types by screening the data in the e-commerce platform and calculating the clustering data. Using data mining technology to carry out quantitative analysis on real data can intuitively locate more valuable users, formulate marketing plans based on customer groups, predict

sales data, optimize network marketing strategies, and improve the economic benefits of e-commerce platforms.

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