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E-Commerce Precision Marketing and Consumer Behavior Models Based on IoT Clustering Algorithm

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ABSTRACT

This article aims to study e-commerce precision models and consumer behavior models based on clustering algorithms, and at the same time conduct detailed research on the Gaussian mixture distribution algorithm, consumer behavior and model construction, and precision marketing strategies in the clustering algorithm. First, a lot of analysis and demonstration of precision marketing strategies and the construction of consumer behavior models are carried out, and then the clustering algorithm-based electronic some experiments were carried out on the application of commercial precision marketing methods and consumer behavior models. The experimental results show that the precision marketing method using the clustering algorithm is more in line with the development of modern e-commerce. The application of the algorithm in the precision marketing methods of enterprises and consumer behavior models has promoted the vigorous development of enterprises, making the sales volume of enterprises reach 9.8%.

KEYWORDS

Behavior Model, Clustering Algorithm, E-Commerce, Precision Marketing Methods

1. INTRODUCTION

With the rapid development of network and information technology, e-commerce has become an important form of information communication and trade activities between many enterprises and consumers, and it has become more and more closely connected with consumers' lives. This has had a greatly impact on marketing techniques. Marketing starts from a large-scale type and is characterized by a high rate of return on investment for measuring marketing effects and the correct division of investment markets. Philip Kotler, a world marketing expert, pointed out the promotion and marketing as a new trend of market communication. This new concept can be immediately recognized in all fields. In recent years, with the improvement of online transaction systems and the standardization of credit management systems, the scale and number of e-commerce websites have entered a period of rapid development. Network-based precision marketing is eye-catching. For the e-commerce industry, precision marketing methods are more analyzable and benign. For companies with unified management and decentralized users, precision marketing methods are even more important. However,

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in the research of Presion marketing, most of them only focus on unilateral marketing plans such as advertising marketing and customer relationship management, and there is insufficient research on the system related to application marketing of e-commerce websites. The current e-commerce industry has many problems, such as fierce competition among industries, high product similarity, lack of personalized design, lack of precision in advertising investment, lack of a better profit model, and so on. Now that the era of big data has arrived, the advantages of big data should also be applied to the marketing of e-commerce companies. E-commerce companies need to change the original extensive marketing into precision marketing in the era of Internet big data. With the growth of business volume, e-commerce companies can collect massive amounts of customer information and data every day, but the format of the data is complex, and the regularity of the data is not easy to grasp. Because many companies cannot understand the real needs and consumption behavior of consumers, when faced with a large amount of user data that seems to be irregular, the effect of marketing is very poor without professional data collation and analysis. How to make good use of the data torrent in the era of big data, and how to understand the real needs of consumers for precision marketing, will become one of the important issues that e-commerce companies should think about in depth.

With the rapid development of information technology, e-commerce has also developed rapidly, and traditional enterprises are transforming to Internet+. Nowadays, consumers are increasingly demanding personalized products and services, and manufacturers can effectively understand consumer needs through the rapid development of the Internet to capture business opportunities. It can be said that the Internet has built a bridge between manufacturers and consumers. In this environment, precision marketing came into being. E-commerce companies using the Internet to implement precision marketing can achieve a win-win situation for manufacturers and consumers. The purpose of this article is to systematically classify the application of precision marketing in e-commerce on e-commerce websites and summarize the application system of marketing through the analysis of precision marketing strategies. The real importance is to provide advice on precision marketing that is most suitable for e-commerce, and to extend the precision marketing system of e-commerce from e-commerce to other e-commerce systems. The establishment of universities, accurate e-commerce marketing models and effective consumer consumption models can not only meet the diversified requirements of new and new humans, but also provide target customers with more suitable services and improve target customers' product loyalty. It greatly reduces the transaction costs of e-commerce companies, enables companies to obtain greater benefits, and promotes the prosperity and development of the e-commerce industry.

With the continuous progress and development of society, e-commerce is also constantly progressing, which has also had a certain impact on our social development. Agrawal D R pointed out that the rapid growth of e-commerce has changed the ability of jurisdictions to levy commodity taxes based on destinations. This will result in different effective tax rates depending on the way goods and services are purchased and the characteristics of the products and sellers (Agrawal and Fox, 2016). Oliveira T also pointed out that with the development of E-commerce, trust plays an important role in shaping consumers' purchasing intentions. Through continuous experiments, Oliveira T's survey results show that consumers with high overall trust levels show higher willingness to buy online (Oliveira, et al., 2017). Of course, the development of e-commerce has not only affected human society, but Biagi F has conducted a series of studies on whether ICT/e-commerce activities will have an impact on labor demand. It is shown that over time, ICT/electronics the increase in business activities did not significantly lead to a decrease in employment (Biagi and Falk, 2017). Although e-commerce is constantly developing, it is also growing in the continuous development of social technology. Tadelis S pointed out that the growth of online e-commerce is not only due to their ease of use, but also to the reputation and feedback system they provide to help market platforms build trust (Tadelis, 2016). In addition to the continuous development of social science and technology, which is driving the continuous development of e-commerce, precise marketing models are also continuously promoting the continuous development of e-commerce. Zhao S pointed out that the

precision marketing data source system based on big data focuses on the connotation and thinking of precision marketing to find the basic method to promote data standardization, so as to provide a reference for building a data source system based on big data (Zhao and Ma, 2017). Of course, while the development of e-commerce affects people's consumption behavior, people's consumption behavior is also affecting the development of the market. Jae-Hwa pointed out through a large number of studies that the mother's preference and eating frequency's positive recognition of processed foods will have a negative impact on children's eating habits and snacking behavior, thereby affecting their online shopping behavior (Jae-Hwa, et al., 2016). Not only in food purchases, but also in the real estate industry. Rafsanjani H N has conducted research on most real estates and found that the energy consumption behavior of occupants has a significant impact on the overall energy consumption of commercial buildings (Rafsanjani, et al., 2018). The continuous development of e-commerce has changed people's lifestyles and consumption patterns, but over-accurate marketing methods have had a certain impact on people's lives, making people often harassed by some e-commerce companies' marketing messages and phone calls in their daily lives. Moreover, the development of e-commerce commerce has also caused the waste of resources such as express packaging boxes and environmental pollution to a certain extent (Bartels and Reinders, 2017) (Verma, et al., 2018). The consumer behavior model provides a basic structure and process or conceptual model for describing the characteristics of consumers in this article. It also reflects today's belief and understanding of the nature of consumer psychology and behavior.

The innovation of this article is to use clustering algorithm to improve the e-commerce marketing model and consumer behavior model. Although the precision marketing concept has been proposed for a relatively short period of time, there are not many applications at this stage. Now there are many examples of precision marketing mainly used in e-commerce. Most e-commerce companies use large-scale collection and analysis of online behavior records and trends of Internet forum registered groups, and then analyze and predict which types of groups represent the potential customers or target audiences of the company's products, so that they can be targeted Implement precision marketing strategy. Since most of the e-commerce is still in the current stage of growth, many companies have not thoroughly studied and recognized it when using the platform. They still use the traditional e-commerce habit to do product business operations. Consumer needs run counter to each other and cannot make marketing strategies more detailed and comprehensive. Judging from the current situation, the existing precision marketing theories are often on the surface of the theory, and have limited guidance for the practice of product e-commerce enterprises. This article will combine specific cases to improve the model of general product e-commerce model precision marketing. Further advance the in-depth analysis and comprehensive discussion, the specific analysis of the operation mode of the model, prompts the existing problems, and summarizes the general rules. The shortcomings of this article are the lack of practical experience and the lack of comprehensive and in-depth research on the problem, so this article has carried out many tests on the experiment in the later period.

2. E-COMMERCE PRECISION MARKETING METHOD BASED ON IOT CLUSTERING ALGORITHM AND CONSTRUCTION METHOD OF CONSUMER BEHAVIOR MODEL

2.1 Algorithm Based on Clustering

Cluster analysis, also called cluster analysis, is an important algorithm generally used in computer technology, especially data mining technology. Clustering helps market analysts distinguish various consumer groups from consumer databases and summarize various types of consumer consumption patterns or habits (Saghiri and Meybodi, 2017). As a data mining module, it can be used as a separate tool to detect detailed information distributed in the database and summarize the characteristics of each category, or focus on specific categories for further analysis.

2.1.1 K-Means Mean Value Algorithm

K-means mean value algorithm is an unsupervised learning algorithm. Its parameter tuning is not as complicated as other algorithms. There is only one k value. At the same time, this algorithm converges faster in large-scale data processing and has undergone a large number of industries. People's use, quality and credibility are guaranteed to a certain extent (Chung and Simpson, 2017). This paper explores the influence of different weight functions and basis functions on the moving least squares fitting. Then, in the influence of the degree of discrete points on the fitting accuracy, this paper finds that the discrete points have little effect on the fitting accuracy. We can think of this algorithm as an algorithm for a given data set of k clusters. Assuming that the number of clusters is 4, then using this method is to divide the data into four categories, as shown in Figure 1.

The e-commerce marketing recognition algorithm combined with the K-means mean algorithm classification is as follows:

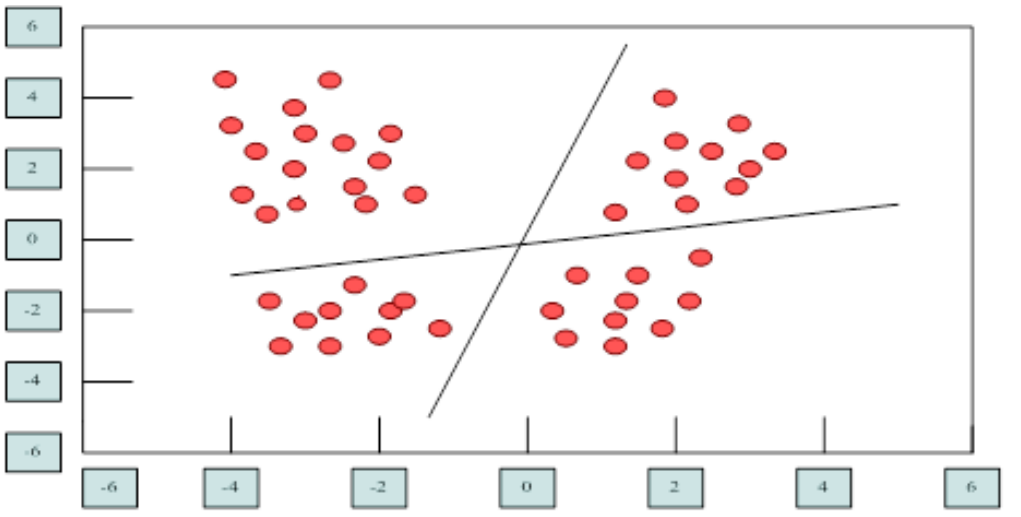
1. Assuming that the number of e-commerce platforms is w, we extract multiple data from them as samples, and then select k objects and treat them as an initial cluster center, which is completely random.
2. Calculate the average value of each object in this cluster as the intermediate object, and then calculate the distance from other objects to these central objects, and then re-divide the corresponding objects according to the smallest distance (Lv, et al., 2016).

We can use the Euclidean formula to calculate the distance from the object to the center of mass. The specific formula is as follows:

$$S\left(x,y\right)=\sum_{r=1}^{w}\left(x_{r}-y_{r}\right)^{2} \tag{1}$$

3. We have to continuously calculate the center object of each cluster that has changed.
4. Repeat the steps from 2) to 3) until each cluster stabilizes and no longer changes, that is, the criterion function converges, and the clusters with more obvious effects can basically be formed. Generally we use the square error criterion, such as the formula:

Figure 1. Schematic diagram of the number of clusters



$$A = \sum_{r=1}^{q} \sum_{m \subset Vi} m - e_r^{\,2} \tag{2}$$

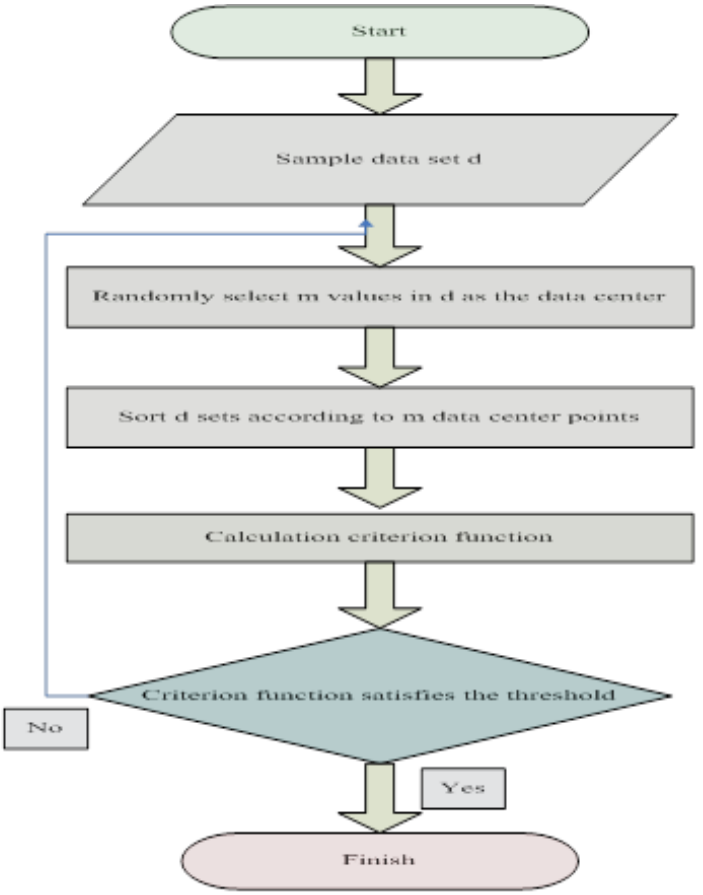
In this formula, A represents the sum of the errors in the squared difference of all data in the database, m represents a point in the space, and er is the mean value of the cluster Vi. In this way, we can calculate the distance metric through the above Euclid formula (Wu, et al., 2016).

The K-means algorithm flow is as shown in Figure 2.

2.1.2 Gaussian Mixture Distribution

As a posterior learning algorithm, the Gaussian mixture distribution algorithm is essentially a probability density function, introducing the concept of probability, which is conducive to our analysis of various models, and then make judgments and analyses on the results obtained (Saeed, et al., 2017). Through the GMM algorithm, the output result obtained is different from the K-means algorithm. The result is a series of probabilities that conform to each model. Finally, we divide the most likely result into this type of model. The essence of GMM is to continuously train M probability distributions, the sum of the results obtained in N distributions for the same sample data is 1, and finally select the most likely result as the final classification result (Hoseynzadeh and Ahmadi, 2020).

Figure 2. K-means algorithm flow chart



The definition formula of the mixture Gaussian model is:

$$R\left(x\right)=\sum_{n=1}^{n}\pi_{n}R\left(xn\right) \tag{3}$$

In this formula, n represents the number of models used, and the weight of the nth Gaussian is expressed as πn, which is the probability density function of the nth Gaussian.

Let's use a picture to explain the Gaussian mixture model, as shown in Figure 3.

In order to make the effect more intuitive, we can assume that the two ellipses in the figure are twice the standard deviation ellipses of the two Gaussian distributions, so that the data distribution of the two clusters is more reasonable (Xiao and Hu, 2017). Assuming that there is a random variable e, we will use the Gaussian model to express it, such as the formula:

$$R\left(x\right)=\sum_{n=1}^{n}\pi mQ\left(x,\mu m,\sum m\right) \tag{4}$$

Take the example of the above figure, there are two clusters in the above figure, then we can use two Gaussian distributions, which mean that m=2 at this time, and m is the mixing coefficient, and satisfies:

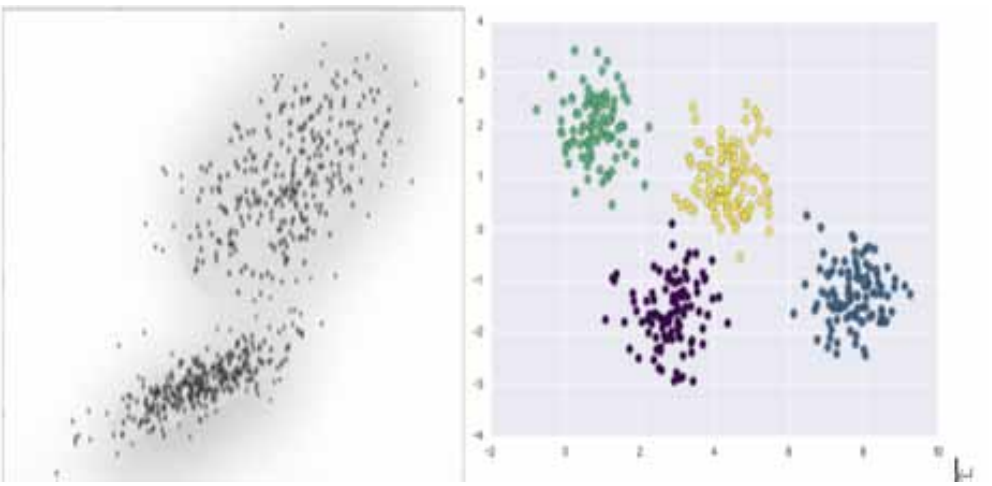
$$\sum_{m=1}^{m}\pi m=1,0\le\pi m\le 1 \tag{5}$$

2.1.3 EM Algorithm Estimates GMM Parameters

The EM algorithm is mainly divided into two steps, which is to first estimate the value of the parameter, and then use the obtained value to optimize the maximum likelihood function. To achieve this step, we first require the likelihood function of GMM:

$$R\left(q\pi,\mu,\sum\right)=\sum_{m=1}^{m}\pi mn\left(q\mu m,\sum m\right) \tag{6}$$

Figure 3. Gaussian mixture model diagram



To estimate several parameters such as μ, one must find their maximum likelihood function, which can be obtained by calculation:

$$\mu m = \frac{1}{nm}\sum\nolimits_{n=1}^{n}\gamma\left(T,nm\right)En \tag{7}$$

By calculating formulas 6 and 7, we get:

$$nm = \sum\nolimits_{n=1}^{n}\gamma\left(Tnm\right) \tag{8}$$

In the end, the maximum likelihood function of πk has not been obtained, because there are restrictions on πk, so we must add the Langrangian algorithm:

$$\ln R\left(q\pi,\mu,\sum\right)+\lambda\left(\sum\nolimits_{m=1}^{m}\pi m-1\right) \tag{9}$$

Therefore:

$$\pi m = \frac{nk}{n} \tag{10}$$

2.2 Consumer Behavior

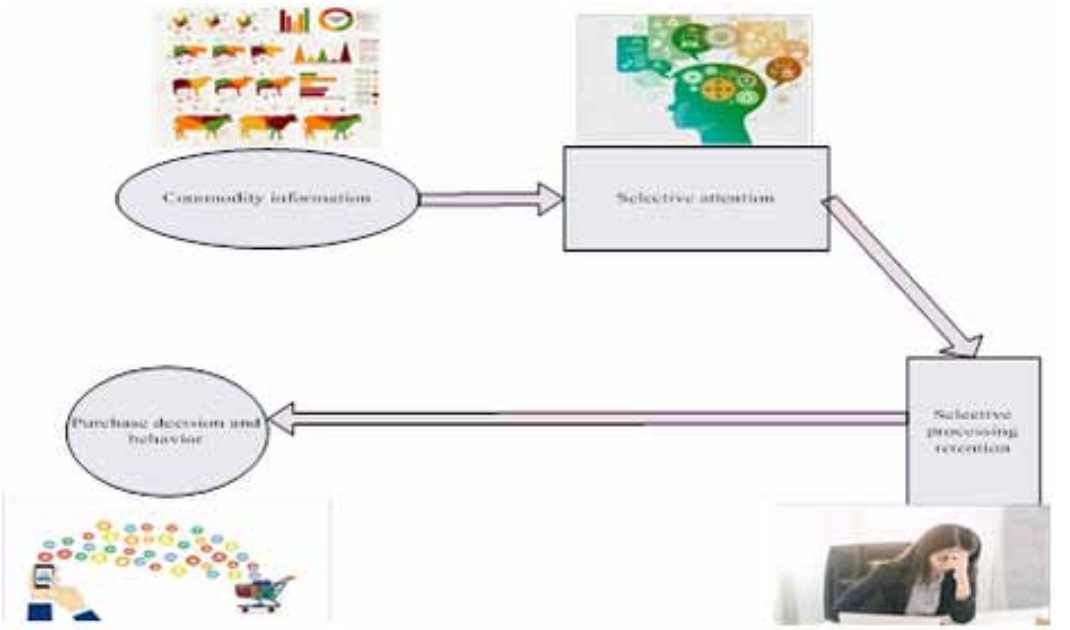
2.2.1 Consumer Buying Behavior Theory

1. The theory established by habit is that if consumers pursue products themselves, and external products can meet the requirements of consumers, consumers will want to buy them, thereby generating a fixed pattern for consumers (Chaparro, et al., 2016).
2. Information processing theory. In the theory of information processing, people's consumption actions are regarded as the process of information processing. Humans are equivalent to information processing devices. The processing device includes information input, coding, storage and extraction (Viana, et al., 2016). As shown in Figure 4, in the case of product information, consumers will first have selected precautions, then selectively process and maintain the notified information, and finally decide whether to buy.

2.2.2 Model Establishment and Research Hypothesis

In an e-commerce environment, consumers must use computers to purchase goods. In online shopping, there are requirements for retrieval, comparison and selection, procurement, and after-sales service. These activities are assisted by computers. The purchaser of the product is also the user of the information system and has a dual identity (Fan, et al., 2016). Therefore, the technical acceptance model that explains the personal use of information systems is also applicable to explain consumers' online shopping behaviors. Consumers' awareness of the usefulness and ease of use of online shopping directly affects consumers' attitudes towards shopping. For example, when consumers realize the ease of use of shopping websites, the design of Web pages will be more beautiful, easy to accept, and easy to read. Or to retrieve products, consumers accept the shopping website becomes simple, and online shopping is also very convenient. On the contrary, some shopping websites are designed

Figure 4. Information processing theory



to be too complicated for security reasons, and so are consumers. There are many steps when buying something, and many consumers will abandon the order because they are afraid of difficulties (Jiang, et al., 2020).

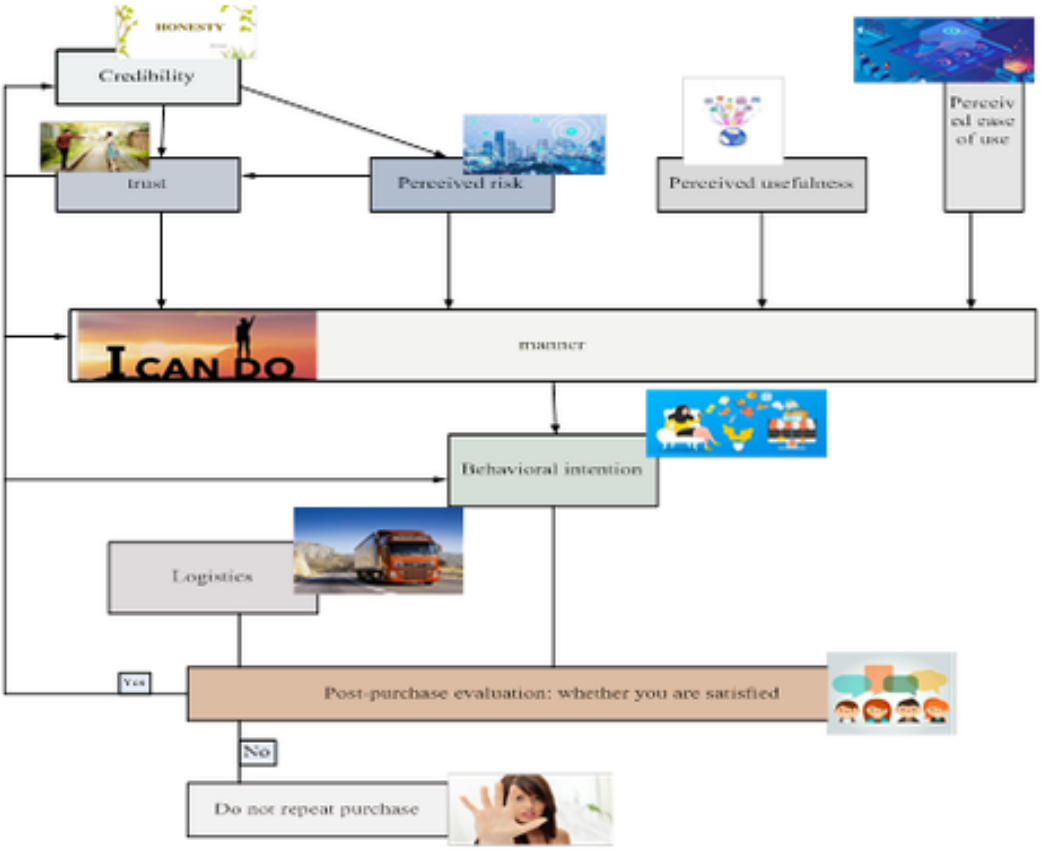
Moreover, after online shopping, consumers will have a certain degree of satisfaction with their shopping process. According to the degree of satisfaction, a post-purchase evaluation will be generated. The evaluation after purchase enriches the existing evaluation of online sales and the evaluation of online sales. This evaluation will become a reference for other consumers when shopping online, and affect other consumers' shopping decisions. The higher people's evaluation of the merchant, the lower the risk that people encounter when buying, and the merchant's trust will increase accordingly. At the same time, evaluation feedback actions after purchase may also directly affect consumers' repeated purchase attitudes and action intentions. If consumers are satisfied with the shopping, they will repeatedly emphasize the buying attitude and action intention (Yamamoto, et al., 2019).

When consumers shop online, what affects consumer satisfaction is whether or not after-sales service is implemented, the perceived value of the product, the length of the master's thesis and the principle of simplified model, such as logistics and distribution efficiency, express delivery services, etc. This article only considers the relationship between logistics distribution and satisfaction. The relationship between consumer's perceived value and satisfaction has been confirmed in the online expectation confirmation theory (Switzer and Combes, 2016). In addition, compared with previous business activities, after-sales service is not important for e-commerce. The products consumers want to buy online are generally products with low dependence on after-sales service such as clothing and cosmetics (Gao, et al., 2020). Please do not choose to buy refrigerators and washing machines that rely on after-sales service online. Figure 5 is a flow chart of making consumer decision-making action patterns in online shopping.

2.2.3 Single Factor Variance and Structural Equation Model

Unit distribution analysis is used to investigate whether different levels of control variables have a significant effect on the observed variables. By inferring whether there is a significant difference in

Figure 5. Consumer decision-making behavior model in online shopping



the overall average of the observed variables at each level of the control variable, analyze whether the control variable has a significant effect on the observed variable (Zhou, et al., 2016). The formula for verification statistics is as follows:

$$K = \frac{VVS\left(l-1\right)}{VVR\left(n-l\right)} = \frac{BBS}{BBR} \tag{11}$$

The structural equation model includes two parts: the structural model and the measurement model. Usually depicted in the form of a path diagram. The structural model describes the correlation between latent variables. The measurement model of structural equation model describes the relationship between latent variables and indicators, indicating which measurement variables a latent variable is measured by (Kang, et al., 2017).

The relationship between indicators and latent variables is usually described as the following measurement formula:

$$w = \wedge_{w} \xi + \delta \tag{12}$$

$$t = \wedge_t + \varepsilon \tag{13}$$

W refers to a vector composed of external factors, and t refers to a vector composed of internal factors.

The relationship between latent variables is usually written in the following form:

$$\eta = O\eta + \Gamma\xi + \zeta \tag{14}$$

Before establishing a model, it is necessary to set up a theoretical model based on theoretical analysis and previous research results, such as clarifying the observed variables of each latent variable and the relationship between the latent variables. According to the set theoretical model, the mathematical expressions of the structural equations of the four latent variable theoretical models are as follows:

$$\eta = O\eta + \Gamma\xi + \zeta$$

$$\begin{bmatrix}\eta_1\\ \eta_2\\ \eta_3\\ \eta_4\end{bmatrix} = \begin{bmatrix}0 & 0 & 0 & 0\,0 & \eta_{16}\\ \eta_{21} & 0 & \eta_{23} & 0\,0 & 0\\ \eta_{33} & 0 & 0 & 0\,0 & 0\\ 0 & \eta_{42} & \eta_{45} & 0\,0 & \eta_{46}\end{bmatrix}\begin{bmatrix}\eta_1\\ \eta_2\\ \eta_3\\ \eta_4\end{bmatrix} + \begin{bmatrix}0 & 0 & 0\\ 0 & 0 & 0\\ 0 & 0 & 0\\ \gamma_{41} & \gamma_{42} & 0\end{bmatrix}\begin{bmatrix}\xi_1\\ \xi_2\\ \xi_3\end{bmatrix} + \begin{bmatrix}\zeta_1\\ \zeta_2\\ \zeta_3\\ \zeta_4\end{bmatrix} \tag{15}$$

X's measurement model:

$$\begin{bmatrix}X_1\\ X_2\\ X_3\\ X_4\end{bmatrix} = \begin{bmatrix}\omega_{11} & 0\,0\\ \omega_{21} & 0\,0\\ \omega_{31} & 0\,0\\ \omega_{41} & 0\,0\end{bmatrix}\begin{bmatrix}\xi_1\\ \xi_2\\ \xi_3\end{bmatrix} + \begin{bmatrix}\delta_1\\ \delta_2\\ \delta_3\\ \delta_4\end{bmatrix} \tag{16}$$

y's measurement model:

$$\begin{bmatrix}Y_1\\ Y_2\\ Y_3\\ Y_4\end{bmatrix} = \begin{bmatrix}\lambda_{11} & 0 & 0\,0\,0\,0\\ \lambda_{21} & 0 & 0\,0\,0\,0\\ \lambda_{31} & 0 & 0\,0\,0\,0\\ 0 & \lambda_{42} & 0\,0\,0\,0\end{bmatrix}\begin{bmatrix}\eta_1\\ \eta_2\\ \eta_3\\ \eta_4\end{bmatrix} + \begin{bmatrix}\varepsilon_1\\ \varepsilon_2\\ \varepsilon_3\\ \varepsilon_4\end{bmatrix} \tag{17}$$

The estimation of structural equation model parameters includes generalized least squares estimation, two-level least squares estimation, maximum likelihood estimation and other estimation methods. In this paper, the most-likelihood inference algorithm is used to infer the model.

The estimate θ that minimizes the next fitting function M is called the most likelihood estimate, or m estimate for short:

$$M = \log\left|\sum\left(\theta\right)\right| - \log\left|a\right| + tr\left(a\sum^{-1}\left(\theta\right)\right) - \left(k+l\right) \tag{18}$$

where tr(a) represents the trace of matrix a, and Σ(θ) is the covariance matrix derived from the model.

2.2.4 Validity Test of Consumer Behavior

In order to test the validity of the convergence of consumer actions and the validity of recognition, this research uses confirmed factor analysis. This paper uses the lisrel8.7 tool to take confirmatory factor analysis on consumer behavior data, and the parameter estimation method is the maximum likelihood estimation method:

$$WTA = \frac{\sum_{n=1}^{l}\lambda^2}{\sum_{n=1}^{l}\lambda^2 + \sum_{n=1}^{l}\varepsilon^2} \tag{19}$$

$$QR = \frac{\left(\sum_{n=1}^{L}\lambda\right)^2}{\left(\sum_{n=1}^{L}\lambda\right)^2 + \sum_{n=1}^{L}\varepsilon} \tag{20}$$

Through confirmatory factor analysis, it can be concluded whether the consumer behavior has a certain degree of convergence validity.

2.3 E-Commerce Precision Marketing Methods

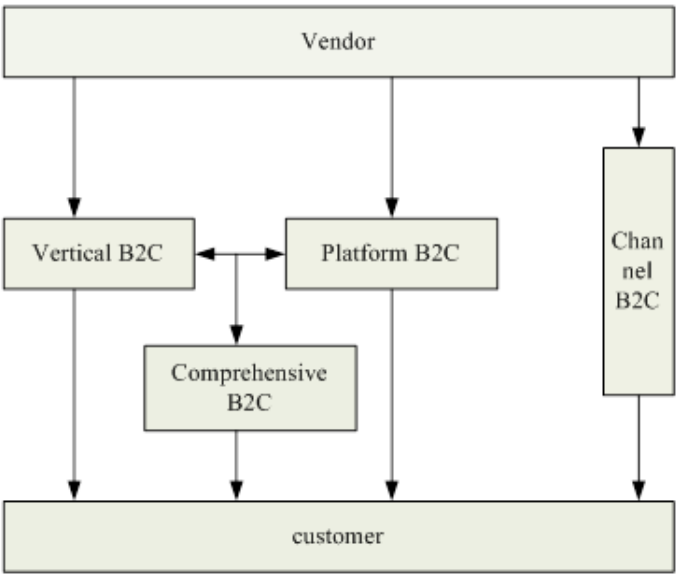
2.3.1 E-Commerce

E-commerce usually refers to a wide range of business activities and various trade activities carried out around the world based on the application method of the browser/server in the open network environment of the Internet. Through online shopping, merchant online transactions and online electronic payments, as well as a variety of business activities, transaction activities, financial activities and related comprehensive service activities of a new type of business operation model. The three most common e-commerce models in e-commerce are B2B, B2C and C2C. Here, we will focus on the development of B2C. As shown in Figure 6.

2.3.2 Precision Marketing Methods

Precision marketing is not a new marketing concept at all. With the rapid development of information technology, market patterns, people's consumer behaviors, and consumer concepts have undergone great changes, resulting in a new marketing environment and promoting the development of marketing techniques, marketing channels. Traditional marketing theories continue to evolve and develop. Research on precision marketing by foreign scholars mainly focuses on the following points: the meaning, rules, advantages, content and trends of precision marketing. He first put forward the principles of applied marketing, that is, the right customers, the right information, the right channels, and the right time. Delivering the right information to the right customers through the right channels will really have an impact. Promote the effective achievement of target customers' purchasing decisions and marketing goals. Several characteristics of publicity marketing are obvious. The first is to accurately identify the market, the second is to rely on technological means, the third is to provide personalized services, and the fourth is to improve the accuracy of marketing. Although the definition of precision marketing is still uncertain, it does not hinder the development and popularization of

Figure 6. B2C development model diagram



precision marketing ideas and methods. With the popularization of the Internet, online marketing has an advantage. Now, Internet-based marketing is attracting attention. New research results in online marketing continue to emerge. Precision marketing has been widely promoted in emerging industries on the Internet, and has gradually been applied to traditional industries. Category management refers to the company's brand management based on product categories. As a pioneer in brand management, Procter & Gamble, like many other first-class companies, has begun to adopt category management. So this article analyzes the categories of the merchants.

After understanding the precision marketing theory, this article summarizes its characteristics, including four.

First, the rationality of the target audience. The first feature of online pre order marketing is the target buying group. The previous advertising activities popular in sales and network also carried out market segmentation and positioning. However, there are many things that have no effect from various restrictions such as previous publicity media and technical conditions. However, in online pre-defined marketing, using sufficient relevant database information, using current Internet technology, accurately evaluating and estimating the actions of expected buyers, and using appropriate channels can provide necessary services and products for target audiences.

Second, cost economics. In economics, buying groups must make decisions quickly and accurately. Use the filtering and selection of customer information on the network to achieve more accurate positioning, so as to reduce costs and find target buyers more accurately.

Third, the controllability of the effect. In addition to the shortcomings of simple traditional publicity mode and one-way publicity, we can also enrich the information content, let the consumer group deeply understand the content of interest, and let enterprises master the feedback data of target consumers and group them in time. Accurate online sales communication is generally reflected in the following aspects: first, the sender and audience of information can first start to communicate on both sides; second, it can plan and design according to customer requirements, especially for customers; third, publicity and consumer feedback can be transmitted at the same time. Feedback materials from the consumer group can be obtained first, and good oral publicity can be used to guide consumers' impression and consumption.

Fourth, dynamic precision. Online pre-defined marketing is a phased and correct process for each link. The online prestressing market is in the initial stage of regional publicity, the stage of publicity based on consumers' preferences, and the later stage has passed the current period. Based on the action and correspondence of the latest information technology and data analysis of Internet audiences, the detailed investigation and estimation of buyers' needs, as well as the needs of buyers as the basis for further publicity. Accuracy is also a phased process, and its accuracy is not absolute. It is a certain change. The process continues. It is more accurate now than before and will be more accurate in the future.

2.3.3 Implementation Methods of Precision Marketing

The communication method of precision marketing is similar to the commonly used marketing communication methods, but there are email camps, email marketing, direct return ads, telephone calls, text messages, search engine marketing, search engine optimization, social marketing, etc. However, these marketing activities are based on a thorough investigation and analysis of customers and the market, and a clear control of the equipment in all aspects of sales in order to achieve low-cost expansion.

Email marketing mainly refers to license marketing. Compared with marketing without a license, license marketing has obvious advantages. For example, it can alleviate the trouble of user advertising, improve the accuracy of potential customer positioning, strengthen the relationship with customers, and increase brand loyalty. It is a marketing method using the registered user information of the website. The general forms are news mail, member exchanges, electronic publications, etc.

Direct feedback advertising is an improvement of the previous mass advertising. The core of the design is the design of activity incentives. The principle is to make the right target group interested in advertising. Design activities that are of interest to the people in this group. The purpose is to achieve the following one-to-one communication. Activity rewards refer to things that specific customers are interested in, including more consumer psychology surveys and purchasing behavior surveys.

Search engine marketing and search engine optimization are important methods of e-commerce network promotion, mainly through keyword advertising in search engines, keyword bidding rankings, search engine positioning advertising and optimizing advertising click effects, etc., in order to improve the website or its The purpose of product ranking in search engines must focus on the search habits of target users, research on common keywords in user searches, and summarize the ranking rules of search engines to reasonably optimize the website so that the website can be on Baidu or etc. The ranking of search results in search engines is improved, thereby effectively increasing website visits, ultimately increasing website transaction volume, and expanding the purpose of product and brand promotion.

Precision marketing breaks through the previous framework marketing organizational structure and channel restrictions. A comprehensive and reliable logistics circulation and settlement system is required. Convenient and fast logistics circulation system and reliable settlement system are the two main factors restricting pre-marketing. The call center is the main channel for customer personality communication. It is a one-to-one communication platform established with customers through network technology and telephone. Its main function is to process customer orders to answer customer questions and maintain customer relationships through customer care. According to consumer surveys, the most important reasons hindering online shopping are unpleasant shopping experience, insufficient social communication, and lack of one-on-one discussions with customer service personnel. Through promotion and marketing, users' shopping experience can be improved, customer participation can be improved, and one-to-one customer service effects can be achieved.

2.3.4 Establishment of Customer Database

In marketing, in order to better communicate with customers in two ways, carefully select target customer groups, systematically collect individual data of target customers, and then form a target customer database is very important. From the decision to establish the customer database to the

beginning of the marketing of the enterprise, there are roughly six stages. They are: the company decides to establish a customer database, collect customer information from various channels, fill in customer information cards, organize and filter information, form a customer data database, and use customer database information flexibly. With the increase of customer data, companies need to continuously filter and remove spam from customer database systems. At the same time, companies need to continue to expand the database to store more customer information.

3. E-COMMERCE PRECISION MARKETING METHOD BASED ON IOT CLUSTERING ALGORITHM AND EXPERIMENTAL DESIGN OF CONSUMER BEHAVIOR

3.1 E-Commerce Precision Marketing Design

The database is "a warehouse that organizes, stores and manages data according to the data structure". It is a collection of organized, shareable, and unified management of large amounts of data stored in the computer for a long time. So, this article designs a database of marketing design. This experiment takes a large e-commerce company as an example. The company's main product is coffee. In order to establish a better marketing effect and establish a more precise marketing method, its company's major e-commerce platforms Statistics on the monthly sales data and the growth of store members will be conducted. Finally, the analysis and judgment will be conducted based on the statistical results to guide the construction of the company's precise marketing strategy. Table 1 and Table 2 below are

Table 1. Monthly sales volume of each store

	One branch	Second branch	Three branch	Four branch	Five branches
Jan.	1268	2665	3135	1351	2513
Feb.	1354	2985	3929	1916	2649
Mar.	2612	2464	2516	1645	1948
Apr.	3516	3456	3984	2647	3546
May	2165	3676	4261	2956	2648
Jun.	1566	2456	3196	2544	3461
Jul.	3123	3574	3414	2453	1954
Aug.	2651	2834	5423	1944	2652
Sep.	3561	4853	4034	2675	1051
Oct.	1612	3561	3464	1566	2941
Nov.	4654	3843	5464	3568	3826
Dec.	3516	5631	5641	3215	1205

Table 2. Quarterly membership changes in stores

	One branch	Second branch	Three branch	Four branch	Five branches
The first quarter	2601	3651	3002	1003	1300
Second quarter	3642	2513	3521	2503	2512
third quater	2130	3560	4560	1360	3201
Fourth quarter	3560	4500	5120	3012	2100

the monthly sales volume data table and the quarterly membership change table of the company's five stores with large transaction volume.

Table 3 shows the sales of each product in the company's first branch.

3.2 Consumer Behavior Model Design

In addition to the sales analysis of the company's stores, it also investigated the consumption status of the company's store members. Through the consumption of store members, more accurate product supply planning and maintenance and more branch marketing activities were implemented. Table 4 below shows the quarterly revenue of the company's five major branches.

Table 5 shows the consumption status of members in the five major branches in each quarter, as shown in Table 5.

Table 3. Sales of various commodities

	Coffee	Milk	Drinks	Bread	Chocolate
Jan.	1268	2634	2360	2568	3256
Feb.	1354	3654	2987	3684	3698
Mar.	2612	3215	2268	2541	2485
Apr.	3516	2564	2541	3985	2369
May	2165	2551	1895	1256	1025
Jun.	1566	1289	2566	2501	2015
Jul.	3123	1965	1087	1098	1198
Aug.	2651	2564	1598	2241	1895
Sep.	3561	2698	2894	3560	3356
Oct.	1612	2984	3541	3981	2510
Nov.	4654	3059	1562	2503	3564
Dec.	3516	2018	2513	3068	2987

Table 4. Revenue of major branches in each quarter

	One branch	Second branch	Three branch	Four branch	Five branches
The first quarter	69521	89621	156030	95610	163510
Second quarter	71203	92813	169201	163210	95816
Third quarter	98501	130250	262165	156001	120351
Fourth quarter	123604	168201	361650	226000	150360

Table 5. Consumption table of branch members in each quarter

	One branch	Second branch	Three branch	Four branch	Five branches
The first quarter	45021	65196	135160	81649	103210
Second quarter	62151	81645	145101	136151	65503
third quarter	69130	92516	200000	121651	92654
Fourth quarter	78203	102513	253873	160516	65516

3.3 Clustered Marketing Volume and Consumption Behavior Analysis and Design

The company's data analysts analyzed the marketing economy and membership data of the company's five major branches through sales data and consumer consumption, and then made a series of adjustments to the marketing activities of these stores through rankings. Table 6 shows the marketing economy and membership data rankings of the five major branches.

4. CLUSTER-BASED PRECISION MARKETING METHODS AND CONSUMER BEHAVIOR ANALYSIS

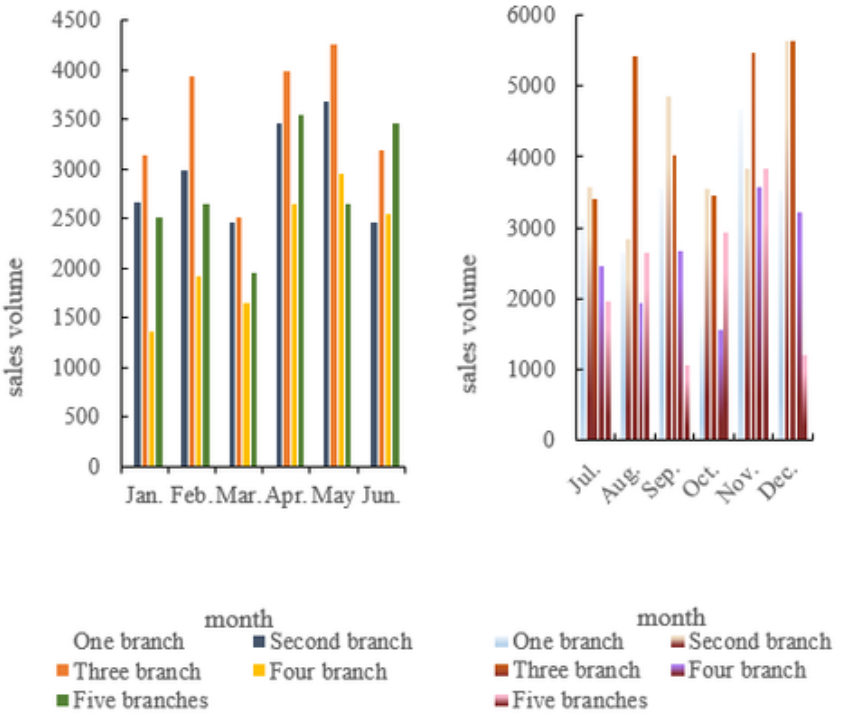
4.1 E-Commerce Precision Marketing Methods

From Table 1 in the experimental part, we can get the company's total sales volume in a year. We divide it into two parts for analysis, namely the first half of the year and the second half of the year. The specific result analysis is shown in Figure 7.

Table 6. Statistics of marketing economy volume and member consumption ranking

	First	Second	Third	Fourth	Fifth
Marketing volume	Three branch	Four branch	Five branches	Second branch	One branch
Member consumption	Three branch	Four branch	Second branch	Five branches	One branch

Figure 7. Comparison of the company's marketing volume in the first and second half of the year



From Figure 7 we can see that the sales volume of the company's five major branches was unstable in the second half of the year, except for the fifth branch. The other four branches all showed a sales growth of 9.2% in the second half of the year. In order to analyze whether the increase in sales volume is related to the number of store members, a statistical analysis was made on the overall changes and sales of the company's members. The statistical results are shown in Figure 8.

From Figure 8 we can see that as the number of member changes, the overall marketing volume of the store is also constantly changing. The general rule of change is that as the number of members increases, the sales of the store also increase, and vice versa.

4.2 Consumer Behavior Analysis

The influence of consumer behavior on the store is very important. Therefore, based on the data obtained from the above experiment and some other data, we have drawn a consumer behavior diagram of consumers buying coffee products, as shown in Figure 9.

From Figure 9 we know that consumers who bought coffee consumed more in June, July, August, November and December, but from the perspective of the company's marketing economy, the company's main revenue still depends on the fourth quarter. By integrating the data in Figure 9 and combining the single-factor variance in the formula in the above method and the structural equation model for calculation, relevant consumer behavior can be predicted and analyzed. The sales volume accounted for more than 28.6%. The company's sales volume in the summer was obviously underperforming, and it did not gain market advantage.

4.3 Marketing Situation Based on Improved Clustering Algorithm

After statistical analysis of a large amount of data, through the improved precision marketing method based on the clustering algorithm, the following results are obtained, as shown in Figure 10.

Figure 8. Analysis of sales volume and membership growth

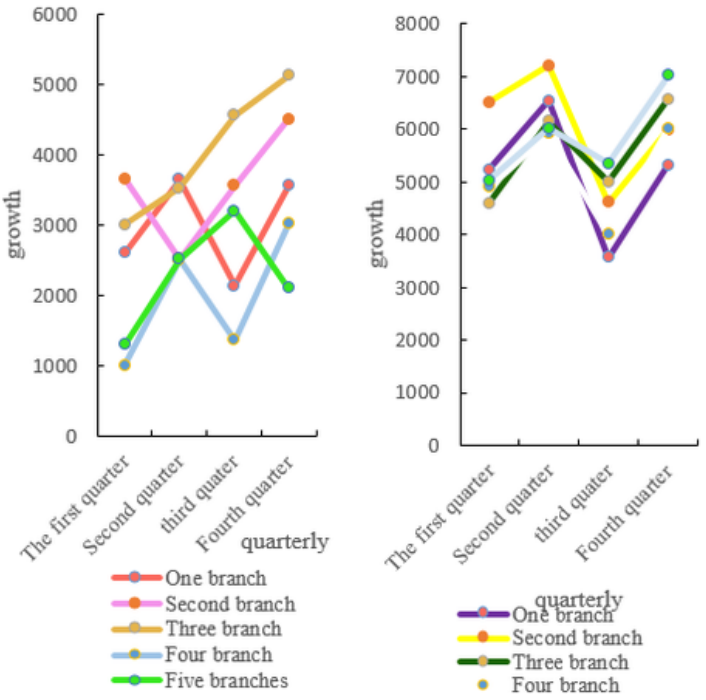


Figure 9. Consumer buying situation graph

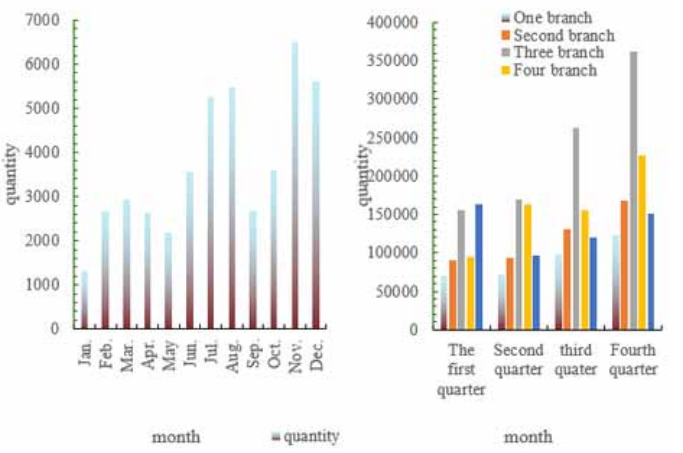
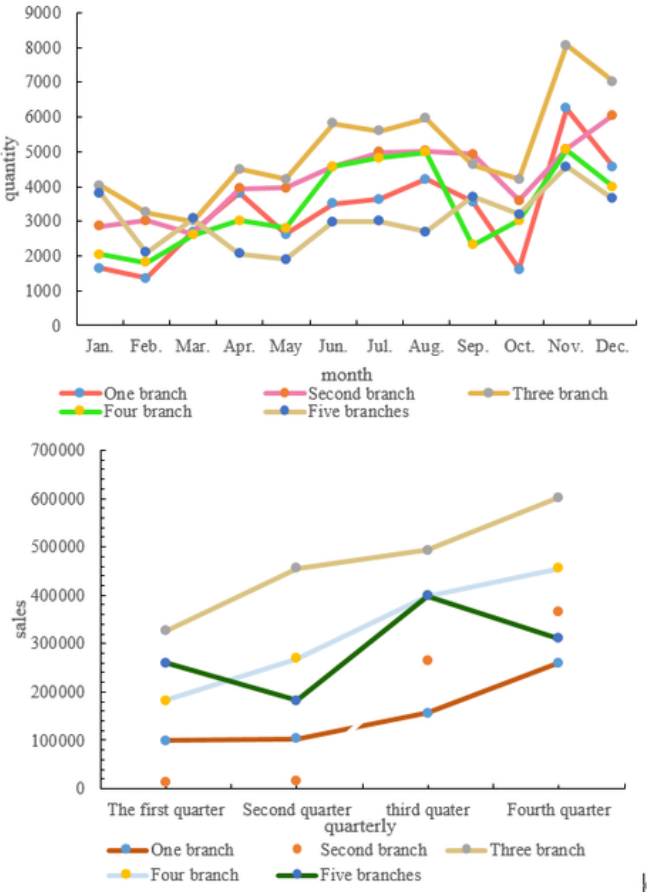


Figure 10. The improved marketing situation



It can be seen from Figure 10 that the improved marketing plan not only increased the company's sales in June, July, and August by more than 9.8%, but also increased the original total sales by 18.6%. The use of precision marketing strategies based on clustering algorithms has promoted the expansion and development of the company's business.

5. CONCLUSION

Based on the in-depth analysis of the research of relevant experts and scholars, this paper expounds the precision marketing theory and introduces the current situation of e-commerce, and summarizes the precision marketing strategies of e-commerce companies based on the clustering algorithm. By taking an e-commerce company as a case, analyzed its successful precision marketing strategy and its further improvement, and obtained the influence of e-commerce precision marketing strategy combined with clustering algorithm and consumer behavior on the company's product sales and sales. For example, in the case of an e-commerce company in this case, the company's product sales in June, July, and August were obviously insufficient when it had not formulated a precise marketing model and consumer behavior model in the early stage. After improvement, the company's overall sales have been increased by 18.6%.

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