



Research on a new retail business model of energy e-commerce based on clustering analysis

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Abstract. After the Internet has gradually entered the era of big data, our lives have gradually entered the information age, which has changed and reshaped the behavior of enterprises and consumers. In this paper, a user portrait clustering model based on big data is proposed to implement business model design for specific groups after clustering, target potential user groups for active marketing, and promote actual purchase behavior. The research results provide a certain reference for precision marketing of relevant industries and enterprises.

Keywords: big data, user portrait, business model, precision marketing

1 Introduction

At present, the research focus of e-commerce new retail is mainly on the application of high-tech, improving customer experience and timely meeting customer needs [1]. Information technology including big data, virtual reality and artificial intelligence will reshape the pattern and future of new retail. Academics believe that the focus of new retail lies in channel integration, the application of mobile technology, the role of social media, the response to customers' diverse needs, the balance between individuality and privacy, and supply chain design [2]. The results show that online channels can significantly improve individual industry sales, cost, inventory and ROI. At the same time, the coordinated development of online and offline retail channels will have a positive impact on enterprises, rather than conflict [3]. In terms of satisfying customers' needs, the study found that enterprises should provide customers with unique value, which will make them remember, and a good shopping environment will greatly attract customers.

The two key problems facing the new retail are to build a retail platform that can enable the in-depth integration of multiple online and offline channels, and the support of high-tech and new technologies for the retail industry, highlighting the role of big data [4]. Some scholars have emphasized the integration of online and offline, the role of big data and high-tech in new retail and the impact of supply chain management [5].

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The development and utilization of big data and data mining play a crucial role in the development of new business models and formats [6]. The continuous maturity of Internet technology provides technical support for the development of new retail, making e-commerce and physical stores no longer separate from each other but develop in coordination, opening a new pattern of zero-operation. New retail is in the new normal of constant change, mainly manifested by the deep integration of online and offline with logistics, as well as the comprehensive support of big data to the retail process [7]. The development of new retail is still to explore the essence of retail, and to meet consumer needs more comprehensively with new technologies, new logistics and multiple channels. The above scholars emphasized the role of science and technology in promoting new retail, and emphasized the application of big data, cloud computing and information and communication technology in new retail.

2 Analysis of the relationship between user portrait definition and business model

Environment at present, large data system can collect and analysis the basic attributes of consumer (age, gender, address), preferences (often purchase category, shopping preferences, etc.), consumer characteristics (high consumption, loyalty, channels, etc.), asset characteristics (hierarchy have house, car, assets, etc.), such as tag data, and constantly improve the description of the user's portrait, Describe the user portrait system that can meet the needs of multiple scenes, and then analyze and mine users through various channels through the application of big data technology system. At the same time, user behaviors and characteristics are constantly changing. According to label attributes, there are slowly changing labels and rapidly changing labels. Therefore, enterprises need to update and adjust user portraits in real time to meet the changing business requirements of users. Therefore, a good data base can better analyze users and mine their behavioral preferences and potential needs.

To sum up, user portrait is the virtual image of consumers. Label collection of various user characteristics obtained through big data provides sufficient data basis for further accurate and rapid analysis of user consumption. The key of big data marketing is user portrait, and the key of user portrait is label. The analysis of specific groups after clustering is carried out to locate potential user groups for active marketing and actual purchase behavior. After or during the implementation of a precise marketing strategy, an enterprise can also check the effectiveness of its marketing through consumer interactions, consumer evaluations, and other data, and feed these results back into the user Profile database to improve its business model strategy.

3 User portrait model construction based on user big data

Clustering analysis is extracted from the target key factor, classifying similarity factor combination, are mainly used for analyzing the sales data, its purpose is through constructing classification model, to determine the customer's interest and the propensity

to consume, then divide the data into a given category, thus concluded that the next step of consumer behavior, consumer K-means algorithm model as shown below:

1. A random sample $E = \{E_1, E_2, E_3, \dots, E_{24}\}$ is selected as the first clustering center;
2. Calculate the shortest distance between each sample and the existing cluster center. The larger the distance, the greater the probability of being selected as the cluster center. General similarity measurement methods include Euclidean distance, cosine Angle, Mahalanobis distance, information entropy and other methods. Cosine Angle is selected to measure, and the formula is as follows:

$$\cos \theta = \frac{m_i^{p'} m_j^{p'} + m_i^{v'} m_j^{v'}}{\sqrt{(m_i^{p'})^2 + (m_i^{v'})^2} \sqrt{(m_j^{p'})^2 + (m_j^{v'})^2}}. \tag{1}$$

3. Repeat (2) until the K -th cluster center C_k is selected to form the initial cluster set, and these three types of sets are defined as Q_ζ , according to $E_i \in Q_\zeta$, denoted as $E_i^{(\zeta)}$. In addition, the sample mean of each set is used as the new clustering center Q_ζ^{new} , namely:

$$Q_\zeta^{new} = \frac{1}{n_\zeta} \sum_{k=1}^{n_\zeta} E_i^{(\zeta)}. \tag{2}$$

4. Then, divide each sample point into the cluster represented by the nearest cluster center point;
5. The center points of all sample points in each cluster represent the center points of the cluster;
6. Repeat (4) and (5), re-measure the similarity of each sample, and repeat the cycle until the termination condition is met. Define the sum of squares of error as the termination function, namely:

$$T_{end}(I) = \sum_{\zeta=1}^3 \sum_{k=1}^{n_j} \left\| E_i^{(\zeta)} - S_\zeta(I) \right\|^2, \tag{3}$$

where n_j is the number of samples contained in the cluster set j . When the difference of two adjacent error function values satisfies the given precision, the clustering ends.

4 Business model selection scheme for C-end users based on user consumption preference

Based on the user portrait method, the user portrait is refined from the micro point of view, and the user type is further subdivided, so as to provide a choice scheme for the accurate business model selection of energy e-commerce.

4.1 User portrait research scheme design

In order to better observe, record and quantify consumers' purchasing behavior and achieve consumer psychological insight, this paper adopts the form of questionnaire to collect behavioral data. In order to ensure the scientific design of the questionnaire, the expert opinion method was adopted to collect the opinions of e-commerce personnel, and the content of the questionnaire was revised repeatedly. The final questionnaire design included the basic information, transaction information and preference information of consumers, namely the specific information of products purchased by consumers.

4.2 Cluster analysis results based on k-means method

K value is an important factor affecting the degree of clustering. It can be seen from Figure 2 that, with the increase of K value, the clustering effect will be more detailed and more conducive to the detailed division of users. However, if users are classified too much, more labels need to be marked on users, which may bring inconvenience in the subsequent work. Therefore, it is necessary to select a reasonable K value to classify users on the premise of ensuring sufficient subdivision of data. Here, the sum of squares of errors within clusters (SSE) is needed to select K values. Figure 1 shows the SSE- K curve from 0 to 20 for K values. The abscissa represents the value of K , and the ordinate represents the value of the sum of squares of errors within the cluster (SSE).

As can be seen, with the increase of K value, the sum of squares of errors in the cluster presents a downward trend. When K value is less than 4, SSE decreases rapidly; when K value is 4, SSE decreases slowly. Therefore, K value is 4.

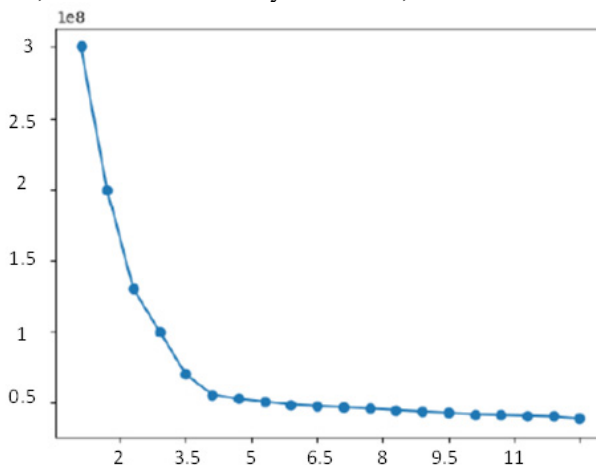


Fig. 1. The trend of sum of squares of errors in clusters

4.3 Presentation of user portrait Results

When K value is set to 4, 4 central points can be selected. With price, emotion, demand and attachment as the central points, coordinates of each central point are analyzed and crowd characteristic information is marked to carry out user portraits, a label system is constructed and group portraits are classified. The results are shown in Figure 2.

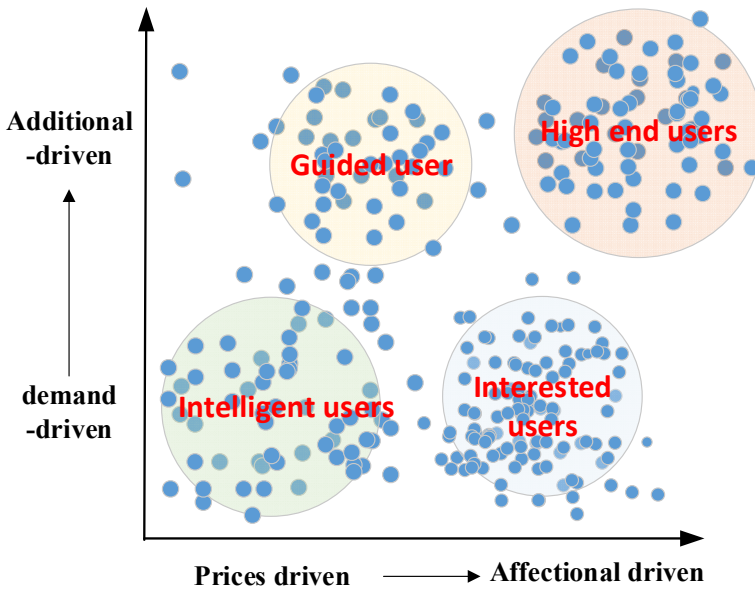


Fig. 2. User portrait result display.

The more to the right of the x-coordinate means that the user's purchase of products is less restricted by the price of products, that is, the price of products has less influence on the user's purchase of such products, and users are more concerned about their own interests and satisfaction of value; the higher the y-coordinate means that the user is more concerned about the added value of products when purchasing products. That is, users gradually increase their concern and demand for added value in addition to focusing on the most basic functions of the product itself. Based on Figure 2, according to the clustering results and specific behavioral characteristics of multiple consumer samples covered by this type, feature description is carried out for each type of consumer. The specific feature description of the four typical types is shown in Table 1.

Table 1. Description of user types

type	Consumption behavior	Income level	Product features
Intelligent users	pay attention to product function, material and specific use method	Income levels are low	Cost-effective, practical

Guided user	The mass consumption mode will pay attention to the consumption of others their own	Have a certain economic level	"Best-selling" sign, pay attention to whether the product is popular
Interested users	Habit type, purchase on payment, will place orders for their own interests	Have a certain economic level	attention to whether goods meet their interests and hobbies
High value users	High quality, high quality	High income level	performance, comfort and their own interests

5 Business model selection scheme based on user portrait

5.1 Business model scheme for intelligent users

Based on the study of user picture, we can see that cerebral users, because of the influence of income level, in the process of consumption in the process of choose and buy the products pay more attention to the product price, therefore, cerebral users against design in the process of business model, on the one hand, should pay attention to recommend a high cost performance, good and inexpensive products, on the other hand provide appropriate for promotional activities, Improve the rational users' desire to buy, among which, the common promotion methods include display, discount, buy gift, lucky draw, bundling sales, etc., and different promotion methods have obvious different effects.

5.2 Business model scheme for high-end users

Based on the study of user's portrait, it can be seen that the high-end users, more attention to the added value of products in the process of consumption, the pursuit of their own, therefore, cerebral users against design in the process of business model, on the one hand, should attach importance to the promotion of comfort products, high-end smart products, high-quality energy-saving high-end products, on the other hand provide customized products and services, According to the needs of users, to carry out differentiated marketing.

5.3 Business model scheme for interested and guided users

Based on the study of user portraits, it can be seen that interested and guided users have certain similarities in the consumption process. Both of them have certain consumption power and are affected by their own interests. Therefore, in the process of designing business models for interested and guided users, attention should be paid to the recommendation of personalized products. Two common recommended methods are as follows:

- (1) User-based collaborative filtering recommendation

User-based collaborative filtering analyzes user-to-user behavior. If a user has already purchased or likes a product, it can be inferred that users with similar attributes will also like the product. The company can classify products or services according to the interest labels of all users in the system, and then find out user groups with similar attributes to the specified users, and recommend products or services that these user groups like.

(2) Product-based collaborative filtering recommendation

Product-based collaborative filtering is a system that first classifies products by their attributes, and then forms a prediction that users once liked a product and will now like similar products.

6 Conclusion

This paper adopts the user portrait method and puts forward the k-means clustering model of e-commerce users. Will C end users are divided into cerebral users, high-end users, interests, and guide users, using the theory of time and the users are divided into high value, low value users and ordinary users, and according to different user types differentiated business model is designed, provides a typical business model based on energy electricity consumption preference options, It provides reference for the orderly development of energy e-commerce.

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