

## Research on Precision Marketing Algorithm of Agricultural e-Commerce Based on Association Rule Mining

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### **Abstract**

*With the rapid development and maturity of big data and artificial intelligence technology, the field of e-commerce is also facing new development opportunities and challenges. How to push suitable products to customers more intelligently, accurately and effectively has become one of the core competitiveness that major e-commerce sellers are striving to improve. It is necessary to build a safer, more convenient and more efficient e-commerce marketing platform for agricultural products on the basis of studying the advantages of big data technology and according to the current situation of e-commerce marketing platform construction for agricultural products in China. As an innovation different from the traditional marketing model, e-commerce has its outstanding advantages. E-commerce enterprises are faced with massive commodities and diversified customer demands, and there is still a lack of intelligent and effective methods and tools in product correlation recommendation. In this paper, the association rule mining technology is applied to the actual precision marketing of agricultural products, and the multi-dimensional association rule set is constructed by using the association rule mining algorithm to mine and analyze agricultural products and precision marketing of agricultural products.*

**Keywords:** Mining association rules, Agricultural products, Precision marketing

### **I . Introduction**

As China's economic development enters the new normal, although China's overall economic growth rate slows down, at this stage, China's Internet based industry and some other emerging industries are developing rapidly and expanding rapidly [1]. At present, these emerging industries have gradually grown into one of the important driving forces for China's development. At present, with the development of e-commerce, the new transaction mode based on technological innovation is forming a powerful force to promote the reform of the whole circulation industry [2]. The supply of agricultural products has changed from a large shortage to a basic balance between supply and demand. Therefore, China's agricultural product marketing market has also undergone earth shaking changes, mainly reflected in the greatly increased binding force of the market on agricultural products [3]. The seller's market of agricultural products has become a buyer's market. Strengthening the e-commerce marketing innovation mechanism of Chinese agricultural products has become increasingly important. The development of e-commerce marketing of agricultural products has significantly promoted the expansion of consumption and the development of service industry, and effectively promoted the transformation and upgrading of agricultural product processing enterprises [4]. In order to realize agricultural modernization, occupy market share and develop agricultural economy, we must develop the e-commerce marketing mode of agricultural products, continuously improve the sales process and production process through the highly information platform of the Internet, and fully integrate modern elements into all links of agricultural products trading [5].

E-commerce enterprises still lack intelligent and effective methods and tools for commodity Association recommendation in the face of a large number of commodities and diversified customer needs. Although some enterprises have recommended associated commodities for enterprises with the help of association rules, they lack accuracy due to their failure to consider customer labels [6]. As an important link in the development of e-commerce for agricultural products, marketing has made full use of the advantages of the Internet in the development of e-commerce for agricultural products, promoted the upgrading and rapid development of e-commerce for agricultural

products, and improved the competitiveness of China's agriculture in the market [7]. The essence of the difficulty in selling agricultural products is the problem of information asymmetry, that is, the contradiction between small farmers and the big market. The asymmetric information of agricultural products market and the imperfect commodity circulation system in rural market have led to the structural, seasonal and regional surplus of agricultural products [8]. In practice, prominent problems such as low degree of data sharing, low degree of technology utilization and difficult guarantee of information security also restrict the integrated development of big data technology and e-commerce marketing platform for agricultural products to a certain extent [9]. How to push appropriate products to customers more intelligently, accurately and effectively has become one of the core competitiveness of major e-commerce sellers. This paper applies the association rule mining technology to the actual precision marketing of agricultural products, excavates and analyzes agricultural products and agricultural product marketing, and provides guidance for the operation and decision-making of agricultural products enterprises.

## **II. Effect of Big Data on e-Commerce of Agricultural Products**

### ***A. Guide Agricultural Production***

Under the trend of modernization, agricultural production is different from the past. First of all, because of the role of big data, it is no longer dependent on the weather to eat in the process of agricultural product production, and all kinds of data can be easily collected and summarized. This data method has also improved agricultural planting skills to some extent, increased the enthusiasm of farmers in production and sales, and transformed the self-sufficiency model into export sales. The application system of big data technology, which mainly consists of super-scale data collection, processing, analysis and application, can effectively solve the above problems, and effectively help the operators of agricultural products e-commerce platform to carry out precise marketing through the technical analysis results. There is a big difference in the amount of information held by the main body of agricultural product market transactions. Compared with individual farmers or small-scale agricultural organizations, some large enterprises have many channels, wide range and short time lag to hold market information and national policies, which makes the information asymmetry in agricultural product market transactions increasingly prominent [10]. Big data brings not only information but also modern products. Agricultural production no longer relies on traditional artificial breeding. For example, for planting industry, we can know the current advanced planting machinery and harvesting equipment through big data, which reduces the labor cycle of agricultural production and improves production efficiency. E-commerce marketing platforms for agricultural products are equipped with online communication modules, which not only promote the communication between consumers and sellers, but also generate original data related to consumers' preference for purchasing agricultural products after ordering.

### ***B. Guide the Circulation of Agricultural Products***

The core purpose of e-commerce marketing platform for agricultural products is to make agricultural products more freely circulate and trade. With the support of big data, this circulation will become simpler. With the support of big data technology, online order processing and offline logistics distribution can be established through effective data model, and the best distribution scheme can be designed for platform operators' reference [11]. This not only greatly saves the time cost and human resource cost of agricultural product marketing platform, but also significantly improves the overall efficiency of precision marketing. Under the background of big data, the e-commerce marketing platform for agricultural products has been slowly changing the traditional trading mode of agricultural products in China. With the integration of agricultural products, big data and e-commerce, its production and consumption system is already in the process of restructuring. Through e-commerce marketing of agricultural products, farmers and agriculture-related enterprises can be provided with all-round market supply and demand information. Farmers and agriculture-related enterprises can analyze the market agriculture-related situation according to the market information of agricultural products obtained through the network, and form correct planting, processing, inventory and sales decisions. Agricultural products, as physical products, must realize the effective

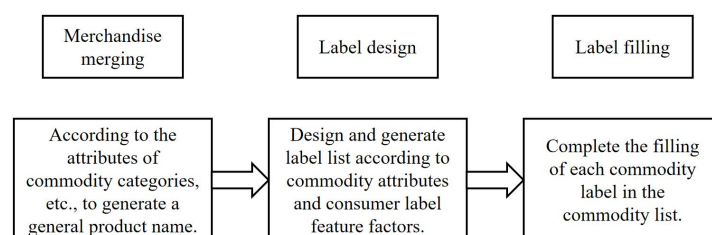
connection between online order processing and offline logistics distribution in the process of completing e-commerce marketing, so as to promote the efficient implementation of the whole process.

### III. Precision Marketing of Agricultural Products Based on Association Rule Mining

#### A. Combined Application of Commodity Labeling and Association Rules

According to the characteristic factors of consumers' labels, enterprises design commodity labels in different dimensions. The design of commodity labels needs to combine customer demand, and select the dimension that has a great influence on consumers as the item of commodity labels. If customer demand changes greatly, the commodity labels also need to be updated accordingly. More detailed and accurate positioning of agricultural products market is the key to accurate marketing of agricultural products e-commerce. Therefore, in the implementation of precision marketing, it is first necessary to classify agricultural products in detail, and then accurately locate the target according to the market demand. First of all, e-commerce operators of agricultural products can classify different agricultural products according to their profit and quality. The design of label items also needs to match with the customer information database, which can identify the corresponding dimensions from the customer information database, such as consumption level, customer age and other labels. If the product label designed by the enterprise cannot be extracted from the customer database or customer access information, then this dimension design will lack practicality. Due to the fixed and limited marketing volume of products, single agricultural products will lead to fierce homogenization competition in the same region. Secondly, there are also deficiencies in the quality supervision of agricultural products, loopholes and insufficient attention to the branding of characteristic rural areas.

Commodity labeling refers to the process of marking commodities according to their attribute characteristics and customer label characteristics, and realizes the organic combination of commodity labels and visitor labels through marking in different label dimensions. The process is shown in Figure 1.



*Fig.1 Product Labeling Process*

Operators of e-commerce of agricultural products can make full use of the advantages of the Internet to obtain more timely and effective market information data, and build a database based on these data to deeply analyze the demand of consumers in the agricultural products market, other competitors and other potential factors, so as to locate market targets and work out effective marketing schemes. Most agricultural products have a production and sales period. From production to consumption, middlemen master many circulation links. If they maliciously adjust the information at both ends of supply and demand and control the information circulation channels through bad technical means, agricultural producers will be relatively passive in passive sales. Due to the complexity and variety of agricultural products, and consumers do not have the corresponding discriminating ability, therefore, operators can convey the quality information of agricultural products to consumers by positioning different agricultural products prices [12]. The extensive application of data mining and data analysis is changing the marketing environment of agricultural products every day. Consumers will no longer passively accept consumption choices as in the past. Marketers can collect basic information more comprehensively, with low cost and high efficiency through data mining and data analysis technology, and analyze the likes and preferences of the majority of

marketing objects in real time, so as to improve the service ability and quality of precision marketing of agricultural products.

### B. Precision Marketing Model of Agricultural Products

Because most agricultural products have a production and sales deadline, middlemen master many circulation links from production to consumption. If they maliciously adjust the information on both sides of supply and demand, and control the information circulation channels through bad technical means, it will lead to the agricultural producers being relatively passive in passive sales, and the information asymmetry between production and sales. Coupled with the increasing cost of circulation links, it will probably directly lead to the unsalable agricultural products, bring serious harm, disrupt the agricultural economic order, and greatly damage the interests of agricultural products consumers and agricultural producers. The technical flow of data mining in precision marketing of agricultural products is shown in Figure 2.

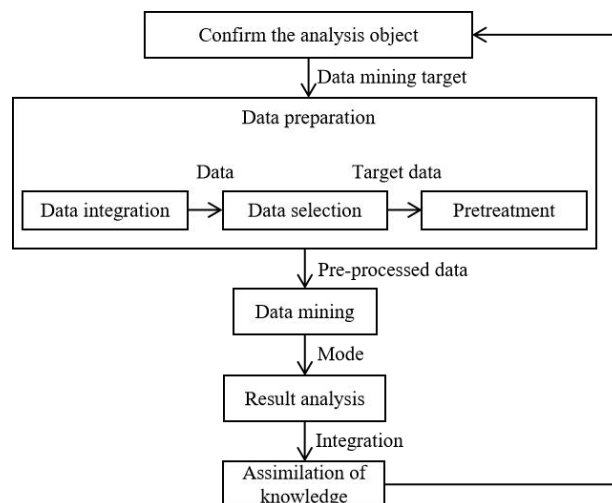


Fig.2 Data Mining Technology Process in Precision Marketing of Agricultural Products

Assume that the index value is  $x_1, x_2, \dots, x_n$  in turn. Each  $x_i$  is a p-dimensional vector. Suppose a certain class

$G_{ij}$  is  $\{x_i, x_{i+1}, \dots, x_j\}$ , and  $j \geq i$  defines its mean vector as:

$$\bar{x}_{ij} = \frac{1}{j-i+1} \sum_{l=i}^j x_l \quad (1)$$

The total difference between the index values within the category is defined as the diameter of the category. Since the most commonly used quantitative indicator to represent the total difference between index values is the sum of squared deviations, the commonly used diameter is the sum of squared deviations within the class, and  $D(i, j)$  is used to represent the diameter of  $G_{ij}$ , which is defined as:

$$D(i, j) = \sum_{l=i}^j (x_l - \bar{x}_{ij})^T (x_l - \bar{x}_{ij}) \quad (2)$$

Divide n ordered index values into k categories, and set a certain classification method as:

$$p(n, k) : \{x_{i_1}, \dots, x_{i_2-1}\}, \{x_{i_2}, \dots, x_{i_3-1}\}, \dots, \{x_{i_k}, \dots, x_n\} \quad (3)$$

Among them, the sub-point  $1 = i_1 < i_2 < \dots < i_k < i_{k+1} = n$  defines the error function of this classification, that is, the objective function is the sum of squares of the total deviation within the class:

$$e[p(n, k)] = \sum_{j=1}^k D(i_j, i_{j+1} - 1) \quad (4)$$

Theoretically, it can be proved that the so-called most significant division is a division method  $e[p(n, k)]$  when the minimum value is reached. As for the determination of the classification number  $k$ , you can draw a graph of the relationship between  $e[p(n, k)]$  and  $k$ , and the  $k$  value at the corner of the curve is the optimal classification number.

Whether the information is smooth or not largely determines the size of the marketing market of agricultural products, while China's rural areas are restricted by hardware and other factors, and are inherently weak in sales. However, depending on the advantages of the network, we can form a marketing network for agricultural products, use mobile terminals to carry out sales activities, and especially launch customized services for agricultural products marketing. Association rule technology plays a very important role in the field of data mining at present, and it is also increasingly applied to the research of agricultural products e-commerce. Its core idea is to extract useful data from huge amounts of data, tap potential information, analyze rules, classify these rules according to different applications, and guide the arrangement of e-commerce commodity sales methods. It is necessary to speed up the establishment of agricultural product logistics centers suitable for the actual situation in rural areas of China, so as to know the information of agricultural product market in a timely and comprehensive manner, and then realize the informationization of agricultural product distribution. The theoretical model of customer behavior intention in agricultural product network marketing is shown in Figure 3.

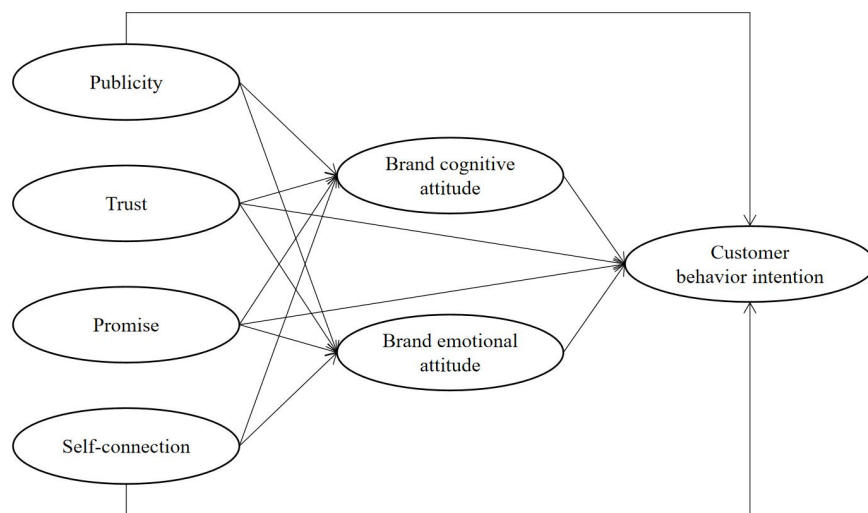


Fig.3 Customer Behavior Intention

Combining agricultural product transaction data and consumer evaluation, calculate the user's preference for agricultural product categories:

$$PC_{u,j} = \frac{\sum_{i \in I_u} PI_{u,i} \times \mu_j(x_i)}{\sum_{i \in I_u} \mu_j(x_i)} \quad j = 1, 2, 3, \dots (5)$$

Where  $PC_{u,j}$  represents consumer u's preference value for category,  $PI_{u,i}$  is consumer u's scoring value for product i,  $I_u$  represents the set of products that consumer u has evaluated, and  $\mu_j(x_i)$  represents the degree of membership of product i to category j.

Any successful marketing needs a good marketing channel, which is the key to efficient marketing. Establishing personalized marketing channels can not only effectively reduce the hierarchy among producers, sellers and final consumers of agricultural products, but also enhance the real-time communication of information among them and enhance the consumer experience. E-commerce marketing of agricultural products needs to improve farmers' network technology and information quality. In view of the actual situation that farmers in rural areas lack knowledge of e-commerce, we should provide short and easy-to-understand e-commerce introductory training as far as possible, so as to help them master the relevant knowledge needed by e-commerce marketing of agricultural products in the shortest time, and effectively promote the better development of e-commerce marketing of agricultural products [13]. Precision marketing of agricultural products e-commerce is a continuous and dynamic activity. Therefore, operators should reasonably integrate all links in the process of precise marketing to maintain the mobility and harmony among all links. The operators of agricultural products should work out the marketing plan of precise marketing in advance on the basis of fully analyzing consumer demand, and take corresponding marketing actions. At the same time, it is also necessary for operators to be able to track and grasp the change information of consumers' demands, and judge whether the enterprises really meet the needs of different consumers according to the changes of these information.

#### IV. Conclusions

Today, with the continuous development of modern economy, the mode of agricultural development should be constantly changed with the progress of the times. The extensive application of data mining and data analysis is changing the marketing environment of agricultural products in Jilin Province every day, from passive to active. Marketers improve the service ability and quality of precision marketing of agricultural products in Jilin Province through data mining and data analysis technology. The future development of e-commerce marketing platform for agricultural products still needs to be constantly improved. With its own hard power, it can stand on the trend of the times, achieve stable development and lay a solid foundation for agricultural development. Precision marketing of agricultural products e-commerce is a continuous and dynamic activity. Therefore, operators should reasonably integrate all links in the process of precise marketing to maintain the mobility and harmony among all links. To comply with the future development trend of e-commerce, we should improve the marketing level of e-commerce of agricultural products continuously from the aspects of the development of mobile e-commerce platform, strengthening the logistics management of agricultural products, customer management and improving the service level with the help of the development of IoT.

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