Research on the Application of Precision Marketing Based on Big Data

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Abstract

Entering the 21st century, the Internet industry is developing rapidly, and all walks of life face huge challenges. How to attract more customers under the huge impact of the internet is a problem that enterprises urgently need to solve. This article starts with precision marketing and introduces banking products. With the deepening of internet big data technology, the bank has its mobile client and studied how the banking industry uses various means to collect data in the big data environment, establish its user profile, and adjust its marketing strategy. When the bank recommends to users, it must choose an appropriate algorithm to serve its marketing. The collaborative filtering algorithm is the most classic and easy-to-operate recommendation algorithm. This article provides an improved collaborative filtering algorithm, a method for calculating the similarity of recent interests related to time. This improved collaborative filtering algorithm can provide a new reference for the precise marketing of banks.

1. Introduction

After entering the 21st century, scientific and technological revolutions time after time have promoted the development of the entire society. The term "big data" has slowly entered people's field of vision. "Big data," as the name implies, means that the amount of data is very large [1]. The basic characteristics of big data can be summarized in four aspects: large capacity, diversity, low-value density, and fast speed. The capacity is large. The general data volume can reach the leap from TB to PB level. Diversity means there are many types of data. For example, the data types generally include weblogs, audio, video, pictures, geographic location information, etc. The value density is low. That is, there is not much valid data under a huge amount of data. For example, in very long video data, the generally useful data may only be two or three seconds. Fast speed means that big data has its requirements for data processing speed, which generally conforms to the "1-second law". The processing result is generally required to give the analysis result within a second-time range. If the time is too long, it will lose value. The speed requirement is also the essential difference between big data processing technology and traditional data mining technology.

Big data is one of the most promising technologies in the 21st century. From the current payment methods that are becoming more and more electronic and intelligent, we can see that in the future, our consumption and financial management models will become more and more

intelligent and informative. Significant data technology development prospects in commercial banks are also very broad. As the hub of currency circulation in society, commercial banks can rely on retrieval technology to collect a large amount of customer behavior information [2]. The behavioral information of these customers is an important reference data for us when recommending bank products. It helps banks improve their business insights and trend prediction capabilities, increase profitability for banks, quickly respond to market changes, improve risk early warning capabilities, meet customer purchase needs, and strengthen core competitiveness.

2. The concept of precision marketing

2.1. The concept of corporate marketing and precision marketing

A marketing strategy refers to the fact that the company takes the actual needs of the customers as the foothold in the business process and obtains information on the purchasing power and demand of the customers, the expected value of the market, and other data based on the previously accumulated purchase experience. Organize various production and business activities in a planned way. The marketing strategy mainly studies the various situations faced by the enterprise's marketing under the current market conditions. In other words, marketing strategy mainly studies how to accurately recognize, analyze, select, and seize market opportunities to cater to consumers' shopping needs in the market environment and marketing environment, to maximize the company's wealth and make it long-term Survive and develop.

As the name suggests, precision marketing is a type of marketing strategy. Compared with traditional marketing strategies, precision marketing has a clearer focus. The first step of precision marketing is precise positioning and the use of modern information technology to establish a personalized customer communication system so that companies can achieve capital expansion in a low-cost manner. Precision marketing has become the backbone of network marketing and is also one of the core views in the attitude of network marketing [3].

2.2. The steps of precision marketing

Precision marketing has three main meanings: the ultimate goal of precision marketing is marketing without marketing. However, you need to go through step-by-step marketing to reach this goal. Precision marketing is a systematic guarantee and means for implementing precision, and this means is also measurable. The purpose of precision marketing is to achieve low-cost, sustainable corporate goals.

Precision marketing is a very popular marketing term nowadays. Overall, it is to use the current emerging media to make corresponding marketing plans for corporate decision-makers accurately.

2.3. Theoretical basis for precision marketing

The theory of precision marketing is mainly composed of four aspects: 4C theory, customer value, communication theory, and reaction principle. The 4C theory mainly emphasizes the buyer's initiative, active participation in marketing, and the convenience of the customer's purchase. Precision marketing also creates a small environment for buyers and sellers to communicate in time, which aligns with consumers' shopping orientation, purchase convenience, low cost, and adequate communication. These are the practical applications of

the 4C theory. Precision marketing can guide consumers' shopping orientation. The core idea of the 4C theory is to make each enterprise take the needs and desires of consumers as the basic orientation. The core idea of precision marketing is to understand the expected satisfaction of the market faster than other competitors. Precision marketing is one of the shortest marketing methods. The key is that it reduces circulation links, reducing consumer satisfaction costs. Precision marketing also facilitates customer purchases and realizes two-way interactive communication with customers. This is also the difference between precision and traditional marketing [4].

The concept of customer value is another development of marketing theory. "Customer value" refers to the difference between the customer's total cost and total value. Customer total cost refers to the sum of money, time, and energy spent by customers when purchasing a product; total customer value refers to the sum of the benefits customers expect to obtain when purchasing a product. The introduction of precision marketing reduced the total cost of customers and increased the total value of customers.

Communication theory refers to the "straight line" communication between customers and companies. Everyone knows that the straight line between two points is the shortest. If the communication between the customer and the company is "straight line," then a lot of unnecessary consumption can be reduced, including time consumption, energy digestion, and money consumption. The reaction principle refers to the relationship between customers and companies: precision marketing uses CRM to manage the relationship between customers and companies; precision marketing cares about customer loyalty; precision marketing also focuses on customer value-added and fission.

The above are the main theories of precision marketing. Generally speaking, it is to efficiently and directly build a bridge between customers and enterprises to maximize the benefits.

3. Banking products

3.1. Introduction of bank wealth management products

Develop, design, and sell the capital investment and management plans. In the investment method of wealth management products, the bank only accepts the client's authorization to manage funds, and the investment income and risks are borne by the client or both the client and the bank by the agreed method. The "Interim Measures for the Management of Personal Financial Management Services of Commercial Banks" promulgated by the "personal financial management services" as "specialized service activities such as financial analysis, financial planning, investment consulting, and asset management provided by commercial banks for individual customers." Personal financial management services of commercial banks are divided into financial advisory services and comprehensive financial management services according to different management and operation methods. We refer to "bank wealth management products" as comprehensive wealth management services.

With the deepening of Internet technology, more and more banks have mobile clients. Customers can learn about different wealth management products through the mobile clients of major banks [5]. Experts in the industry said that strengthening cooperation and complementary advantages between traditional financial bank wealth management and the internet will become the main trend. P2P wealth management combines traditional banks' strict credit review mechanism and powerful data management mechanism with Internet

credit review technology, enabling financing services to cover more small and micro enterprises but can also help reduce the financing costs of small and micro-enterprises [6].

3.2. Components of bank wealth management products

1) Issuer

The seller of financial products is generally the financial institution that develops financial products. Generally, investors should pay attention to the strength of R&D and the investment management of issuers. Financial products issued by powerful financial institutions are more reliable. In addition, some investment channels are qualified to be restricted, and small financial institutions may not be qualified to participate in these investments, which limits the investment direction of issuers and ultimately affects the yield of financial products. Therefore, the credit of strong institutions is more reliable.

2) Subscriber

That is, investors in bank wealth management products. Some wealth management products are not for all the public but are launched for targeted subscription groups.

3) Time limit

There will be a time limit when any wealth management product is issued. Most wealth management products banks issue are relatively short-term, but foreign banks have launched wealth management products with a 5 to 6-year maturity. Therefore, investors should be clear about the sufficiency of their funds and the possible liquidity requirements during the investment period to avoid the inconvenience caused by this. When investing in long-term financial products, investors also need to pay attention to macroeconomic trends and have a general judgment on indicators such as interest rates to avoid losses caused by fluctuations in interest rates or difficulties in the liquidity of funds.

4) Prices and benefits

Price is the core element of financial products. Funders selling financial products aim to obtain income equivalent to the product's price, and the investor's investment amount is equal to the price of the financial product purchased. For wealth management products, the price is the related subscription, management, and other expenses and the opportunity cost of the investment (which may be interest income or other investment income). The purpose of investors investing in the product is to obtain a return equal to or higher than the price. The rate of return represents the percentage of the product's investment to investors. It is the rate of return calculated by the original terms of the product after the end of the investment management period.

5) Risk

In an effective financial market, risks and returns are always equal, and only when the corresponding risks are assumed can the corresponding returns be possible. In actual operation, the financial market is not always effective or not always effective. Due to factors such as information asymmetry, the market may have low-risk, high-yield, high-risk, and low-yield possibilities. Therefore, investors should have a detailed understanding of the risk structure of wealth management products to make judgments and assessments to see if they match the income earned.

6) Liquidity

Liquidity refers to the liquidity of assets, which contradicts the rate of return. Some economists define interest as the "price of liquidity." Under the same conditions, the better the liquidity, the lower the rate of return, so investors need to make a trade-off between the two.

7) Other rights nested in wealth management products

Financial products, especially some structured financial products, often embed options and other financial derivatives. For example, investors can redeem clauses early, which is a right (although not necessarily the best option); the bank's early termination power is a clause in favor of the bank. Therefore, investors should fully explore the information when choosing financial products and use their rights [7].

3.3. Construction of User Portrait

1) The concept of user portrait

User portraits mainly portray the characteristics of a user. The user's characteristics are abstracted into a tagged user model. A label is a feature identification highly condensed to the user's information. Different users can be distinguished from the computer by labeling the users [8]. There are two different ways to express the characteristics of labels. One is semantic, which makes it easy for people to understand the meaning of each label [9]. There is also a short text, and each label only represents a meaning to facilitate the machine in extracting standardized information.

User portrait is the modeling of users in the real world. User portrait mainly includes five aspects: goal, method, organization, standard, and verification. Goal: Describe, recognize, understand, and understand people. Method: Informal means, such as text, voice, or image; Formal means. Organization: Structured and unstructured organizational form. Standard: Use the gradual common sense, consensus, and knowledge system process to portray characters and understand users. Verification: There are two ways: de facto standard verification and no de facto standard verification. Among them, verification of de facto standards requires data and learning; verification of no de facto standards requires hypothesis and implementation to verify.

The construction of user portraits must first determine the initial tags, followed by manual refinement processing and repeated iterations. The choice of the label should have attenuation and weight. With user portraits, users can be classified. The criterion for classification is the similarity between tags.

According to historical user characteristics, analyze the potential users of the product and the potential needs of users, target specific groups, and use SMS, email, and other methods for precision marketing. User portraits must be based on business scenarios to solve business problems. The reason for user portraits is to acquire new users, improve user experience, or restore lost users and other clear business goals.

2) Classification of user portraits

User portraits can be divided into qualitative user portraits, qualitative user portraits, quantitative verification, and quantitative user portraits. Quantitative is mainly quantity, and qualitative is mainly a characteristic.

Qualitative user portrait: qualitative interviews, user type segmentation, and construction of user portraits. Advantages: Fast and convenient, can dig in-depth usage scenarios and motivations—disadvantages: lack of data verification.

Qualitative user profile plus quantitative verification: build a user profile using qualitative interviews, user type segmentation, and quantitative data verification. Advantages: Data and qualitative combined verification. Disadvantages: heavy workload and high cost.

Quantitative user profile: user group segmentation hypothesis, data collection plus cluster analysis, and user profile construction. Advantages: There is sufficient data to support, and accurate data on user characteristics and proportions can be obtained through statistical analysis. Disadvantages: high statistical requirements; difficulty understanding the usage

scenarios; difficulty exploring the reasons and deep-level motivations behind the user's emotional tendencies and behavioral operations.

From the application's perspective, it can be divided into behavioral portraits, health portraits, corporate credit portraits, personal credit portraits, static product portraits, rotating equipment portraits, social portraits, and economic portraits.

3) Data required for user portrait

The data required to describe the user portrait differs according to business requirements. In the Internet field, user portraits mainly include the following aspects: ① Demographic attributes, Including basic information about people such as gender and age. ②Interest characteristics: browsing content, favorite content, reading consultation, purchase preference, etc. ③Consumption characteristics: characteristics related to consumption. ④ Location features the user's city, residential area, user's movement track, etc. ⑤Equipment attributes: terminal features used, etc. ⑥Behavior data: user's behavior log data on the website such as access time and browsing path. ⑦Social data: user's social-related data.

4. Combination of big data and bank wealth management products

4.1. Traditional recommendation algorithm

As the core of the recommendation system, the recommendation algorithm plays a vital role in the quality of the final recommendation result. Therefore, when the bank recommends to users, it must choose an appropriate algorithm to serve its marketing. The traditional recommendation algorithm is the collaborative filtering algorithm. The collaborative filtering algorithm is the most classic and easy-to-operate recommendation algorithm. It is mainly divided into two types: one is a user-based recommendation, and the other is an item-based recommendation.

User-based recommendation mainly focuses on the "user" itself. The main goal is to find users similar to yourself and then recommend what these "similar users" like to your customers. Common in life is "what else do people like you like" [10]. Item-based recommendation mainly focuses on the "item" itself. The main goal is to find similar items your customers like and recommend. A common thing in life is "What else might you like."

Example: In Figure 1, user A and user B like item A and item B. It can be considered that users A and B are highly similar; they are "neighbors" to each other. Then, item D, which user B likes, can be recommended to user A. In [Figure 2], the item combination A D is liked the most by the user simultaneously, so it can be considered that item A and item D have the highest similarity. Therefore, item B can be recommended to users who like item A.
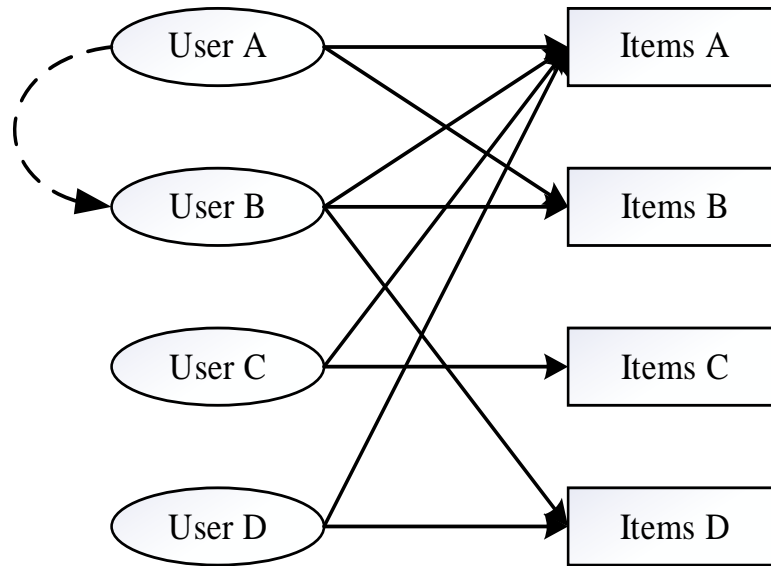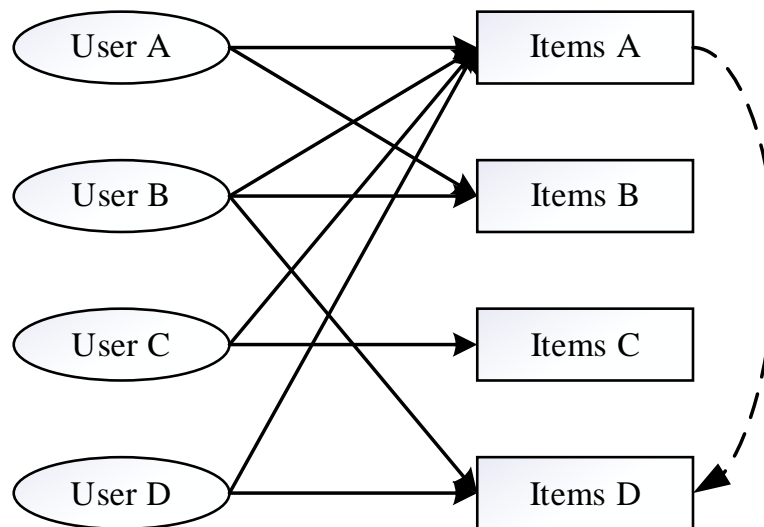
Figure 1. Recommendations based on users

Figure 2. Recommendations based on items

The traditional collaborative filtering recommendation algorithm has its advantages and disadvantages. The advantage is that this recommendation algorithm can be applied to various fields, and its experience is also public, which can help users find many of their potential hobbies. The disadvantage is that our recommendation algorithm relies heavily on the user's previous data, which has caused a lot of trouble for many people just starting to make personalized recommendations. It also gives rise to the cold start problem. The traditional recommendation algorithm stores the user's historical preferences in a sparse matrix. Still, the sparse matrix has many problems in the calculation, so this has an impact on the accuracy of

the recommendation system. Traditional collaborative filtering algorithms are based on historical data. After capturing and modeling user preferences, it isn't easy to modify or evolve according to the user's use, which makes this method not flexible enough.

4.2. Improvements to the collaborative filtering recommendation algorithm

The traditional collaborative filtering algorithm has many shortcomings, so this article proposes the following two improvements:

Consider the popularity of items and user activity

Based on users: If two users behave similarly on unpopular items, their interests are the same. It is proposed to use the following formula to calculate the similarity between users:

$$W(u,v) = \frac{\sum i \in N(u)\frac{1}{log(1+|N(i)|)}}{\sqrt{|N(u)||N(v)|}} \tag{1}$$

Among them, u and v, respectively, represent two different users. $N(i)$ represents the number of users who have acted on item i. This formula solves the effect of popular items in the common interest list of users u and user v on their similarity.

Based on items: We believe active users contribute less to item similarity than inactive users. It is proposed to use the following formula to calculate the similarity between items:

$$W(i,j) = \frac{\sum u \in N(i) \cap N(j)\frac{1}{log(1+|N(u)|)}}{\sqrt{|N(i)||N(j)|}} \tag{2}$$

Among them, i and j respectively represent two different items. $N(u)$ represents the number of items user u has acted on.

Consider the influence of time.

The above algorithm improvement does not consider the time factor. The time factor also has an impact on the accuracy of the recommendation algorithm.

User-based: If two users are interested in an item in the "same period," they are more similar. To add the time factor to the calculation, the following formula can be used:

$$W(u,v) = \frac{\sum i \in N(u) \cap N(v)\frac{1}{1+|Tui-Tvi|)}}{\sqrt{|N(u)||N(v)|}} \tag{3}$$

Among them, Tui represents when user u acts on item I, $\frac{1}{\partial * |Tui-Tvi|}$ can be replaced by any function that decreases with $|Tui - Tvi|$ and is greater than 0. After finding users with similar interests to the current user u, the recent interests of this group of users are closer to the current interests of user u than the previous interests, which can be calculated using the following formula:

$$P(u,i) = \sum_{v \in S(u,k) \cap N(i)} W(u,v) \cdot r(v,i) \times \frac{1}{1+\partial(T_0-Tui)} \tag{4}$$

Where T_0 represents the current time.

Based on items: Generally, the items that users like in a short time are more similar. When calculating the similarity of items, add the time factor and use the following formula:

$$W(i,j) = \frac{\sum u \in N(i) \cap N(j)\frac{1}{1+\partial * |Tui-Tuj|}}{\sqrt{|N(i)||N(j)|}} \tag{5}$$

The user's recent behavior can reflect the user's current interest more than the previous behavior. The following formula can be used to calculate $P(u, i)$:

$$P(u, i) = \sum_{j \in S(i,k) \cap N(u)} W(i,j) \cdot r(u,j) \times \frac{1}{1 + \partial(T_0 - Tuj)} \qquad (6)$$

4.3. Combination of time-related calculation methods of recent interest and precision marketing

Aiming at the improvement of the collaborative filtering algorithm proposed in the previous section, we use the time-related calculation method of nearest interest similarity to achieve the experimental verification of this article. The idea of verification is to implement an improved collaborative filtering algorithm recommendation based on user similarity based on a user's evaluation of financial products, and the calculation of similarity uses time-related recent interest similarity calculation [11]. The brief steps are as follows:

Find the hobbies of user A (user_id_1).

Find the Set of user groups Set <user_id> who have the same interest and hobbies of wealth management products as user A (user_id_1) in the "same period."

Find the Set of wealth management products "recently" liked by this group Set <products_id>.

Recommend these wealth management products—Set <products_id> to user A (user_id_1).

But sometimes, we will encounter data expansion between two users. One has large data, and the other has small data, but the two have an obvious linear relationship. We introduce the Pearson correlation coefficient to measure the linear correlation between two variables. The range of the Pearson value is -1 to 1. Among them was a completely negative correlation, 1 was a completely positive correlation, and 0 was no correlation. The correlation coefficient is very strong in the range of $0.8 \sim 1.0$; it is a strong correlation in the range of $0.6 \sim 0.8$; it is a moderate correlation in the range of $0.4 \sim 0.6$; The range of 0.4 is weakly correlated; the range of 0.0 to 0.2 is very weakly correlated or no correlation.

5. Conclusion

The personalized recommendation of bank products proposed in this article is not complicated enough and can only be applied to standardized fund products and wealth management products. It is especially suitable for the current normal and mainstream personalized recommendation products on electronic screens such as bank outlets and mobile banking. However, precision marketing requires more machine learning and financial knowledge to support personalized recommendations for more complex product portfolios. Therefore, studying whether the recommended products meet customers' expectations and reducing customers' disappointment rate is a topic we must pay attention to and study in the future.

References

[1] Y. Wang, L. A. Kung, and T. Byrd, "A. Big data analytics: Understanding its capabilities and potential benefits for healthcare organizations," Technological Forecasting and Social Change, Jan., vol.126, pp.3-13, **(2018)**

[2] Y. Dimitrakopoulos, A. Economou, and S. Leonardos, "Strategic customer behavior in a queueing system with alternating information structure," arXiv e-prints, **(2019)**

[3] E. Karadag and T. V. Engers, "Optimizing precision marketing through psycho-demographic analysis of social media users," 4th European Conference on Social Media, **(2017)**

[4] C. Supriya, D. R. Jegadeesan, and R. Rakesh, "Efficient decision making in smart systems using weighted frequent item mining," International Journal of Innovative Research in Computer and Communication Engineering, vol.6, no.3, pp.684-693, **(2019)**

[5] V. Baová and R. Hanák, "Financial product choices: Does attribute preference help avoid the attraction effect?" Studia Psychologica, vol.61, no.2, pp.71-85, **(2019)**

[6] S. Vacic, M. Lyons, and Y. Pipoz, "The fundamentals of financial product distribution oversight: Towards the age of maturity," Journal of Securities Operations and Custody, **(2018)**

[7] R. Tashfeen, T. Azhar, and S. Ullah, "Corporate governance, financial derivatives, and firm size," Social Science Electronic Publishing, **(2017)**

[8] W. C. Minnis, M. Nagaitis, and T. Pokorney, "Dynamic reconfiguration of web pages based on user behavioral portrait," US, **(2014)**

[9] P. Y. Chiang, C. V. Lin, and C. H. Tseng, "Generation of Chinese ink portraits by blending face photographs with Chinese ink paintings," Journal of Visual Communication and Image Representation, vol.52, pp.33-44, **(2018)**

[10] K. W. Carley, L. M. Harrington, and J. S. Dikeman, "Providing a notification when a plurality of users is altering similar data in a health care solution environment," US, **(2004)**

[11] T. G. Kim, Y. R. Lee, and B. J. Kang, "Binary executable file similarity calculation using function matching," Journal of Supercomputing, vol.75, no.2, pp.607-622, **(2019)**