

# Research on Application of Precision Marketing based on Big Data

Samuel Singh

*Deakin University, Australia*  
*samuel.singh.a@deakin.edu.au*

## **Abstract**

*Entering the 21st century, the Internet industry is developing rapidly, and all walks of life are facing 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. Collaborative filtering algorithm is the most classic and easy-to-operate recommendation algorithm. This article provides an improved collaborative filtering algorithm, which is a method for calculating the similarity of recent interests related to time. Through this improved collaborative filtering algorithm, it can provide a new reference for the precise marketing of banks.*

**Keywords:** *Big data, Marketing strategy, Banking industry, Collaborative filtering*

## **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, that is, the general data volume can reach the leap from TB to PB level. Diversity, that is, there are many types of data. For example, the types of data generally include weblogs, audio, video, pictures, geographic location information, and so on. The value density is low, that is, there are 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 most 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. The development prospects of big data technology in commercial banks are also very broad. As the hub of currency circulation in the whole society, commercial

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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 to recommend 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 the 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. To 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 wealth of the company 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 it 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, to reach this goal, you need to go through step-by-step marketing. 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. On the whole, it is to use the current emerging media to accurately make corresponding marketing plans for corporate decision-makers.

### **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 initiative and active participation of the buyer in marketing, and mainly emphasizes the convenience of the customer's purchase. Precision marketing also creates a small environment for buyers and sellers to communicate in time, which is in line with consumers' shopping orientation, purchase convenience, low cost, and adequate communication. These are the practical applications of 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 in the market. Precision marketing is one of the shortest marketing methods. The key is that it reduces circulation links, thereby 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 marketing 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 certain product; total customer value refers to the sum of the benefits that customers expect to obtain when purchasing a certain 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" mode of 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 in accordance with 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. What we generally refer to as "bank wealth management products" actually refers to comprehensive wealth management services among them.

With the deepening of Internet technology, more and more banks have their mobile clients. Customers can learn about different wealth management products through the mobile clients of major banks [5]. Experts in the industry said that in the future, the strengthening of cooperation and complementary advantages between traditional financial bank wealth management and the internet will become the main trend. P2P wealth management combines traditional bank's strict credit review mechanism and powerful data management mechanism with Internet credit review technology, which will not only enable financing services covering more small and micro enterprises can also help reduce the financing costs of small and micro-enterprises [6].

### **3.2. Components of bank wealth management products**

#### **1) Issuer**

That is to say, 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 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**

When any wealth management product is issued, there will be a time limit. Most of the wealth management products issued by banks are relatively short-term, but there are also foreign banks that have launched wealth management products with a maturity of 5 to 6 years. 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 liquidity of funds.

#### **4) Prices and benefits**

Price is the core element of financial products. The purpose of fundraisers selling financial products is to obtain income equivalent to the price of the product, and the investor's investment amount is exactly 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 investment that the product brings to investors. It is the rate of return calculated in accordance with 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 the existence of factors such as information asymmetry, there may be low-risk high-yield, high-risk low-yield possibilities in the market. 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. This is why 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 make full use of their rights [7].

## 3.3. Construction of User Portrait

### 1) The concept of user portrait

User portrait is mainly to portray the characteristics of a user. The user's characteristics are abstracted into a tagged user model. A label is a feature identification that is 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, each label only represents a meaning to facilitate the machine to extract 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, image; Formal means. Organization: Structured and unstructured organizational form. Standard: Use the gradual process of common sense, consensus, and knowledge system to portray characters and understand users. Verification: There are two ways, there are 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 finally 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, use SMS, email, and other methods for precision marketing. User portraits must be based on actual business scenarios to solve actual business problems. The reason for user portraits is either to acquire new users, or 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 plus quantitative verification, and quantitative user portraits. Quantitative is mainly quantity, 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: qualitative interviews, user type segmentation plus quantitative data verification, build a user profile. 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 construction of user profile. 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; difficult to understand the usage scenarios; difficult to explore the reasons and deep-level motivations behind the user's emotional tendencies and behavioral operations.

From the perspective of the application, 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

According to different business requirements, the data required to describe the user portrait is not the same. In the Internet field, user portraits mainly include the following aspects: ① Demographic attributes: Including basic information of people such as gender and age. ② Interest characteristics: browsing content, favorite content, reading consultation, purchase preference, etc. ③ Consumption characteristics: characteristics related to consumption. ④ Location features the user's city, residential area, user's movement track, etc. ⑤ Equipment attributes: terminal features used, etc. ⑥ Behavior data: user's behavior log data on the website such as access time and browsing path. ⑦ Social 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. 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; the other is an item-based recommendation.

User-based recommendation mainly focuses on the "user" itself. The main goal is to find users who are similar to yourself and then recommend the things that these "similar users" like to your customers. What is 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 that are liked by your customers and then recommend these similar items to customers. A common thing in life is "what else might you like".

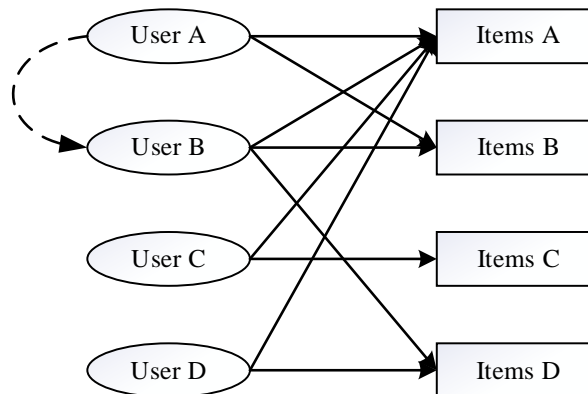


Figure 1. Recommendations based on users

Example: In [Figure 1], both user A and user B like item A and item B. Then it can be considered that user A and user B are users with high similarity, that is, they are "neighbors" to each other. Then the item D that user B likes can be recommended to user A. In [Figure 2], the item combination A D is liked the most by the user at the same time, 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.

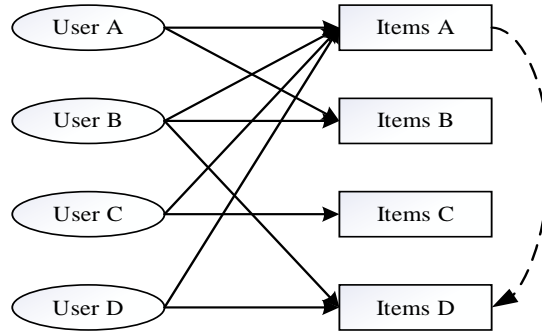


Figure 2. Recommendations based on items

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, so this has caused a lot of trouble for many people who are just starting to make personalized recommendations, and it also gives rise to the cold start problem. The traditional recommendation algorithm stores the user's previous historical preferences in a sparse matrix, but 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 is difficult 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: We believe that if two users take the same behavior on unpopular items, then their interests are the same. It is proposed to use the following formula to calculate the similarity between users:

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

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

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

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

Consider the influence of time

The above algorithm improvement does not consider the time factor, in fact, 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 time period", they are more similar. To add the time factor to the calculation, the following formula can be used:

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

Among them,  $Tui$  represents the time when user  $u$  acts on the item  $i$ ,  $\frac{1}{1 + |Tui - Tvi|}$  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:

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

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:

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

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

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

### 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 time 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 there is an obvious linear relationship between the two. 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-1: completely negative correlation, 1: completely positive correlation, 0: no correlation. The correlation coefficient is very strong in the range of 0.8~1.0; it is a strong correlation in the range of 0.6~0.8; it is a moderate correlation in the range of 0.4~0.6; 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, in actual precision marketing, personalized recommendations for more complex product portfolios need to be supported by more machine learning and financial knowledge. Therefore, studying whether the recommended products meet the expectations of customers and reducing the disappointment rate of customers is a topic that we must pay attention to and study in the future.

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