Research on financial advertisement personalised recommendation method based on customer segmentation

Liming Wang
Hangzhou College of Commerce,
Zhejiang Gongshang University,
No. 18, Xuezheng Str., Xiasha University Town, Hangzhou, China
Email: 15305719981@189.cn

Yanni Liu*
School of Management and E-Business,
Zhejiang Gongshang University,
No. 18, Xuezheng Str., Xiasha University Town, Hangzhou, China
Email: mer2013@163.com
*Corresponding author

Jicheng Wu
Hangzhou Sunyard Digital Technology Co. Ltd.,
No. 3888 Jiangnan Road, Hangzhou, China
Email: 472464731@qq.com

Abstract: In the context of mobile internet, financial companies have encountered some obstacles in the development of marketing. The traditional recommendation system based on association rules regards all customers as a whole to carry out the correlation analysis without considering the individual differences, which greatly reduces the effectiveness of personalised recommendation in rule mining stage. Given those shortcomings, this paper proposes a financial product advertising marketing system based on customer segmentation. Through the segmentation of financial customer groups, the method becomes more representative of different consumption habits and consumer characteristics of the customer groups. Then we carry out the association rules mining in various customer groups, and establish the customer base to provide targeted customer personalised service.

Keywords: customer segmentation; data mining; customer segmentation; personalised recommendation.


Biographical notes: Liming Wang received her master degree in School of Journalism and Communications in 2004 from Xiamen University (XMU), China. She is currently a Lecturer in the Hangzhou College of Commerce at ZJGSU. Her research interests include mobile advertisement, media communication and consumer behaviour.

Yanni Liu received her master degree in the School of Computer Science and Information Engineering, in 2016, Zhejiang Gongshang University (ZJGSU), China. She currently works at ZJGSU. Her research interests include electronic commerce, data mining, and social media.

Jicheng Wu is currently the research and development engineer of Hangzhou Sunyard Digital Technology Co. Ltd. His research interests include information system management and data mining.
1 Introduction

In recent years, the fierce competition among financial institutions such as commercial banks has gradually spread from the network, service and products to the field of advertising and marketing. Financial products can be described as overwhelming in daily life. Financial marketing refers to financial enterprises that use the financial market as the guide, and use the integrated marketing means to provide customers with financial products and services, which not only meet customer needs and desires but also achieve the interests of financial enterprises in the process of social behaviour (Zaki, 2000). Therefore, in the face of increasingly fierce competition, financial enterprises should also carry out precision marketing.

With the development of mobile internet, big data, and cloud computing, the scientific and technological factors can not only support the banks to improve efficiency, but also force banks to seek new ways to collect data and boost financial innovation. By the advantage of big data, we can achieve the so-called precision marketing and reduce the cost of business. However, the commercial banks have not fully adapted to the requirements, and advertising marketing work is facing a lot of outstanding contradictions. So this paper researches how to apply personalised recommendation with data mining technology to solve the financial problem of precision marketing from the perspective of customer segmentation.

2 Related work

2.1 Related research on advertising services for precision marketing

In 2014 China’s online advertising market value reached 1540 yuan, with year-on-year growth of 40%. At the same time, with the rapid development of intelligent terminals such as mobile phones and mobile internet, user data have become a powerful driving force for the development of advertising industry. From the point of view of information systems, accurate advertising service is actually an advertising recommendation system (Murtadha et al., 2016). The advertising recommendation systems are corresponding to the users and products in the traditional recommendation system. Therefore, advertising recommendation and other issues will also face the accuracy and personalised problems.

On the basis of traditional advertising ‘one to many’ or ‘many to many’ modes of transmission, precise advertising inherited and improved the mode, and the scope of the audience is further reduced to individual, which truly realises the advertising of ‘one to one’ communication (Liu et al., 2010). In order to achieve this personalised advertising push function, banks and other financial institutions need to make analysis based on their own customer information and the customer’s investment situation analysis. In other words, the financial institutions need to use the proportion of data in the data resources of the customer’s investment in the purchase of financial products to identify the user’s relevant information in these sites. Meanwhile, financial institutions will make advertisement recommendations to the customers with high similarity in the purchase of goods.

2.2 Related research on customer segmentation

Market segmentation is based on the theory that the enterprises are in accordance with the needs of the different needs of the organisation to organise production (Liu et al., 2010; Marcus, 1998). With the continuous updating of the industry, the market segmentation eventually has two branches: the product-oriented segmentation and customer-oriented segmentation. The customers are gradually regarded as the centre of the market concept. And customer-oriented subdivision is more reasonable and scientific. Therefore, this paper focuses on the customer-oriented segmentation. The customer segmentation variables and the choice of standards are the premise of customer segmentation since the different standards directly have an impact on the final segmentation results. Based on previous research, this paper mainly includes three aspects of customer segmentation, which are shown in Figure 1.

1 Customer attributes segmentation

Customer segmentation is usually classified by the customer attributes: geographical factors and population factors. Geographical factor is an objective basis because different regions of the customers’ demand have a significant difference. With the development of information technology and the country market, the relationship between geographical factors and customer demand is gradually weakened. Moreover, demographic factors are included, for instance, gender, age, income, occupation, education, family, race, and a series of specific factors (AI-Jabri, 2016). This is the key basis for early consumer segment. Marcus believes that this approach is simple and feasible, but not very efficient (Marcus, 1998). So it is difficult to reflect customer needs and value, attract customers, and meet the needs of customer relationship management. Therefore, the geographical or demographic factors on the customer segmentation can merely reflect some basic situations of the customers, and not provide good help for the enterprises to carry out the precise marketing strategy. So other customer segmentation methods are needed to study.

2 Customer psychology segmentation

In the psychological characteristics segmentation, customers were divided into different groups according to the different social classes, career, life style, life attitude and personality characteristics (Hughes, 1994; Tsoumakas et al., 2010; Davies and Bouldin, 2009). Psychological variables are difficult to receive through enterprise internal system, but the previous research receives data through the questionnaire survey and other external sources.

3 Customer behaviour segmentation

Behaviour segmentation is based on a deep understanding of the customer’s current behaviour data, which mainly research past and current consumer behaviour and mode
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through the enterprise database (Alvares-Cherman et al., 2012). The purpose is to predict the future behaviour of customers, and develop targeted strategies to meet customer needs by customer classification.

Hughes proposed three behavioural variables to describe and distinguish the customers: the customer’s recent purchase behaviour, the overall frequency of the purchase and the amount of money spent (Hughes, 1994). First, the product of three indexes is sorted according to the result of indexes. Finally, different strategies are implemented for different classes of customers.

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3 The financial advertising precision marketing model based on customer segmentation

3.1 The algorithm idea

The traditional association rule on recommendation algorithm is based on the historical information of customer’s purchase of financial products to establish the relationship between the products (Lu et al., 2005; Zenebe and Norcio, 2009). And this association rule is used to recommend the potential financial products for customers. However, the number of customers in a financing institution is large, and a large amount of transaction data is produced per day, which results in the formation of customer transactions database (Huang and Sun, 2016). In such a large-scale database, a direct correlation analysis is conducted with a higher cost. Because of the background difference among customers, customers have a big difference in the requirements of the product, which leads to the lack of the rules of the mining and reduces the effect of personalised marketing. In this paper, we consider that the financial customer group is represented as a social network, which is used to represent the individual financial customers. The relationship between the vertices is similar, which can be called the financial customer relationship network.

Community is a kind of structure characteristics in the social network, which describes the vertices’ clustering phenomenon due to the locality of edge contact. The community in the network of financial customer relationship is closely related to the network topology. In the practical sense, it represents the customer groups with similar interest or purchasing behaviour characteristics. Analysis of these associations will help financial institutions to further analyse the user’s interest characteristics and behaviour patterns, and can be used to predict customers’ behaviour.

The characteristic similarity of the customers in the same community is generally much higher than that of different societies. Therefore, it is necessary to carry out the correlation analysis in a number of representatives of different customer communities. So this paper presents a personalised recommendation algorithm based on customer segmentation. First, the algorithm is used to divide customers into groups with different interests and preferences based on the interest and behaviour of financial customers. Then, the correlation analysis is carried out in various customer groups. This not only can greatly reduce the time and space costs of the association rules mining, but also can effectively improve the marketing effect of financial products advertising.

3.2 The algorithm process

In the paper, the association rule based on personalised recommendation is composed of two parts, including the customer community segmentation and association rules mining. The personalised recommendation system is shown in Figure 2.

![Figure 1](image1.png)

**Figure 1** The model of customer segmentation

![Figure 2](image2.png)

**Figure 2** Personalised recommendation system based on association rules
Customer segmentation based on community mining

Firstly, we analyse the financial products purchased by customers. If the purchase of the product has a certain commonality between the two customers, an edge will be established for the two customers in the financial network to show that these two customers have a certain relationship. Then through the community mining algorithm in customer relationship network mining community, the customers are divided into many different customer groups, each customer has different product preferences.

The association rules mining on customer groups

Because the initial transaction database is divided into several small and non-intersecting transaction databases, the efficiency of association rules mining is greatly improved. According to the target customer’s association rule, we could match the customers’ purchase information on the financial product to provide personalised product recommendation service.

The system design of financial advertisement precision marketing

Financial advertising marketing system makes use of the customer’s basic attribute information, historical purchase information and other indicators to calculate the similarity of the customer’s personality. And all registered customers form the customer relationship network. In such a customer relationship network, community mining means that all customers are divided into several representatives of different interest groups of customers.

The system has been used to carry out the association analysis of the members of the community to get the association rules, and recommend financial products to the targeted customer. As shown in Figure 3, the system consists of five modules, namely the login module, data entry and processing module, community management module, association rule management module, as well as the recommended generating module.

3.4 The experimental results and analysis

The experimental data set is derived from the personal information data of 856 customers in a commercial banking system and the purchase information of investment and financial management. We firstly use the traditional personalised recommendation algorithm and the XCZ algorithm based on customer segmentation (based on sub-cluster similarity) to deal with community mining in the data set. The number of the community is three, so the customer is divided into three groups. Then each customer’s purchase sequence is divided into a training set and a test set. For each customer, we select their last purchase of financial products as the target, and the purchase of other product sequences as the training set for mining-related rules. We generate a list of four financial products for each customer. If a customer’s forecast product appears in its recommended list, it is considered that the recommendation is successful, otherwise it is a failure.

When measuring the effectiveness of a recommended system, we commonly use accuracy rate (precision), recall rate (recall) and F1 (Friedman et al., 1997; Basu et al., 1998; Read et al., 2011). In order to better measure the performance of the recommendation system, it is usually required to combine precision and recall to form a comprehensive evaluation index – F1. Generally speaking, the greater the F1 value is, the better the corresponding recommendation is.

\[
F1 = \frac{2 \times \text{precision} \times \text{recall}}{\text{precision} + \text{recall}}
\]

Figure 3  Financial advertising precision marketing system
As can be seen from Table 1, the performance of the association rules recommendation algorithm based on customer segmentation is obviously superior to the traditional recommendation algorithm based on association rules. This is due to the customer segmentation-based association rules recommendation algorithm. First of all, according to the customer’s historical purchasing behaviour, customers are divided into different interest groups. And then, it analyses the association of different groups of different clients. The association rule model is more efficient to target customers, so the accuracy of recommendation is higher.

<table>
<thead>
<tr>
<th>Min sup</th>
<th>The traditional recommendation method</th>
<th>The recommendation method based on customer segmentation</th>
<th>T-value (Δdiff)</th>
</tr>
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<tr>
<td>0.05</td>
<td>0.09</td>
<td>0.19</td>
<td>2.52*</td>
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<td>0.10</td>
<td>0.11</td>
<td>0.23</td>
<td>2.63**</td>
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<td>0.15</td>
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<td>0.25</td>
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<td>0.30</td>
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<td>0.35</td>
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<td>3.42***</td>
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<td>0.40</td>
<td>0.03</td>
<td>0.29</td>
<td>3.67***</td>
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Note: *p < 0.05; **p < 0.01; ***p < 0.001.

4 Summary

This paper presents a personalised recommendation method and system for financial advertising recommendation based on customer segmentation, since there are obvious and potentially similar behaviour characteristics among financial clients. Customer segmentation focuses on the core of the target customers, and effectively achieves the purpose of marketing. Through the segmentation of the financial customer groups, the method can reveal different consumption habits and consumer preferences of the customer groups. Then the association rules mining is carried out in various customer groups based on the customer segment to provide the targeted customer personalised service. This method not only seeks the target market, but also plays an important role in the precise market positioning of products, and meets the needs of consumers.

References


