Marketing Recommendations with Association Rules for Retail Business

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ABSTRACT: This paper describes data mining and association rules algorithm related theories and proposes several specific and feasible marketing recommendations results for the supermarket business. The work shows that although some patterns do not have a relatively high degree of confidence-support rate, the profit generated is more interesting than those with high confidence-support. Thus, this method proves a certain rationality and superiority in using a weighted assessment of the profit for association rules analysis, and has strong promotional value in the actual business operations.

KEYWORD: marketing recommendations, association rules

1 INTRODUCTION

The development of retail industry in China is very rapid in these years, people have high standard of living. Types of goods and daily trading volume are also increasingly large. Due to the widespread use of the cash register in the retail industry, it is convenient to collect a large number of data about the purchase situation. Shops need a tool, which can be used to analyze customer purchase behavior and purchase mode by a large number of sales data, inventory data and consumer information. Data mining is just the tool.

The independent brand supermarkets of our country are faced with not only the same type of supermarkets competition, but also the pressure from international chain supermarkets competition. At the same time, they also face potential threat from the network shopping. In recent years, from retail market Value Share, the international brand of supermarkets has a great advantage in competition. The foreign supermarkets keep their core competitiveness by effectively using the data mining technology to provide the information what they need. This study not only validates the feasibility and accuracy of correlation model, but also is an important application of the theory of analysis of exploration in the supermarket in the data on the association. It has certain theory significance and the practical significance.

2 THEORETICAL BASIS

At present, the research of data mining mainly focus on classification, clustering, association rule mining, sequential pattern discovery, and taking advantage of anomaly discovery and so on. association rules success in the field of commercial applications which make it become a research topic in data mining is the most mature, the most important, the most active. This section will introduce the related concept of association rules. Next page will describe the basic definition of association rules.

2.1 Basic Definition

2.1.1 Project

Set I={i1,i2,...,imp} is called project set. The project is abstracted from concrete problems .In the association rules mining project in the supermarket, project present that customers buy a variety of goods, such as milk, bread, shoes and so on.

2.1.2 Affairs

In the shopping basket analysis, it generally do not care about the customer purchase's goods quantity and price and other factors. So the customer buy shopping goods can present once the purchase record, which is called transaction. So the set of all transaction form of association rules mining data set, which is called the transaction database.

2.1.3 *Support Confidence Lift*

Association rules like U→V, including U, V, and U∩V=φ. Set U, V not included in the same item collection I. For example , analyze some features of U customers have the consumption of certain commodities V. U is the customer's gender, occupation and address attribute set, and V is the collection of goods. Association rule's support of S (U, V) and confidence C (U, V) is an important index to measure the project relation, which describes the usefulness and the certainty of an association rule. Support is an important measure of the user interest. If support association rules is very low which represent a stochastic phenomena. Confidence reflects the degree of accuracy of association rules, how much possibility that customers buy the item sets in U also bought the goods are in V.

In the matter of database in D, support association rules U→V:

S (U→V) = support_count(U ∪ V) / |D|

Confidence association rules U→V:

C(U→V) = support_count(U ∪ V) /support_count(U)

The formula, support_count(U ∪ V) which include U ∪ V support_count(U) which include U.

Lift is a measure of the effectiveness of the rules:

Lift (U→V) = C (U→V) / support (V)

When the lift is more than 1, compared with the traditional dependency set V in the database support, association rules can better predict whether the project will appear. For example, there are generally 30% of customers buy printers, and through the correlation analysis found that buy a desktop computer customers have 60% possibility will buy a printer in a shopping mall. Therefore, customers who purchase the desktop computer, the possibility of them to buy the printers will increase 2 times.

3 THE INFLUENCE ON THE SUPERMARKET RETAIL OF CONSUMER BEHAVIOR

The research field of consumer behavior research covers many aspects which individuals or groups to meet the needs and desires to choose, buy the use or disposal of products, services, processes involved in the concept or experience. This section from the US starts from the consumer culture, consumption demand and lifestyle factors, analysis of their impact on retail industry.

1)Influence of the change of consumption culture in the retail industry. Culture is a complex form of knowledge, belief, art, law, morals, customs and other shared by most members of a society's habit and ability etc.. From a broad sense, cultural values are divided into three forms, namely, others oriented values, environment oriented values, self oriented values.

2)The influence of the change of life style of retailing revolution. Life style is a kind of consumption mode, refers to people based on a general term for a unique lifestyle, specific social and cultural background and personal hobby established patterns of life. Consumption behavior of people is the embodiment of life style, and way of life is a collective life mode, which determines the people in the consumption patterns of selection on hand to be influenced and restricted by consumer groups in their own way, and the mode of consumption influence and guide the group consumption mode.

The theory circle of influence on consumer supermarket shopping factors conducted a series of studies. According to a study showed that the citizens of Chengdu most of the factors to consider when consumers choose the supermarket rich in goods, the price level. The quality of commodities, shopping environment, service attitude and sells whether clean health. In addition, the distance from home, transportation convenience and whether they hold membership card is its consideration. Indicate to consumers survey in Nanjing City: there are kinds of supermarket food main factors influencing consumers to choose the supermarket to buy food. The price of food, supermarket checkout waiting time, the supermarket business hours, supermarket consumers membership etc.. Some studies have found different types of consumer choice of supermarket goods different emphases, which consumers' gender, age, income level and education affect the choice of consumers, and these factors can be used as the starting point of mining association rules in supermarket application.

4 THE SUPERMARKET DATA MINING WITH ASSOCIATION RULES

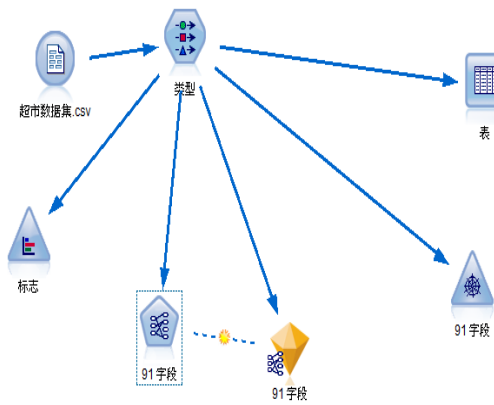In this paper, correlation analysis model are shown in figure 1 below.

Figure. 1 Association rules mining model

后项	前项	实例	支持度 %	置信度 %	规则支持 %
Drinks	Cigarette	517	49.285	86.074	42.421
Drinks	Candy and ch...	466	44.423	91.416	40.61
Drinks	Imported food	455	43.375	94.066	40.801
Drinks	Instant staple ...	383	36.511	91.906	33.556
Drinks	Seasoning	381	36.32	93.438	33.937
Drinks	Biscuits	354	33.746	94.068	31.745
Drinks	Candy and ch... Imported food	307	29.266	96.417	28.217
Drinks	Drink food	297	28.313	95.96	27.169
Drinks	Snack food	290	27.645	93.793	25.929
Drinks	Puffed food	268	25.548	94.403	24.118
Candy and ch...	Biscuits Imported food	266	25.357	80.451	20.4
Drinks	Biscuits Imported food	266	25.357	98.12	24.881
Drinks	Seasoning Imported food	266	25.357	97.368	24.69
Imported food	Biscuits Candy and ch...	263	25.071	81.369	20.4
Drinks	Biscuits Candy and ch...	263	25.071	95.437	23.928
Drinks	Instant staple ... Imported food	261	24.881	97.318	24.214
Candy and ch...	Biscuits Imported food Drinks	261	24.881	80.46	20.019
Imported food	Seasoning Candy and ch...	257	24.5	80.545	19.733

Table 1 Support & Confidence figure

According to the experimental results, this paper suggests a high degree of correlation of goods shelves changed from the past to put to put away from, which displayed in table 1, For example, exchanging the positions of individual product that defend bath and kitchen utensils and tableware laundry supplies and sanitation clean product relatively far away from the city, so that customers need to purchase the goods you need through the kitchen utensils and appliances and household commodities area, easy to cause consumers' impulse to buy. Europe and the United States of some of the big supermarket chains such as "Carrefour", are often changing large-scale supermarket shelves layout, it can break the consumer supermarket shopping habits, make consumers find some in the past did not notice the goods, indirect improve turnover. At the same time the goods sales good in the supermarket should be placed at both ends, small amount sales goods should be placed in medium.

Consumers go to the supermarket, in the wide variety of goods in the layout, supermarket regional formula of science, the channel design and supermarket shelves put can help win more profits. The daily sales of the different kinds of goods has a big difference. Such as fresh food, daily necessities of life than other types of products, average daily turnover for business decision makers how to put sales difference is very big goods reasonable the shelves of different position is quite important.

5 SUMMARY

This paper studies the marketing for the supermarket application of association rules, using the standard research and case study combination. In association analysis of classical algorithms, we propose the use of association rules in various projects and profits weighted to represent the profit that can be generated, the corresponding design of the three models used in supermarket sales, combined with real transaction data to the supermarket a model of the implementation process and specific marketing proposal, the results show that the use of association rules generating profits to assess the association rules with a certain rationality and superiority.

Specific innovative research results are as follows:

1) Proposed the use of weighted association rules and profits of each project to assess the idea of association rules. Solve the traditional support - Confidence assessment system may yield very satisfactory conclusion in statistical point of view, but ignored this problem that the commodity pay more attention to profit enterprises.

2) Combined with the marketing needs of law on the basis of research on the design of the three association rules specific model can be used in supermarket operations. Consider commodity prices, sales volume and profitability factors, proposed the use of association rules of frequent item sets correspond to identify the most profitable supermarket shelves stocked, merchandise sales mix and competitive commodity analysis model. Which enables correlation analysis can effectively play an important role in the decision-making process in the supermarket, to help managers optimize their business through empirical research with good usability.

3) Using Harbin actual data for a large supermarket chain to achieve the model. This paper transaction data under real operating conditions were analyzed, no human intervention and non-normal filter, to achieve full operation results in SAS programming systems, efficient and reliable. After analyzing the results of the model output and induction, for supermarket retailers in addition to better marketing to mention practical advice, feedback through supermarkets, supermarket sales have certainly improved the desired effect.

Information technology management in our local supermarket is also in its infancy, most of the supermarket to buy the software vendor focused on sales summary of the overall solution, so that the data mining techniques for the collection of information is very difficult. In this paper, due to limitations on the data collected, the information can not be collected from supermarket membership and merchandise logistics information, so the design of the model also has certain limitations. Results of this study, there are some shortcomings and problems, so you can further carry out the following work on the basis of this article.

REFERENCES

[1] R. Agrawal, T. Imiclinski, A. Swami. Mining Association Rules between Sets of Items in Large Databases Proceedings of the 1993 ACM SIGMOD Conferrence, Washton DC, USA. 1993: 160-172

[2] R. agrawal, R. Srikant. Fast algorithms for mining association rules. Proc. 1994 Int.Conf. Very Large Databases. 1994:487-499

[3] A. Savasere, E. Qmiecinski, and S. Navathe, An efficient algorithm for mining association rules in large databases. Proceedings of the 21st International Conferrence on Very large Datebase. 1995:502-521

[4] JS Park, MS Chen PS Yu. An effective hash-based algorithm for mining association rules. Proceedings of the 1995 ACM SIGMOD international.1995:175-186

[5] H.toivonen. Sampling large databases for association rules 22nd International Conference on Large Database, Mumbai. INDIA.1996.Proceedings of the International Conference on Very Large Databases 1996,2(1): 134-145

[6] C. Silwerstein, S. Brin, R. Motwani. Beyond market baskets Generalizing association rules to dependence rules. Data Mining and Knowledges Discovery.1998, 2(1):39-68

[7] N. Pasquiter, Y. Bastide, R. Taouil, L. Lakhal. Efficient mining of association rules using closed itemset lattices. Infoemation Systems.1999, 24(1):25-46

[8] J. Han ei al. Mining muitiple-level association rules on large databases. IEEE Transsactions on Knowlege and Data Engineering.1999, 11(5):798-805

[9] D. Xie. Fuzzy Association Rules discovered on Effective Reduced Database Algorithm. IEEE International Conference on Fuzzy Systems. Reno, NV, 2005. IEEE International Conference on Fuzzy Systems (FUZZ-IEEE)2005:779-784

[10] K. Wong, S. Su. Item selection by "Hub-Authority" profit ranking. Proccedings of ACM SIGKDD, 2002: 652-657