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Mohammed Atiquzzaman
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Big Data Analytics for Cyber-Physical System in Smart City

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Contents

Application of Association Rules Algorithm in Teaching Reform Under the Background of Internet Plus Era – Taking the Teaching Reform of International Trade as an Example

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Abstract. Under the background of internet plus era, the teaching reform of international trade major is imperative, but the reform is very difficult. Therefore, an algorithm based on association rules was established to calculate and analyze the related issues of teaching reform. In this way, the difficulty of artificial reform can be simplified, and the goal of reform can be achieved. Through the test and experiment of algorithm, it is proved that our algorithm has great advantages. It not only has short time and high accuracy, but also is an algorithm that has been utilized well, which is suitable for our teaching reform.

Keywords: Internet · International trade · Association rules · Data mining

1 Introduction

In today's society, the internet plus era has come, with rapid development of cross-border e-commerce. But at present, the teaching of international trade major in China already can't keep up with the pace of social development, So it's necessary to make appropriate reforms to use social resources better and cultivate more useful talents for society [1]. In addition, computer technology develops rapidly, and it has been a shortcut of our development to use computer algorithms for reform and calculation. Computer algorithms can be used in many fields [2]. In particular, the association rule algorithm is the computer algorithm which is more suitable for the reform. For the use of association rules, there are still some omissions. For computer algorithms, each algorithm has some shortcomings and deficiencies. The shortcoming is not well understood at present, and constant research is still needed to make up for the deficiency in the algorithm [3].

According to the highly developed computer technology, an algorithm model based on association rules is established to analyze the relevant data of the teaching reform in this paper. The work of curriculum reform of international trade major is liberated from human labor by using the powerful computing ability of computer technology and various data processing methods in association rules, and the powerful computer technology is used for calculation and analysis, which simplifies the amount of labor, and also makes the analysis of data more accurate [4]. Another very important aspect is

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that the deficiency of the algorithm can be made up and analyzed through the research of association rules algorithm, thus contributing to the development and research of association rules algorithm in the future. It can also provide some help for teaching reform [5].

2 State of the Art

The data mining algorithm of association rule started very early in foreign countries, and it has been the focus of foreign scholars. However, domestic research is very late, and it was brought up in the late 90s of the last century and developed slowly. However, foreign scholars and scientists have carried out detailed research and analysis on the association rules with the support of the developed computer technology [6]. So that the association rules develops rapidly. From the 80s of last century to the beginning of this century, the academic seminar on the topic of association rules has been held for fourteen times. What's more noticeable is that the use of association rule data mining in foreign countries has been divorced from the theoretical research stage, has begun a substantive probation period, and has played a huge role in education, medicine and other departments. It has achieved remarkable achievements in teaching reform [7].

At present, the research on association rules is still not very deep in China. Foreign countries have begun to put it into practice, but our country is still at theoretical research stage [8]. This is mainly because many scholars only focus on theoretical research but don't care too much about practical application. As a research topic, it has been studied by colleges and universities continuously. Because of the limitation of computer technology, the association rule algorithm developed too slowly, but the constant development of computer technology in recent years also promoted the research progress of association rules [9]. The research of association rules has been extended to many fields and has achieved some success. It is believed that the domestic research speed will catch up with foreign countries in the near future and reach the world class level [10].

3 Methodology

3.1 Calculation Steps of Association Rule Data Mining Algorithm

For the teaching reform, the association rule is a calculation rule that is very suitable for application. The association rules algorithm is used to study the teaching reform of international trade major under the background of internet plus era in details. But the association rules algorithm is combined with data mining, which can make our calculation more accurate and fast. For the use of association rules algorithm, the first thing is data mining. First of all, the data mining analysis is conducted on the data that we should pay attention to, and then the association rules are calculated, which is a safer way to deal with it. But data mining can't be interconnected without certain order and steps, so that the data excavated can be analyzed and sorted out in calculation, and

the data can be summed up and associated when association rules are calculated. The data mining steps of association rules can be divided into two steps. In the first step, based on the minimum support degree, the highest frequency item sets are found in a large amount of data that we associate with. In the second step, the association rules are deduced from the high frequency item sets according to the minimum confidence level. Figure 1 is the mining sequence of our data mining.

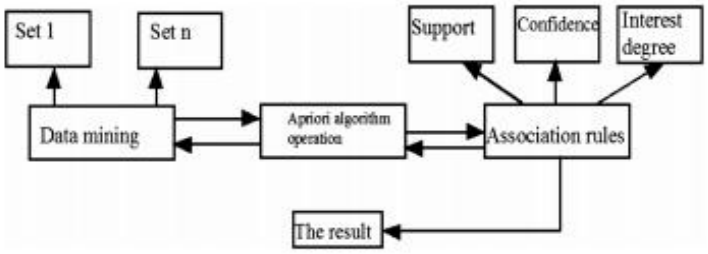

Fig. 1. Data mining calculation steps and methods

Through the information transfer path in above figure, it can be seen that our data is input into the data mining model to do simple data mining firstly, and then the data is calculated and analyzed simply through the data mining calculation rules set. Finally, data calculated by data mining is input to the Apriori algorithm phase in the next node. This part is the key step of using association rules algorithm. After data mining, the data are analyzed step by step here, and all the useless information is ruled out until the data left is highly correlated data. This part efferent data is highly concentrated, which is highly centralized by us. Then the data can be transmitted to the next stage, and the detailed study of association rules is carried out. Through the confidence, interestingness and other computing rules, the data we really want is rearranged and assembled, and then the calculation is conducted with the Apriori algorithm until the frequency of the data reaches our requirements. Finally, the data that meets our requirements are exported. This method of calculating back and forth is helpful to improve the accuracy of the data.

3.2 Research on the Algorithm of Association Rule Data Mining

Association rules and data mining are usually inseparable, and so are the applications in this paper, which is determined by the nature of data mining and association rules. Data mining is responsible for mining data carefully and doing deep analysis on a lot of data. The deep connection of many data is very close, and it's possible that the connections can't be found by simple associations and observations. Only through the form of data mining can the deep meaning of data be dug out, which is also a very important reason of data mining. Another point is that data mining can also analyze the connotation of the data simply, and the irrelevant data can be excluded in the data mining phase, which can also reduce the difficulty of association rules calculation in the next phase. It's very

easy that the association rules calculate the data after data mining. For the data that finishes the data mining, the association can be calculated easily, and the weight of all kinds of information in association rules can be analyzed, which is very important. Another difficulty is the calculation of the threshold of association rules. The algorithm research of association rules is analyzed and optimized strictly.

Next, the concrete formula and research content of association rule algorithm are introduced. The first thing introduced is the concept of "item". Items are the basis of association rules, and what the association rules calculate is the relationships among these items and the causal relationship between them as well as the importance comparison. Association rule is to associate one item with another and calculate them. Many items form a set, which is the same as the set in mathematics. The item set represents $I = (i_1, i_2, i_3 \cdots i_n)$, and the data item set represents $X = (k_1, k_2, k_3 \cdots k_n)$. The expression method of transaction item set is $D = (t_1, t_2, t_3 \cdots t_n)$. The introduction of the basic information about items is finished, and then the research of association rule algorithm calculation is started below.

The concept of "the support degree of item set" is introduced, and the support degree is the most important measurement standard in association rules, which has a great influence on the calculation results. The support degree of transaction D is $Suppert(X)$, and the probability is $P(X)$. The support degree contains probability, and the formula of support degree is defined as the following formula:

$$Suppert(X) = \frac{Sup(X)}{|D|} \tag{1}$$

The above formula $Sup(X)$ is the support degree of data set X.

The frequent item set is a measure unit, which is usually used to describe a threshold for describing transaction density. The frequent item set can be written in the form of min sup. In terms of the concept of support, this is the minimal support degree. Compared with $Suppert(X)$, the frequent item set is less than or equal to $Suppert(X)$. In the definition and calculation process of association rules, it can be found that in a transaction, any two item sets are associated with each other, but the size of the association is different. How to describe the strength of this association? The two concepts of support degree and credibility are introduced, and the two concepts are used to restrict. The associations needed are left, and the irrelevant or unnecessary associations are excluded. This allows the data to be included in the required range. Below is the introduction of the two concepts of credibility and support degree.

Before introducing the support degree and credibility, the concept of association rules should be introduced first. Association rules are similar to the implication expression $X \Rightarrow Y$. The X and Y are two disjoint item sets. The support degree and credibility are the parameter description used to express the strength of association rules.

The support degree: the support degree of item set $(X \cup Y)$ is called the support degree of $X \Rightarrow Y$, and it can be interpreted as the percentage of the $(X \cup Y)$ in the data, which is the probability size. The formula is expressed as follows:

$$Suppert(X \Rightarrow Y) = \frac{Sup(X \cup Y)}{|D|} \tag{2}$$

The credibility: The credibility in association rules is the ratios of the number of transactions that contain both X and Y to the number of transactions that contain X in the database, namely, the conditional probability $P(Y|X)$, and its manifestation is as follows:

$$Confidence(X \Rightarrow Y) = \frac{Sup(X \cup Y)}{Sup(X)} \tag{3}$$

The above is all the calculation formula about correlation algorithm. Many common problems can be solved by the above formula. However, this calculation method is still not enough for this paper, and it is difficult to meet the requirements of education reform. In addition, this calculation can lead to a very serious problem, that is, sometimes it is found that in the calculation the support degree and credibility are very high, but the relevance this item to the object of the study is not very strong, which is because the restrictions are not enough. Therefore, a new concept is introduced, that is interest degree. The emergence of interestingness can filter out many irrelevant factors automatically, plays an important role in improving the accuracy of calculation, can improve the anti-jamming ability of the association rules algorithm, makes the main research object more prominent, and reduces the computing time of association algorithm. The formula of interest degree is defined as follows:

$$I = Interest(X \Rightarrow Y) = \frac{confidence(X \Rightarrow Y) - Support(y)}{max\{confidence(X \Rightarrow Y), Support(y)\}} \tag{4}$$

According to this formula, it can be determined that the greater I than 0, the higher the interest degree is. The smaller I than 0, the lower the interest degree is. The above is all the rules and methods of calculation in this paper, but this method can only be realized by inputting it into the computer. Figure 2 is the computational steps in the computer designed.

In addition, when the model is built in the computer, the requirement of choosing database is also very high, and the database selection for different computations is summarized in Table 1 below.

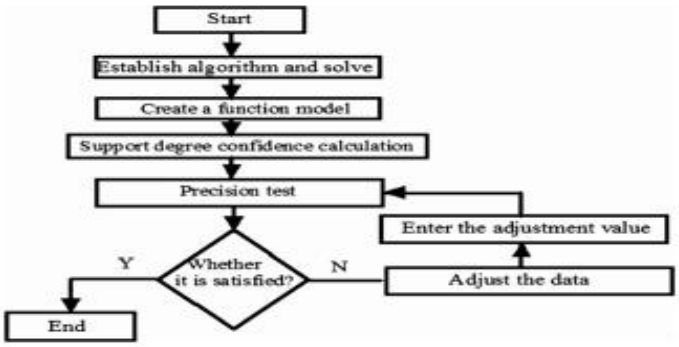

Fig. 2. The calculation steps in the compute

Table 1. Association rules data mining algorithm in the project management application database selection table

Amount of information	Number of concurrent data access records (per/sec)	System stability requirements	Maintenance level	Candidate database
Medium (20–100)	5000–50000	Moderate	General	SQL Server, MySQL
Large (100–1000)	50000–200000	Relatively high	Better	SQLServer, Oracle
Very large (over 1000)	More than 200000	High	Good	Oracle

4 Result Analysis and Discussion

After the calculation rules of the algorithm and the establishment of the computer model are finished, it is necessary to test the use of the algorithm. Through test, the problems or deficiencies in algorithms are found for later modification and maintenance. It can also prove the superiority of the algorithm.

A computational experiment of five projects is established, the items are A/B/C/D/E, and the weight of each part is set as 0.9, 0.6, 0.5, 0.4 and 0.2. It is assumed that the minimum support degree σ is 0.35, the threshold τ is 3. The maximum possible length of state frequent item set is 4. Then, the data mining is tested and calculated. Firstly, the first iteration is made on the parameters, and the number of expenditures of the five sets is obtained. According to the formula: support degree = support number/total number of transactions, C_1 is obtained. Then, according to the minimum transaction support degree set 0.56, the set L_1 is obtained. The calculation set table is shown in Table 2. The calculation process of the following table is as follows, and the weighted temporal support degree of item set A is $S(\{A\}) = W(A) \times \frac{3}{6} = 0.45 \geq 0.35$.

So item set A is a frequent item set, for item set B, $S(\{B\}) = W(B) \times \frac{3}{6} = 0.3 \leq 0.35$. So B is not a frequent item set. With this method, the results of the following table are obtained eventually. The frequent item sets of weighted state are $L_1 = \{\{A\}, \{C\}, \{D\}\}$.

Table 2. Calculation of the data collection table

C1			C2			C3		
Item set	Support count	Life cycle	Item set	Support count	Life cycle	Item set	Support count	Life cycle
A	3	[1, 6]	AB	2	[1, 6]	ABE	2	[1, 6]
B	3	[1, 6]	AC	2	[1, 6]			
C	3	[1, 3]	AE	2	[1, 6]			
D	4	[2, 5]	BE	**2**	[1, 6]			
E	3	[1, 6]						

The above experiments show that the algorithm not only can calculate the reasonable results, but also has advantages over other methods. In this paper, the calculation steps of association rules algorithm are much shorter than those of other algorithms, so that the computation time is shortened greatly. The advantages of the algorithm used in this paper are prominent, and the algorithm has good practicability compared with other algorithms. Through calculation test, it is found that there are many advantages of the algorithm used in this paper, and the summary is in Table 3.

Table 3. Comparison of the algorithm and the general algorithm

Algorithm class	Advantage	Disadvantages
Algorithm	Calculate a small amount	The calculation rules are cumbersome Set up more trouble
	High accuracy	
	Eliminate, do not repeat the calculation	
General algorithm	Longer use	Accuracy at the end Calculate for a long time
	Computationally cumbersome	

In addition, when support degree is different, the percentages of important item sets are also compared. The objects of the comparison are the association rules algorithm used in this paper and the traditional algorithm. The histogram of the two columns' percentages of important items is made for analyzing, as shown in Fig. 3.

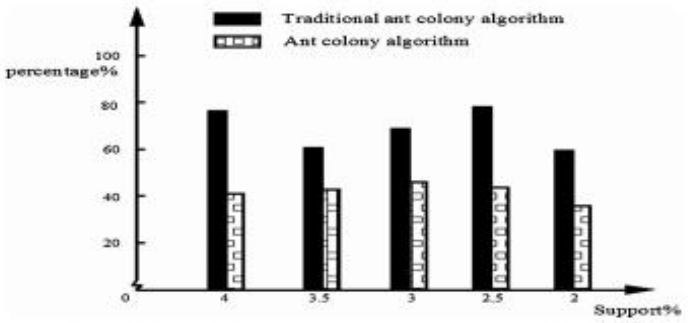

Fig. 3. The two important items set percentage of the histogram

From the figure above, it can be seen that no matter how much the support degree is, the percentage of important items calculated by the association rules algorithm in this paper is higher than the traditional algorithm, which shows that this algorithm has great advantages and good practicability. The results of data mining by the algorithm used in this paper have more practical value, and can provide powerful help for policy makers. Through the analysis of the above experimental results, it can be concluded that the association rules algorithm used in this paper has a strong use value and accuracy, and can calculate more results in shorter time. Not only the time used is short, but also the calculation result is more accurate than the traditional algorithm. It's an algorithm that works well.

5 Conclusions

The continuous development of computer technology has brought unlimited possibilities. With today's advanced computer technology, computers can be used to do a lot of work that people can't do or can't do very well, such as the teaching reform of international trade major under the background of internet plus era. At the present stage of international trade major, there are many places that should be paid attention to for a good education reform. These things are often done by human beings, which can cause a lot of oversight and errors. Therefore, a model using association rules algorithm was established in this paper to promote the progress of the reform. Through the test of association rules algorithm, it is found that the minimum support degree σ is 0.35, and the threshold τ is 3, and the maximum possible length of state frequent item set is 4, the algorithm can calculate the calculation results at a very fast speed through a simplified algorithm. Then, the contrast experiments on the percentage of important item sets with different support degree are also carried out. Through the test, it can be found that the percentage of important items calculated by the algorithm used in this paper is around 70%, while the percentage of important items calculated by the traditional algorithm is about 45%. The algorithm used in this paper has great advantages. Despite this, we still need to continue to work hard, and better algorithms should be worked out for the benefit of society.

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