Chapter 212
Application of Data Mining in the Assessment of Teaching Quality

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Abstract More and more attention paid to the teaching quality of college, the assessment of the teaching quality is of great importance. Traditional teaching evaluation methods have a lot of deficiencies, not identifying what factors are really bound up with the quality of teaching. This paper applies the improved Apriori algorithm QApriori based on data mining technology to teaching evaluation model. On the foundation of data mining definition, mining processes, common data mining methods-Apriori and its improved algorithm-QApriori, this thesis emphasizes study on QApriori in the teaching evaluation model. Through the analysis of data mining, we have come to what factors are mainly related with the teaching quality, which will be very important to teaching and education policy-makers.

Keywords Teaching quality evaluation · Data mining · Association rules · Qapriori

212.1 Introduction

Large-scale enrollment in higher education, on the one hand has provided people with more access to higher education, while on the other hand, students' quality is bound to decline due to the relative reduction of educational resources. Therefore, strengthening the building of faculty, and strengthening the quality of teaching evaluation is of great significance. However, teaching evaluation methods are almost used to just evaluate the level of teaching quality bad or good, which is difficult to explain what factors are related with the teaching level really, that is, it

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is difficult to indicate our teachers in which features, quality of teaching will be relatively high. Especially with the rapid development of computer technology, and the widely used database management system, more and more data is accumulated, but it is not easy to discover hidden relationships in the large data and rules.

Data mining is a decision support process, extracting implicit but potentially useful information and knowledge from a large number of incomplete, noisy, fuzzy and random data. Data mining is the process to find useful information in large data repository automatically [1]. Data mining as a analysis method of deep level applied in the evaluation of the teaching is undoubtedly very useful, analyzing the hidden intrinsic link between the standard of teaching with a variety of factors comprehensively, for example, after the analysis of the data in the database system of teaching evaluation, similar problems can be answered, such as "What are the factors that may affect the level of teacher's teaching", which traditional evaluation methods can not have.

212.2 Data Mining

212.2.1 Concept of Data Mining

Data Mining as an indispensible step of knowledge discovery in databases [2] generally refers to a process that automatically searches hidden information which has a special relationship from the large amount of data process. In other words, that is a process extracting implied, unknown in advance but potentially useful information and knowledge from a large number of incomplete, noisy, fuzzy and random data.

212.2.2 The Process of Data Mining

Data mining process includes the definition of the problem, data preparation, data mining, results analysis and the use of knowledge as shown in Fig. 212.1.

212.2.3 The improvement of Apriori algorithm: QApriori

There are many methods of data mining, including association rules, clustering analysis, decision tree method, and neural grid method and so on. However, the most common is association rules. Apriori algorithm is one of the most influential algorithms of frequent item sets mining Boolean association rules [3]. QApriori

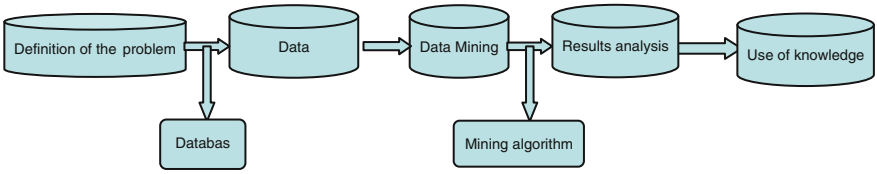

Fig. 212.1 Data mining process

Unlike classic Apriori algorithm data structure uses linked list. There are three nodes, respectively; the itemsets head node, entry node and transaction node. One-level brother node of a linked list ascend order from left to right in accordance with the support count of subset and the benefits of doing so is that even if 1-itemsets is great, it will only produce few candidate 2-itemsets and then generate fewer candidate 3-itemsets, and much fewer go on, the candidate sets will be greatly reduced, thereby system performance is greatly improved. The basic idea of Algorithm QApriori: The improved algorithm QApriori using the data structure of linked list, the head node of k-itemsets K-itemSetHead1 has two pointers, one points the first node K-itemSetNode1 of k-itemsets, and the other points the head nodes of (k + l)-itemsets. Each item Node also has two pointers, one pointer to the first transaction of the transaction set, and the other to the next node. Transaction node AKN has a pointer which points to the next transaction node. The building process of the linked list is as follows:

(1) The entry node K-itemSetNode1 points ascend order from left to right in accordance with the 1-subset support that will produce fewer candidate sets.
(2) Scan and connect all the 1-itemset nodes according to the order of increasing support, and at the same time merge the same affairs AKN to generate 2-itemset nodes.
(3) Scan and connect all the 2-itemset nodes according to the order of increasing support, and at the same time merge the same affairs AKN to generate 3-itemset nodes.
(4) And so on until new item nodes are not generated.

212.3 Teaching Quality Assessment Model

The quality of teaching has associated with many factors, and we selected eleven major impact indicators, including compliance disciplined, strict management; prepare lessons fully teachers; clear point of view, clear concept; featured content, update knowledge; practice, appropriate illustration; focused, coherent; individualized focus on inspiration; vivid language, easy to understand; various means, blackboard writing orderly; knowledge to grasp, capacity-building; thinking

Table 212.1 Teaching quality evaluation index and weighting coefficient

Index code	Evaluation indicator	Weighting coefficient
1	Compliance disciplined strict management	0.06
2	Prepare lessons fully teachers	0.04
3	Clear point of view clear concept	0.15
4	Featured content update knowledge	0.15
5	Practice appropriate illustration	0.08
6	Focused, coherent	0.07
7	Individualized focus on inspiration	0.12
8	Vivid language, easy to understand	0.08
9	Various means blackboard writing orderly	0.10
10	Knowledge to grasp capacity-building	0.08
11	Thinking pioneering interested inspire	0.07

pioneering interested inspire [4]. Different factors given different weights, we use $R = \Sigma Q_i P_i$ to calculate the evaluation scores for each teacher; Q is the Quantitative Evaluation index Point; W is the weighting coefficient. Weights of various impact indicators are shown in the Table 212.1.

212.4 The Application of Data Mining in Teaching Quality Assessment

212.4.1 Data Selection

We select ten teacher's evaluation data from a large number of teaching quality assessment data stored in the school's information management system. In accordance with the calculation method of teaching quality scores in III, we have come to ten teachers' fraction of the eleven evaluation indicators shown in Table 212.2. 1, 2, 3,…. 11 represent the eleven impact indicators in Table 212.1, 200799017514, 200799017970….. 200893000001 are randomly selected ten teachers.

Table 212.2 Teaching quality assessment information data

编号	1	2	3	4	5	6	7	8	9	10	11
200799017514	5.3	3.55	13.4	13.2	7.1	6.2	10.4	7	8.7	7.1	6
200799017970	5.4	3.8	13.7	13.4	7.4	6.2	10.7	7.3	7.2	7.5	6.3
200893000001	5.6	3.8	13.9	13.4	7.1	6.4	10.6	7.1	9	7.1	6.3
……..	…….	…….	…..	……	….	…..	……	……	……	……	…….
201090000012	5.6	3.8	13.9	13.6	7.4	6.5	10.9	7.3	8.9	7.5	6.3

Table 212.3 The binary relation of the teaching quality data

AKN	a	b	c1	c2	c3	c4	d1	d2	d3	e	f	g1	g2	g3	g4	h	i	j	k
1	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1	0	0	0	0
2	0	1	0	1	0	0	0	1	0	1	0	0	1	0	0	1	0	1	1
3	1	1	1	0	0	0	0	1	0	0	1	0	0	1	0	0	1	0	1
……	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…
10	0	0	0	0	1	0	0	0	1	0	0	0	0	1	0	0	0	0	0
support	0.5	0.8	0.3	0.2	0.3	0.2	0.3	0.5	0.2	0.4	0.4	0.3	0.2	0.3	0.2	0.4	0.5	0.4	0.5

212.4.2 Data Processing

The evaluation Data in the Table 212.2 is all quantitative attribute. In order to make discretization, we transform it into Boolean type. The following is the transformation rule, 1——>a, segmentation a1>5.55, a2<5.55;2——>b, segmentation b1>3.65, b2<3.65;3——>c, segmentation c1>13.75,13.65<c2<13.75,13.55<c3<13.65,c4<13.55;4——>d,segmentation d1>13.55,13.35<d2<13.55,d3<13.35;5——>e segmentation e1>7.25,e2<7.25;6——>f segmentation f1>6.35,f2<6.35;7——>g segmentation g1>10.75,10.65<g2<10.75,10.55<g3<10.65,g4<10.55;8——>h segmentation h1>7.15,h2<7.15;9——>i segmentation i1>8.85,i2<8.85;10——>j segmentation j1>7.25,j2<7.25;11——>k segmentation k1>6.15,k2<6.15

In order to facilitate the use of the improved algorithm QApriori,we convert the data changed above into a binary relation table. Assuming the support was 40 %, Table 212.3 shows the conversion,

Ascending the order according to the support count, we get the item set {E, F, H, J A, D2, I, K, B}, and frequent itemset 1-itemset is produced. Generating item set and so on according to the improved algorithm QApriori, frequent item set 4-itemset is emerged at last as shown in Fig. 212.2.

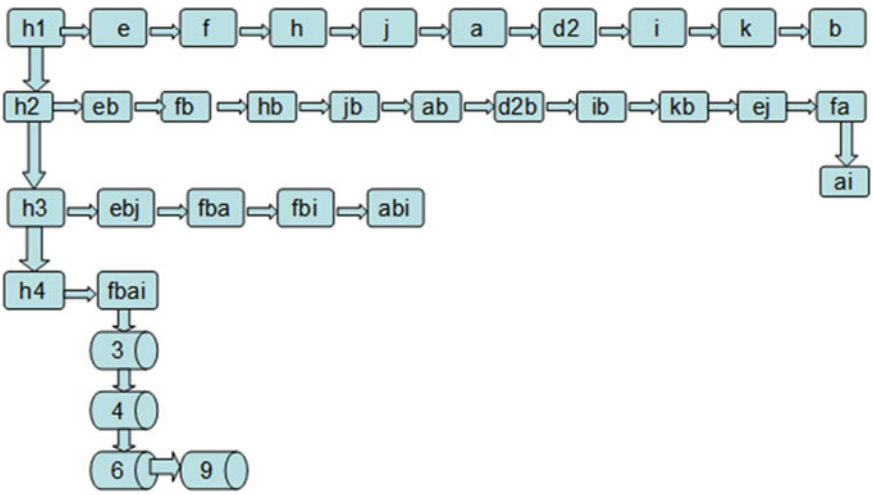

Fig. 212.2 Frequent item set 4-itemset

212.5 Conclusion

This paper describes the importance of teaching quality assessment as well as the assessment of teaching quality defects at the present, showing the advantages and concernment of data mining techniques applied to teaching quality evaluation. Analyzing the classic association rules algorithm Apriori [5] and its shortcomings, put forward an improved algorithm QApriori, and this algorithm is applied to the evaluation of teaching. Exploring several major factors influencing teaching evaluation, we have come to the conclusion that teachers who prepare lessons fully; focus, coherent; various means, blackboard writing orderly generally demand themselves and managing students strictly and the classroom atmosphere is also better. Data Mining applied to the teaching evaluation can not only make the teaching quality get a better rise, but also be more conducive to the work of the education makers.

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