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## The Impact of Big Data on the Teaching Development of University Teachers in the Mobile Internet Era



**Abstract:** - With the continuous development and progress of network and information technology, Internet + has gradually penetrated into various fields. Internet + is to apply Internet technology to various traditional industries, organically combine traditional industries with information technology, and develop traditional industries. In order to objectively and accurately evaluate the teaching quality of college teachers, a teaching quality evaluation method based on sawfcm algorithm is proposed. This method takes the influencing factors related to teaching quality as samples in the feature space. Each run re classifies each state and updates the weight of each sample based on the current data, but it is highly dependent on the randomly selected initial clustering center and the randomly generated initial membership matrix. Taking our university as an example, the experimental analysis is carried out to verify the feasibility of the model.

**Keywords:** "Internet +"; University mathematics; Course teaching innovation; Education mode.

### I. INTRODUCTION

At present, most university mathematics teachers have relatively old-fashioned educational concepts, still using the old injection education methods for mathematics teaching, organizing mathematics classroom education in the form of teachers speaking and students listening, making it difficult to effectively infiltrate virtual reality technology, multimedia technology and Internet technology into the mathematics classroom, and to fully integrate information technology and new educational methods such as inquiry-based teaching and heuristic teaching, which is bound to have a negative impact on the application of Internet+ in university mathematics education[1]. Moreover, most teachers have a relatively superficial understanding of Internet+ education, thinking that Internet+ education means applying information technology to teaching in the classroom, but they do not look at mathematics teaching with Internet thinking, and thus cannot use Internet+ thinking to innovate teaching evaluation and education models[2]. In addition, some teachers focus unilaterally on the use of educational tools such as mathematics education software and multimedia technology, ignore the essence and educational goals of mathematics education, regard the use of information technology as the key task of classroom education, and then generate teaching problems of putting the cart before the horse and putting the cart before the horse[3-4].

in the Internet environment, students can collect mathematics education resources through platforms such as E-class, micro-lessons and mu-classes, etc. Although these effectively extend the channels for students to learn mathematics and enrich the learning forms, they also weaken the students' emotional and ideological identification with teachers' classroom education[5][6].

However, in university mathematics classrooms, the number of students is generally large, making it difficult for mathematics teachers to design educational content or teaching processes based on each student's specific learning feedback, and teachers can only organize educational activities according to students' overall conditions and individual educational experiences[7-9]. In addition, bound by the ideology of exam-oriented education, most teachers lack the concept of student-centered education and tend to carry out mathematics education in the form of didactic posture and knowledge authority, which undoubtedly deviates from the student-centered, interactive and participatory Internet + thinking and is not conducive to teacher and student interaction and teaching feedback[10][11].

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Therefore, this paper organically combines traditional industries with information technology to develop traditional industries. In order to objectively and accurately evaluate the teaching quality of college teachers, a teaching quality evaluation method based on sawfcm algorithm is proposed.

## II. RELATED WORK

University faculty development is the process of continuous improvement and refinement of teachers' professionalism through various ways and means of theoretical learning and practical activities[12]. A university faculty development organization is a community of learning and practice for faculty dedicated to achieving the pedagogical, professional, personal, and organizational development of university faculty[13-14].

The revolutionary impact of information technology on educational development. [15-16] explores the structure and responsibilities of individual university faculty development organizations, the structural features, program design, and operational mechanisms of university faculty development organizations; or examines the history and evolution of a particular faculty development organization from the perspective of organizational growth. [17] explores the interaction between university faculty development departments and educational technology departments, and there is also little coverage of how to integrate faculty teaching development resources with educational technology resources at the institutional level [18]. [19] from the perspective of innovation diffusion theory, it is important to understand the attitudes of university faculty developers toward educational technology under the influence of technology culture and to explore the path of integration of university faculty teaching development and educational technology to enhance the professionalization of university faculty development centers in China and to play the role of educational technology in promoting university faculty teaching development.

[20]provides a model for estimating the socioeconomic value of the Internet: as more users of new technologies become available, the value each user derives from their application continues to increase, and the market-driven cost of new technology use continues to decline.[21] moving from visual instructional media to the design of instructional processes, behaviorist psychologists played the role of early teacher developers.[22]faculty development organizations built on institutional educational technology departments, the core work of such faculty development organizations is the development of faculty instructional development programs by educational technicians in collaboration with curriculum developers [23].

## III. IMPROVING THE O-APRIORI ALGORITHM

### A. *Bottleneck of Apriori algorithm and improvement ideas*

The bottleneck of Apriori algorithm is mainly in the performance, iterative traversal of the database, the system load is too large, especially in the face of massive data, cyclic full library scan mode, the system overhead growth will show an exponential increase, the reduction of efficiency is obvious. At the same time, the process will generate a large set of candidates, and the algorithm will become extremely complex and poorly executable during the process of iterative and repeated comparison of large scale data.

Firstly, it is necessary to do a cut of the database to generate multiple blocks of data with comparable magnitude, with the aim of scanning to reduce the magnitude of the data. Using a distributed approach, 1-3 data blocks are processed at different nodes to generate 3 local frequent itemsets, and the frequent itemsets of each node are concatenated to form a candidate frequent itemset for the node.

The frequent itemsets for each distributed node are concatenated to eliminate the duplicate frequent itemsets and generate the overall frequent candidate itemsets. At the same time, a full library traversal is performed to obtain a reasonable value of the support degree, which is compared with the minimum support degree improved by the correlation degree to derive the frequent itemset.

Combining the traditional Apriori algorithm of support and confidence calculation method, the association degree calculation model is added to obtain the exact association rules.

B. Distributed frequent itemsets

The computational flow of obtaining frequent itemsets using distributed parallel computation is shown in Figure 1, and the execution flow of the local candidate set of O-Apriori algorithm is shown in Figure 2.

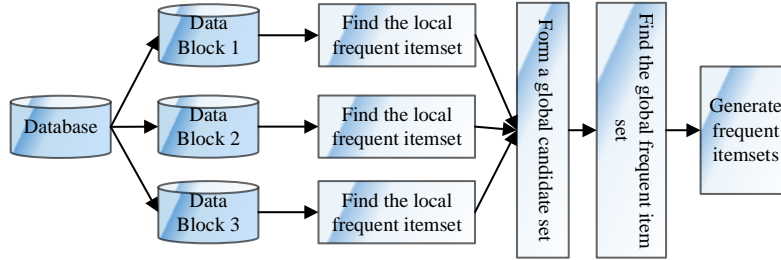


Figure 1 Process of candidate set generation by introducing distributed O-Apriori algorithm

Advantages of the improved algorithm: only two scans are required to mine the full set of frequent items, and the overhead on algorithm execution is reduced. The mining process of local frequent itemsets in each node is non-dependent, which reduces the communication between nodes and improves the efficiency of the algorithm.

The optimized O-Apriori improvement algorithm is described in detail as shown in algorithm 1.

**Algorithm 1:** optimized O-Apriori improvement

Input: sliced database blocks; minimum support threshold  $min\_sup$

Output: local frequent item set  $L$

$H_K = function\_serch(1)$  // Find frequent itemset 1

For ( $i=2$ ;  $H_K \neq null$ ;  $i++$ ) { // Cycle through the data blocks and exit the cycle when there is an empty set

$G_K = function\_Appro(H_K)$ ; // Obtain the candidate set  $K-1$

While( $J$  is in  $C$ ) { // Recurring statistical measures

$G = substrac(cm, J)$  // pruning step

While ( $cis$  in  $G$ ) {

$G.num++$ ;

}

$H_K = \{ g \in G_K \mid G.num > min\_sup \}$  // Obtain the candidate set under the support degree

}

Return  $H = H_K$

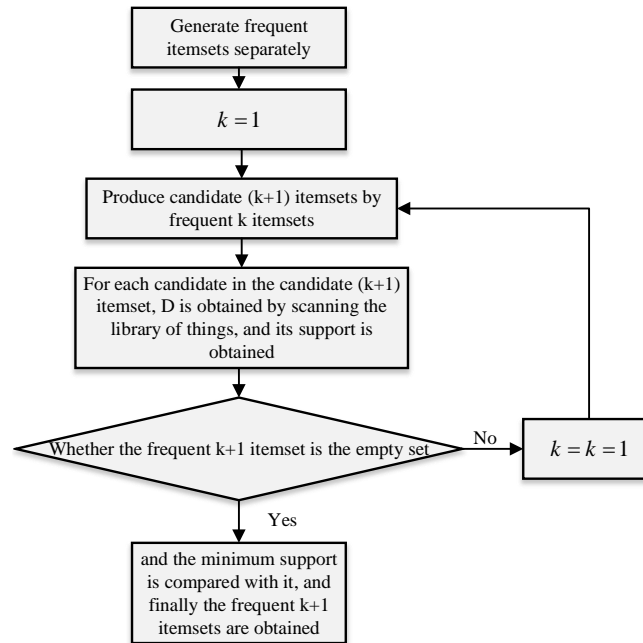


Figure 2 O-Apriori algorithm local candidate set execution flow

C. Association degree calculation model

The key to association rule generation is the setting of support and confidence. In this paper, association values are introduced in the process of finding support and association thresholds to further improve the reasonableness of support and confidence thresholds. In this paper, the association degree calculation model of physical education teaching quality evaluation is introduced based on the integration of correlation interest degree and difference interest degree in the field of data mining, and the specific algorithm is as follows.

$$\text{Int}(L \Rightarrow K) = \text{Conf}(L \Rightarrow K) + \log \left( \frac{D - \text{Count}(L)}{\text{Count}(L) + \text{Count}(K \cup L)} \right) + \frac{\text{Conf}(\bar{L} \Rightarrow K) - \text{Supp}(K)}{\text{Max}(\text{Conf}(L \Rightarrow K), \text{Supp}(K))} \quad (1)$$

The definition in equation (1)  $\text{Conf}(L \Rightarrow K)$  is the confidence level for obtaining the association rule,  $L$  represents the title,  $K$  is the average data, commonly speaking, the teacher is an associate senior title for  $L$ , the quality of the class is evaluated as excellent  $K$ , if  $\text{Conf}(L \Rightarrow K)$  is 20%, which means that 20% of the teachers with the title of associate senior have excellent quality of the class.  $\text{Conf}(\bar{L} \Rightarrow K)$  is the degree of differential interest, which is the opposite rule to the confidence level. If the value is 20%, this means that 20% of the teachers with the title of non-associate senior have excellent quality in their classes.  $\text{Max}(\text{Conf}(L \Rightarrow K), \text{Supp}(K))$  represents the evaluation value, and the evaluation confidence is between 0 and 1. In this algorithm, the support degree of  $\text{Supp}(K)$  and its  $\text{Conf}(L \Rightarrow K)$  difference operation are performed, and the larger the budget result, the smaller the association degree, and the opposite, the higher the association degree. On the other hand, when the total amount of data  $D$  remains unchanged, a decrease in  $\text{Count}(L)$  indicates an increase in the degree of association, an increase in  $\text{Count}(L)$  indicates a decrease in the degree of association, and when the  $\text{Count}(L)$  count result increases, the degree of association increases.

The association model is introduced to the rule extraction as shown in algorithm 2.

**Algorithm 2:** association model

Input: set the input to the set of frequent items, the value of minimum confidence and interest

Output: association rules, the final key factors affecting teaching quality

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for(  $k=2, K++, K < \text{lengt}(L)$  ){
 $G_i = \{ L_m \}$  // Rules document
If (  $L_m$  Contains itmes)
Then apply the O-Apriori algorithm with input parameters  $L_i$  and  $G_i$  to obtain the rules
Calculate the support and confidence Conf
If ( Conf < minimum confidence)
Delete  $h_i+1$  candidate set
Else
Introducing the formula of the correlation algorithm, calculating the correlation
The support degree of  $IntG_i$ 
If (the support degree  $IntG_i >$  minimum support degree)
Generate the final association rule

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*D. SAWFCM-based teaching quality assessment model for university teachers*

The data mining stage is the core part of the whole big data-based teaching quality assessment system for university teachers. The standardized data obtained from the data processing stage can be analyzed by the given clustering algorithm to obtain the teaching quality classification of university teachers.

By applying SAWFCM algorithm to the data mining stage, the teaching quality related influencing factors are used as samples in the feature space in the iteration, and the latest data obtained are re-clustered and the weights of each sample are recalculated and updated, as shown in algorithm 3.

For a given teaching quality evaluation dataset  $X = \{x_i, i = 1, \dots, n\}$ ,  $u_{ik}$  is the affiliation degree of sample  $x_i$ .  $k$  for the  $k$  th class, which takes values in the range  $[0,1]$ ;  $c_k$  is the cluster center of the  $k$  th class  $C_k$ ;  $d_{ik} = \|x_i - c_k\|$  is the Euclidean distance between  $c_k$  and  $x_i$ ;  $m$  is the fuzzy factor, whose data can be set to produce a positive correlation on the fuzzy degree of the sample, and the value of  $m$  is taken as 2 without any special requirements. the specific steps of the university teachers' teaching quality evaluation model can be given by the adaptive weight and distance calculation method of SAWFCM .

**Algorithm 3** :SAWFCM algorithm

Input: data set  $X$  , number of clusters  $C$  .

Output:  $c$  clusters.

Step 1, Initialization: The value range of  $c$  is  $2 \leq c \leq n$ , where  $n$  is the size of the dataset. Set the iteration threshold  $d$  and the fuzzy factor  $m = 2$ . Randomly create an affiliation matrix  $U$  with the value range  $[0,1]$  and satisfy the constraints in Eq.  $\sum_{k=1}^c u_{ik} = 1, \forall_i = 1, \dots, n$ .

Step 2, calculate the cluster centers  $c_k$  : Use equation  $\sum_{i=1}^n u_{ik}^m x_i / \sum_{i=1}^n u_{ik}^m$  to calculate  $c$  cluster centers  $c_k$  .

Step 3, Calculate the radius parameter  $\mathcal{G}$ : Calculate the radius parameter  $\mathcal{G}$  from equation  $\mathcal{G}_k = \frac{1}{|C_k|} \sum_{x_i \in c_k} d_{ik}$ , based on the current data differentiation pattern.

Step 4, Calculation: Normalize the effect of processing sample  $x_i$  corresponding to the class to which it belongs by equation  $w_{i,k} = f(i,k) / \sum_{i=1}^n f(i,k)$ , where  $f(i,k) = e^{-d_{ik}^2 / \mathcal{G}_k^2}$ .

Step 5, update the affiliation matrix  $U'$ : as the sample weights, calculate and update the affiliation matrix by Hadamard product, and calculate the corrected weighted affiliation matrix based on Eq.  $u'_{ik} = w_{ik} * u_{ik}$ .

Step 6, update the clustering center  $ck$ : According to step 5, the clustering center  $ck$  is updated by the equation  $ck = \sum_{i=1}^n u'_{ik} x_i / \sum_{i=1}^n u'_{ik}$ .

Step 7, output the clustering result: when the objective function  $J(U, c_1, \dots, c_c) = \sum_{k=1}^c \sum_{i=1}^n u'_{ik} d_{ik}^2$  tends to be smooth or the iterative frequency is greater than the set threshold, output the clustering result and end the algorithm, otherwise, the algorithm jumps to step 3.

#### IV. EXPERIMENTAL VALIDATION AND ANALYSIS

The experimental database selected in this paper is the physical education learning achievement and teacher evaluation data from our university's 2020 teaching quality management and evaluation system with a total of 300,000 pieces of data. In the experimental procedure, O-Apriori algorithm is used to mine the frequent item set and introduce the correlation degree for the calculation of support and confidence thresholds. The evaluation data of teachers' titles and teaching styles and teaching attitudes are taken as examples,As shown in Table 1.

Table 1 Experimental data

Score	Multimedia teaching	Multimedia teaching	Total
Students listen attentively	40	20	60
Students do not listen carefully	34	14	48
Total	74	34	108

The data in Table 1 illustrate that 40 teachers and students among those with high student concentration chose multimedia instruction, 20 chose multimedia instruction, 34 teachers who did not listen carefully did not choose multimedia instruction, and 32 teachers who were not associate high did not use multimedia instruction. The support level is 31%: the confidence level is 69%.

Where  $L$  represents the title and  $K$  is the average data, setting the minimum support at 30% and the minimum confidence at 69%, which indicates that the rule of using multimedia teaching and students listening attentively is positively correlated holds.

The use of multimedia instruction is likely to reduce students' concentration and the absolute value of support is less than the minimum support threshold, indicating that the rule is incorrect. Therefore, the wrong association rule can be effectively eliminated by this algorithm. In order to verify the performance improvement of this algorithm over the classical Apriori algorithm, experiments were conducted in terms of time, and the results are shown in

Table 2: The distributed processing mode adopted by the O-Apriori algorithm largely improves the processing speed of the algorithm, and the mode of scanning the database in batches reduces the amount of processing the database in a single time and improves the efficiency of the algorithm.

Table 2 Comparison of time performance between traditional Apriori algorithm and O-Apriori algorithm

Support Threshold Confidence Threshold Traditional apriori algorithm			O- apriori algorithm	
			Relevance Threshold 0.4	Relevance Threshold 0.5
0.5	0.6	50	53	44
0.1	0.6	30	27	28
0.15	0.6	3.5	3.3	3.5
0.20	0.6	0.7	0.4	0.4
0.25	0.6	0.3	0.2	0.3

In this paper, five minimum support thresholds are chosen to compare the data of the traditional Apriori algorithm with the O-Apriori algorithm in association rule mining accuracy. The specific results are shown in Figure 3.

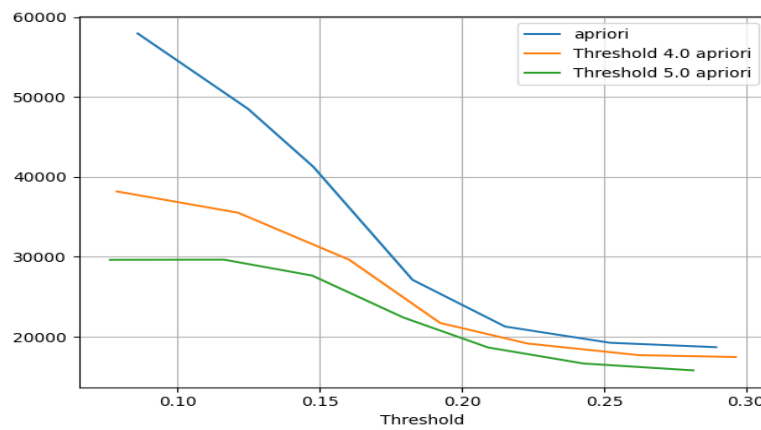


Figure 3 Data comparison between traditional Apriori algorithm and O-Apriori algorithm in association rule mining accuracy

According to the data, the amount of association rules identified by the traditional Apriori algorithm and the optimized O-Apriori algorithm under the same threshold of minimum support has a larger query, and the number of association rules of the optimized algorithm is less, which indicates that the algorithm of this paper can filter the association rules with less strong association and error by the university.

Applying the SAWFCM algorithm based on the evaluation model of teaching quality of college teachers, the experimental results in Table 3 are finally obtained through the model calculation, and the teaching quality is divided into A, B and C categories, among which A category is excellent, B category is good and C category is qualified.

Table 3 Experimental results

Category	Number of data	Data Characteristics
A	4	Associate Professor, Lecturer (Dual-Teacher)
B	3	Lecturer
C	3	Assistant Professor

From Table 3, we can see that the dual-teacher teachers with high titles and rich teaching experience and practical experience are more favorable to the students. Some young teachers are relatively inexperienced in teaching and unfamiliar with the relevant teaching content, resulting in less satisfactory teaching evaluation. Teachers in higher education should actively organize activities that can promote experience exchange among peer teachers, such as lecture, micro-lesson competition, lesson plan sharing, etc., in order to achieve the good effect of mutual learning and improvement and improve the quality of teaching in the whole school. According to the experimental results, higher education teachers can recognize their own shortcomings in time, so as to improve their teaching level in a purposeful and targeted way.

## V. CONCLUSION

This study proposes an evaluation model of College Teachers' teaching quality based on sawfcm algorithm, and takes our school as an example to verify the feasibility of the evaluation model. This paper organically combines traditional industry and information technology. However, the evaluation system is not comprehensive, the accuracy of the algorithm needs to be improved, and the algorithm can not automatically obtain the number of clusters. The next step is to improve the teacher teaching quality evaluation system based on big data and improve the fuzzy clustering algorithm, so as to make a more accurate evaluation of the teaching quality of college teachers.

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