Exploration and Practice of Informatization Means in the Quality Supervision of College Classroom Teaching

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Abstract. Constructing the monitoring system of teaching quality in colleges and universities is an effective and effective means of reforming higher education. The monitoring of classroom teaching is an important part of the monitoring system of teaching quality in colleges and universities. In this paper, the artificial intelligence technology at the forefront of information technology in recent years is applied to the classroom teaching monitoring in colleges and universities. From pre-class attendance to classroom state, information and means are used to monitor students and teachers in all aspects. Using machine learning related algorithms to analyze attendance and classroom state data and final grades, and improve the quality of classroom teaching quality monitoring. This expectation provides a certain reference for China's higher education reform.

1. Introduction

Since the 18th National Congress of the Communist Party of China, the party and the state have continued to promote the reform of higher education and plan for the development of higher education. On September 3, 2018, the Ministry of Education issued the document "Notice of the Ministry of Education on the Implementation of the Spirit of the Undergraduate Education Work Conference of the National Higher Education In the New Era", emphasizing the comprehensive rectification of education and teaching order and strict supervision of undergraduate teaching quality.

The quality of teaching can be defined as the degree of conformity between the ability level of a university to train students and the goal of the school's development plan [1]. In addition, it can be more specifically expressed as the degree of conformity between the basic quality and ability development level of the various disciplines of the students and the objectives of the discipline training program [2]. The quality monitoring of classroom teaching determines the quality of teaching to a large extent, and there are many problems in the traditional quality monitoring methods of classroom teaching. Before class, attendance generally adopts the method of manual signing and attendance form. This method can't solve the problem of signing the code. Therefore, it is impossible to urge students to attend classes on time from the time and attendance means. In class, the student's situation is controlled by the class teacher most of the time, even if the school regularly checks. The situation of the class, but most of the random checks are in the form, unable to effectively control the
students’ class situation, and cannot define the quality of the students from the detailed classroom performance data. In addition, the teacher’s quality assessment is only completed by the student’s final evaluation. The subjective factors of the students are occupied more, the enthusiasm of the teachers is not easy to mobilize, and the quality of teaching cannot be guaranteed.

This paper combines the information technology such as artificial intelligence with the quality control of classroom teaching, and forms a comprehensive monitoring and management system from the attendance of attendance to the students and teachers in the class. For the student image behavior data obtained by the monitoring management system, the students in the same course different teachers’ attendance data, the same class different courses to the lesson data, data analysis, improve students’ enthusiasm for class, and urge teachers to improve the quality of teaching. The results of data analysis can provide direction for schools to formulate teaching policies, and even provide some reference for the reform of education industry.

2. The connotation of informationized classroom teaching monitoring system
The information-based classroom teaching monitoring system uses the face recognition and radio frequency card reading technology to attend the attendance and attendance of the students and teachers before class. The class uses the camera to collect data such as the students and the teacher’s class movements. The student’s class rate data and student class action image data are uploaded to the backend server in real time. At the end of the period, the students’ final grades are summarized. The back-end management system uses the association rule mining algorithm in artificial intelligence technology to statistically analyze the students’ daily school data and student scores. It uses data thinking analysis to find the intrinsic link between class data and final grades.

The informationized classroom teaching monitoring system relies on information means, and has the following significance in the formation and improvement of the teaching quality monitoring system.

2.1. Help build a teaching monitoring and evaluation system
A scientific and efficient evaluation mechanism is a necessary prerequisite for ensuring the rational formation of the teaching monitoring system [3]. The informationized classroom teaching monitoring system acquires classroom data and analyzes classroom data in a credible and efficient way, and helps to construct a teaching quality monitoring method system, a supervisory feedback system, and an indicator system. The analysis results are fed back to the classroom teacher. The teacher is intrinsically linked according to the association rules of the classroom behavior data and the final grades, adjusts the classroom teaching plan, determines the appropriate teaching method, and feeds the analysis results to the school academic department, and the teaching department formulates the classroom teaching rules accordingly. By standardizing the teaching order; feeding back the analysis results to the school leaders, and the school leaders will develop a teaching monitoring index system to contribute to the high-quality development of the university.

2.2. Help improve the teaching information science feedback channel
The teaching information science feedback channel includes information collection mechanism and information feedback mechanism [4]. The informationized classroom teaching monitoring system uses artificial intelligence technology, image processing technology, Internet of Things technology, traditional website technology, and wired communication technology to accurately collect and analyze classroom information, and effectively help to construct an information collection mechanism. For teachers, academic staff, school leaders, and relevant leaders of the education department, we can coordinate and help build an information feedback mechanism at the technical level. With scientific and efficient means, help to establish a sound feedback channel for teaching information science.
2.3. Help Improve the teaching management system

It can help establish a sound teaching supervision and protection system. The analysis results collected by the teaching monitoring system can help the education department to supervise and perfect the teaching management system and effectively construct the flexible mechanism of teaching management. Make timely adjustments to the policy system, avoid the permanent rigidity of the system, and inject scientific and efficient vitality into the improvement of the teaching management system.

3. Principles of informationized classroom teaching monitoring system

The principle of classroom teaching monitoring system mainly introduces the principle of face recognition based on artificial intelligence technology: the principle of association rules analysis between students and teachers in class behavior data and final grade analysis.

3.1. Face recognition and image action classification principle

(1) Face recognition.

The face recognition method mainly includes face feature extraction and comparison including three parts, face position detection, face feature extraction and face feature comparison. The traditional image recognition method needs to realize the above three parts separately, the position detection is not accurate, the feature extraction generalization is insufficient, and the feature comparison process is too cumbersome, resulting in a low final success rate.

The convolutional neural network algorithm is an algorithm that includes convolution calculations, which is modeled after the biological visual mechanism. The parameter sharing and sparse connection in the convolutional kernel in the hidden layer make it possible to have a small amount of computation. Stable learning effects, no additional feature requirements for data [5][8]. This system combines the application requirements with the AlexNet convolutional neural network designed by 2012 ImageNet competition winner Hinton and his student Alex Krizhevsky, and improves it to form an improved AlexNet convolutional neural network algorithm. The specific improvement measures are:

- Remove the top layer FC 1000 full connection layer and change the last layer of FC 4096 layer to FC 2048 layer;
- Change all ReLU activation functions to PReLU functions;
- Remove all LRN layers;
- Change the first layer convolution layer to the 9*9 convolution kernel, the second layer convolution layer 5*5 convolution kernel to two 3*3 convolution kernels, and remove the 4th layer 3*3 convolutional layers.

The AlexNet convolutional neural network and the improved AlexNet convolutional neural network are shown in Figures 1 and 2.

![Figure 1. AlexNet network structure](image1)

![Figure 2. Improved AlexNet network structure](image2)

Face recognition is applied to the pre-class check-in in this system. At the same time, using RFID card reading technology, students need to be double-identified by one-card identification and face
feature comparison. If both identifications are passed and not late, the information will be entered. The attendance database is recorded as a sign-in success; if the identification is passed, but it is late, it is recorded as late; if the card is passed but the face identification is not passed, it is recorded as a substitute; if the student has not swiped before the end of the class, It is recorded as absenteeism.

(2) Classroom image action classification

When the system is running, the camera monitors the movements of classroom students and teachers in real time. The classroom monitoring video is transmitted to the back-end server through the campus network. The background management system uses H.264 video decoding technology to decode the video data, and processes each frame image. The convolutional neural network algorithm is used to analyze and classify each frame image. When the class was found, most of the students looked up, the images of a few students bowed, the images of the students playing the mobile phone during the class, the pictures of the teacher's lecture board or ppt, the images of the teacher's call during the lecture, and the image of the mobile phone.

Using the human head detection algorithm combined with the improved AlexNet algorithm, the number of students in the class at the same time and the number of students at the same time are counted. If the ratio of the number of heads to the number of heads is less than 1/4 of the threshold and more than 3 times in a class, the number of people will be lowered. Record; if the student plays the mobile phone during class, the class will record the number of mobile phones [6][9].

Definition 1: Association rules

An event relationship of the form $X \rightarrow Y$, which is an association rule. $X$ is called the leader of $X \rightarrow Y$, and $Y$ is called the successor of $X \rightarrow Y$. Among them, the association rule $XY$ has support and trust. The popular can be understood as $X$ for the event $X \rightarrow Y$ associated condition and 10 for the result.

Definition 2: Support (support)

The probability that the event $\{X, Y\}$ appears at the same time is the ratio of the number of people who meet the event and the event to the total number of people, expressed as:

$$support = \frac{\text{Number of people present at the same time}}{\text{The total number of people who happened}}$$

In the classroom data analysis, $X$ can be expressed as the number of students whose number of students has more than 3 in the first semester of a class, or the number of students who play mobile phones during the whole semester; $Y$ can be expressed as the number of students who fail the final grade. Calculate the association rule support based on this.

Definition 3: Confidence

The probability that the person with event $X$ appears at the same time as event $Y$ is expressed as:

$$confidence( X \rightarrow Y ) = \frac{\text{Number of people present at the same time}}{\text{Number of people who have event X}}$$

In the classroom data analysis, the confidence level can be expressed as the number of students whose number of students has more than 3 in the first semester of a class, or the number of students who play mobile phones during the whole semester, and the probability of unsatisfactory final results.

Definition 4: Minimum support and minimum confidence

The minimum support (min_sup) and the minimum confidence (min_conf) are the scales that measure the event, and the parameter size is adjustable. When $support > \text{min_sup} \& \text{confidence} > \text{min_conf}$ established, it can be considered that $X \rightarrow Y$ is related.

4. Teaching monitoring information data analysis

The background attendance management system adopts the B/S architecture, and the administrator can log in to the relevant page by using the browser to implement attendance management. The front-end
data is passed to the back-end management system in real time, and the administrator can perform real-time processing. The main functions include: course data query analysis and various management functions. Management functions include: attendance management, course and classroom management, and personnel management [10].

The sample used for association rule analysis comes from the experimental data obtained from a classroom of the classroom attendance monitoring system installed by the School of Information. Among them, the computer network and the computer composition principle of the 2016 computer science and technology major are in this classroom. get on. The experimental data consisted of 96 students and 1,200 records.

In the course of the whole semester, each class has a number of students who look up, a few people bow their heads, and the number of students more than 3 times and the number of students who are playing mobile phones in each class, as shown in Table 1.

| course                        | Bow over 3 times (person) | Play mobile phone (person) |
|-------------------------------|---------------------------|-----------------------------|
| computer network              | 7                         | 3                           |
| Computer composition principle| 5                         | 4                           |

The number of unsatisfactory people is shown in Table 2.

| course                        | Failed (person) |
|-------------------------------|-----------------|
| computer network              | 11              |
| Computer composition principle| 9               |

Table 3 and Table 4 show the results of the two courses and the confidence and support of the mobile phone.

| measure                        | Failed at the head | Failed to play mobile phone |
|--------------------------------|--------------------|------------------------------|
| Support                        | 0.0625             | 0.0312                       |
| Confidence                     | 0.857              | 1.00                         |

| measure                        | Failed at the head | Failed to play mobile phone |
|--------------------------------|--------------------|------------------------------|
| Support                        | 0.041              | 0.0312                       |
| Confidence                     | 0.800              | 0.75                         |

We set the minimum support (min_sup) to 0.01 and the minimum confidence (min_conf) to 0.80. The following association rules are obtained:

1) **Bow down → Failed grades**, according to the analysis results of the two course association rules, to meet the minimum support and confidence, it can be judged that the class leader is not associated with the grade failure. For example, in a computer network course, if a student has a class that has been bowed more than 3 times, the probability of failing to pass the final grade is about 85.7%.

2) **play cell phone → Failed grades**, according to the analysis results of the two course association rules, to meet the minimum support and confidence, it can be judged that the student's playing mobile phone is not associated with the performance failure. For example, in a computer network course, if a student plays a mobile phone in class, the probability of failing to pass the final grade is about 75%.
5. Teaching monitoring system analysis function

The course data query analysis mainly includes the class rate inquiry, the same class analysis, and the same class analysis. The rate-based query function allows administrators and teachers to view the status of each class for each class. The corresponding date and corresponding course can be selected. There are four states: normal check-in, absenteeism, late arrival, and substitute classes. They are denoted by the symbols "√", "×", "-", "*", respectively. The class rate query display is shown in Figure 3.

| Serial number | Student ID     | name         | class       | 03/08 15:30 | 03/15 15:30 | 03/22 15:30 | 03/29 15:30 | 04/05 15:30 | 04/12 15:30 |
|---------------|---------------|--------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| 1             | 201522450601  | ping zhang   | computer15-4 | ✓           | ✓           | ✓           | ✓           | ✓           | ✓           |
| 2             | 201522450602  | shi li       | computer15-4 | ✓           | ✓           | ✓           | ✓           | ✓           | ✓           |
| 3             | 201522450603  | ziln xie     | computer15-4 | ✓           | ✓           | ✓           | ✓           | ✓           | ✓           |
| 4             | 201522450604  | ming wang    | computer15-4 | ✓           | ✓           | ✓           | ✓           | ✓           | ✓           |
| 5             | 201522450605  | zifan wang   | computer15-4 | ✓           | ✓           | *           | ✓           | ✓           | ✓           |
| 6             | 201522450606  | jiancei zhou | computer15-4 | ✓           | ✓           | ✓           | ✓           | ✓           | ✓           |
| 7             | 201522450607  | ruofan zha   | computer15-4 | ✓           | ✓           | ✓           | ✓           | ✓           | ✓           |
| 8             | 201522450608  | feng li      | computer15-4 | ✓           | ✓           | ✓           | ✓           | ✓           | ✓           |
| 9             | 201522450609  | biao zhang   | computer15-4 | ✓           | ✓           | ✓           | ✓           | ✓           | ✓           |
| 10            | 201522450610  | ting li      | computer15-4 | ✓           | ✓           | ✓           | ✓           | ✓           | ✓           |
| 11            | 201522450611  | wenhao li    | computer15-4 | ✓           | ✓           | ✓           | ✓           | ✓           | ✓           |
| 12            | 201522450612  | yi miao      | computer15-4 | ✓           | ✓           | ✓           | ✓           | ✓           | ✓           |
| 13            | 201522450613  | si lin       | computer15-4 | ✓           | ✓           | ✓           | ✓           | ✓           | ✓           |
| 14            | 201522450614  | hanyun li    | computer15-4 | ✓           | ✓           | ✓           | ✓           | ✓           | ✓           |
| 15            | 201522450615  | ming ze      | computer15-4 | ✓           | ✓           | ✓           | ✓           | ✓           | ✓           |
| 16            | 201522450616  | linyi xu     | computer15-4 | ✓           | ✓           | ✓           | ✓           | ✓           | ✓           |
| 17            | 201522450617  | zhizhuan li  | computer15-4 | ✓           | ✓           | ✓           | ✓           | ✓           | ✓           |
| 18            | 201522450618  | jiaxiong zi  | computer15-4 | ✓           | ✓           | ✓           | ✓           | ✓           | ✓           |
| 19            | 201522450619  | gang xiao    | computer15-4 | ✓           | ✓           | ✓           | ✓           | ✓           | ✓           |

Figure 3. to the class rate query function display

The same class analysis function can count the different classes of the same class to the class rate and visualize. According to this data, it is possible to analyze the learning status and the degree of love of different courses of the same class, which is helpful for the adjustment and reform of college courses.

The same class analysis function can count the students’ attendance rate of different teachers in the same course and visualize them. It can be used as a reference for students’ preference for teachers' teaching methods, so as to encourage teachers to prepare lessons and lectures. The same class analysis function is shown in Figure 4.

Figure 4. shows the same class analysis function
6. Conclusion
This paper first analyzes the importance of teaching quality monitoring and the main problems existing in the teaching quality monitoring system of colleges and universities. For such problems, artificial intelligence technology is applied to teaching quality monitoring. Then the meaning of the information quality monitoring system is analyzed. Finally, the function and principle of the system are analyzed and displayed. The results of classroom data analysis can provide direction for the school to formulate teaching policies, and even provide some reference for the reform of the education industry.

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