Teaching Monitoring Model Based on Big Data Face Recognition

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ABSTRACT
With the increasing number of college enrollment and the development of educational reform, the quality of higher education has become a hot topic concerned by public. In China, classroom teaching still performs as the main teaching form in most universities, therefore, the improvement of quality of classroom teaching must be emphasized in order to achieve better higher education. Currently, some problems such as students’ being late or absent, leaving early, playing personal smartphones, taking snacks freely during class time and some other inappropriate behavior may affect the quality of classroom teaching, which cannot rely on the traditional teaching monitoring model to control. This paper focuses on the application of face recognition technology harnessed in the teaching monitoring model, and aims to attain a set of face recognition system that is connected with the school monitoring system, by which the real-time monitoring of classrooms can be realized. As a consequence, the information gained from this system, can serve as indicators for class assessment, teaching quality inspection and other relevant evaluations to promote the traditional teaching monitoring model.

KEYWORDS
Teaching monitoring, Teaching quality, Face recognition, OpenCV.

INTRODUCTION
For institutions of higher education, it is important for them to explore and improve the monitoring system for the quality of classes as quality of the classes is the vital to higher education. The traditional teaching monitoring model emphasizes on the results while thinks less of the process. And the shortcomings have drawn the attention of educators. Currently, there are some bad behaviors existing in classes, for example, some students are absent-minded during the class and bury themselves in their cell phones or novels. In order to solve these problems, a class monitoring system with high efficiency, low interference and certain immediacy becomes a need.

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This paper combines face recognition with the demand of the monitoring of the quality of the classes via OpenCV. In this way, the system is capable to help teachers to manage the class and record students’ state on class. Besides, this system stores students’ grades during the studying process and provides the basis for class assessment and teacher assessment, which can improve the shortcomings of the existing classroom teaching monitor model.

RELATED RESEARCH AT HOME AND ABROAD

Qin Baoling put forward in the study of teaching quality monitoring that, with the enlarged enrollment of colleges and universities, teaching resources are seriously insufficient while teaching quality problems are more and more prominent, especially in teaching quality monitoring. Problems like monitoring system is still unsound, the access to information is incomplete, the methods to monitor are unscientific and so on. For these problems, if we combine modern information technology, utilize Internet+, cloud computing and other new network technology, redesign the monitoring system, improve the ways to monitoring, the results of monitoring would be greater, and the problems would be solved effectively. [1]

There are lots of theoretical research related to teaching monitoring model at home and abroad, among which a representative one is put forward by Tian Caiping, when studying how to run teaching quality monitoring system and conduct its long-effect mechanism: ways to run teaching quality monitoring system and construction of long-effect mechanism mainly includes 6 aspects: building authoritative organizations and high quality management teams, scientific evaluation system and methods to monitor, improved information mechanism and efficient teaching information feedback channel, normative management system mechanism and guarantee, cultivating teaching achievement system as well as encouragement and constraint mechanism, establishment of improved teaching safeguard mechanism[2].

Chen Yanyun put forward and realized a face perception supervision system based on PC client and mobile client in The study and application of face perception in network teaching effectiveness supervision. It focuses on face detection and recognition of internet course learners, makes face matching comparison, supervises and evaluates the effectiveness of learners. The system works well during testing, the feasibility, rationality and validity of the application of face perception in network teaching monitoring effectiveness are verified. [3].

Wang Wanqing drew a comparison between various methods as well as applied multi-threshold LBP face recognition method based on Gabor wavelet into the attendance system. As a result, each function module of the system was actualized. In her paper, the prototype system was tested under different lighting conditions. The test results show that the prototype system has certain practicability and validity [4]. DG Sawant suggested that the monitoring measures provided by IQAC (Internal Quality Assurance Cell), one of the most important education institutions, proved to be effective, according to the obtained data via issuing questionnaires to 29 India universities [5].
PRESENT SITUATION OF TEACHING MONITORING MODEL

Under the background of university reforms, traditional teaching monitoring method, which consists of attendance, homework and final examination, is no longer adequate to measure the teaching quality of teachers. And the problems of it can be listed as follows:

1. Hysteretic feedback. Practically, teachers often receive the feedback in the midterm exam and final exam, so some issues cannot be solved immediately during the teaching process but to be exposed at the end of the semester, which has been too late to be changed. These things include the degree of difficulty of class does not fit the students, students do not concentrate in classes, and some students do not attend most of the classes.

2. Incomplete monitoring means. In the traditional monitoring system, most schools would assign teachers to listen to others’ classes so that them can judge and grade them. However, this method not only have low efficiency but also disturbs the class. Apart from sending people, it also requires time and labor force to arrange the data.

3. The lack of evaluation factors. In the traditional monitoring system, if one class wants to be the excellent class of the year, there will be some certain requirements. However, the evaluation factors do not include the difference between difference universities and the distinction of a certain class. That will indirectly force teachers to make class easier to adapt to the standard.

Given that, the current teaching monitoring system has many defects, and we need to improve and innovate on the basis of the original one.

CONSTRUCTION OF TEACHING MONITORING MODEL BASED ON FACE RECOGNITION

The basic idea

In this paper, based on OpenCv, face detection and the statistics of the number of rise are realized. The statistics of the rate of rise can be shown in the form of charts, tables and others to display the teaching situation. And the teachers who are in charge of related areas will be informed immediately when there are some special circumstances. Also, the rate of rise was involved in the traditional teaching monitoring model.

According to the demand, the following four types of data are obtained

1. The rate of rise. Because the number of students in each class is fixed, the rate of change is modest, we consider the number students should attend is the same as the number of students present. The video collected by the camera can be processed frame by frame, and the rate of rise equals to the number of students detected per frame divided by the number students should attend.

2. The rate of occupancy of front-row seats. The video surveillance will start from the beginning of one lesson to the end of it, shooting every ten minutes. And then take the average of the data obtained. The seats of the entire classroom are divided into three parts of front, in, the last. According to real situation. In general, the larger the rate of occupancy of front-row seats is, the more active the students are, and the more popular the teachers are.
3. The value of rise. Take Advanced Math Course which lasts for 90 minutes as an example, teachers generally teach new knowledge in the first half of the course, and the second half of the course focuses on repetitive knowledge, so the value of the rise in the first half is higher than that in the second half. Therefore, teachers can select the judgment method of data in the program and whether to use the data according to actual needs.

4. The stable base. The software in the identification process will recognize each of the rise of the face and converts them into the face of the image in the pixel location storage. We call the face of the pixel position as a positioning point. Based on the collected rate of rise, it can be judged how many students in the class are most stable. The most stable number of students in the class is considered as a stable base.

The Construction of Teaching Monitoring Model

GENERAL TEACHING MONITORING MODEL BASED ON FACE RECOGNITION

The model which was improved by us is called the general teaching monitoring model based on face recognition, and it is

$$S = \sum_{i=1}^{4} (\omega \times p_i) = \omega_1 \times p_1 + \omega_2 \times p_2 + \omega_3 \times p_3 + \omega_4 \times p_4$$ (1)

Where $S$ is the score for the course in this model. $P_1$ is the score for the attendance of students in the course. $P_2$ is the score for the students’ average grades in the course. $P_3$ is the rate of occupancy of front-row seats. $P_4$ is the score for the rate of rise. We assume the weight is $\omega_1=0.3$, $\omega_2=0.5$, $\omega_3=0.1$, $\omega_4=0.1$

$S$ can not only reflect the actual effect of a teacher’s teaching in the classroom, but also the overall evaluation of a class. At the same time, $S$ can also be included in the assessment of teacher’s performance.

The assessment model of teacher’s performance is

$$\delta = \omega_1 (S_1 + S_2 + \ldots + S_n)/n + \omega_2 \times j_1 + \omega_3 \times j_2$$ (2)

Where $\delta$ is the score of teachers’ performance based on the new model. $S_1, S_2, S_n$ are scores for the course in this new model. $j_1$ is the score of teacher’s research performance. $j_2$ is the score teachers received from their students. We assume the weight is $\omega_1=0.4$, $\omega_2=0.4$, $\omega_3=0.2$.

INTRODUCE THE TEACHING MONITORING MODEL WITH THE VALUE OF RISE AND THE STABLE BASE.

The value of rise $R$ and the stable base $C$ is introduced to this new model. The formula of the value of rise is

$$R = R_g + R_b = \omega_1 \frac{P_{11} + P_{12} + \ldots + P_{1n}}{gn} + \omega_2 \frac{P_{21} + P_{22} + \ldots + P_{2n}}{bn} = P_4$$ (3)

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Where $R$ is the value of rise which equals to $P_1$, $P_{g1}$, $P_{g2}$, ..., $P_{gn}$ are the values of rise which are taken when most students rise their heads and listen to teachers carefully, which is called the high rate of rise. $g_n$ is the total time when there is the high rate of rise. $w_1$ is the weight for the high rate of rise. On the contrary, $P_{b1}$, $P_{b2}$, $P_{bn}$ is the low rate of rise. $b_n$ is the total time when there is the low rate of rise. $w_2$ is the weight for the low rate of rise. Where $C_S$ is the stable value and $C_A$ is the total number of classes. The general teaching monitoring model can be improved to

$$S = \sum_{i=1}^{n} (w_i \times P_i) = w_1 \times P_1 + w_2 \times P_2 + \ldots + w_n \times (C_S / C_A)R$$

\[ (4) \]

**APPLICATION TESTING.**

We collected data from three different teachers, including approximately 15-hour class video, the scores of mid-term and final exams, and other data of each teacher, which are the base for verifying this model. According to the data above and the teaching monitoring system that is based on face cognition technology, the final scores of the teachers are demonstrated in Table 1.

| Teacher Number | $F$   | $S$   | $F - S$ | $\delta_F$ | $\delta_S$ | $\delta_F - \delta_S$ |
|----------------|-------|-------|---------|-------------|-------------|-----------------------|
| A              | 85.238| 78.851| 6.387   | 91.428      | 87.3106     | 4.1174                |
| B              | 78.77 | 70.256| 8.514   | 81.262      | 76.1536     | 5.1084                |
| C              | 75.214| 66.769| 8.445   | 69.1284     | 64.0614     | 5.067                 |

From the scoring table, teacher A has the best classroom performance followed by teacher B. However, the performance of teacher C ranked the last. In the face-based teaching monitoring model, the teacher with the highest impact on the rate of students’ looking up to the lectures and the rate of the occupancy of front-row is teacher B, which proves that the teacher's score is higher than teacher C in terms of comprehensive evaluation. Whereas the problems existing in the teacher C’s class are more serious than those of teacher C’s and teacher A’s.

**CONCLUSION**

This paper proposed a teaching monitoring model based on face recognition and some tests were done about it. In this paper, we tested three teachers’ classroom teaching situation and sorted out the data, and finally put the data into traditional teaching monitoring model and our model based on face recognition. The results proved our original assumption: there are some loopholes in traditional teaching monitoring model. For example, teacher's problems in classroom cannot be exposed in the assessment of traditional teaching monitoring model in time. Therefore, to a certain extent, the teaching monitoring model based on face recognition makes up for the traditional one which has three problems including delayed feedback information, backward monitoring methods, and few evaluation factors. Therefore, the teaching monitoring model based on face recognition has certain application value and application prospect.
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