Intelligent classroom perception system based on Artificial Intelligence

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Abstract. Through the construction of intelligent campus classroom prediction system, the realization of intelligent management and intelligent teaching can not only greatly improve the management efficiency and teaching quality of schools in the region, but also greatly reduce the cost of school management and teaching. At the same time, it can also increase the social transparency of educational resources, and realize the intensification, standardization and Standardization development.

Keywords: Intelligent education, Information technology, System.

1 Introduction

In such a new information environment, teachers can improve their academic and scientific research level and cultivate excellent students through a good scientific research environment [1], training environment and teaching environment [2]; Students can improve their comprehensive quality and explore their personal potential through a good learning environment [2], living environment and training environment.

School information construction is a far-reaching project, which is directly related to the progress and effectiveness of school modernization and information construction. Information construction can not only improve students' learning and living environment, school scientific research environment, teaching environment and management environment, but also directly improve the quality of technical talents delivered by the school to the society.

2 System structure

Smart classroom perception system realizes information-based teaching applications such as classroom recording and broadcasting, teaching monitoring, mobile learning and teaching management through advanced video, audio and cloud technology. It is an important auxiliary means of information-based teaching management. The scheme structure is shown in Figure 1.

EAI Urb-IoT 2021, December 20-21, Shenzhen, People's Republic of China

DOI 10.4108/eai.20-12-2021.2315037

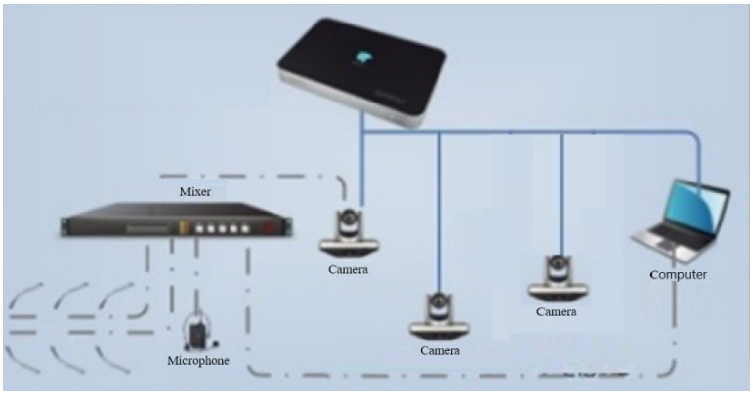

Fig. 1. Composition block diagram of smart classroom perception system

The front-end smart classroom is responsible for the recording of normalized course resources and the data collection of teaching process. Through the cloud control service system, it fully realizes the unified and centralized management of multiple clustered front-end smart classrooms. With the help of intelligent management strategy, the management efficiency can be effectively improved. At the same time, it supports online course browsing. According to the school's teaching business application, it can carry out teaching inspection, online teaching and research, teaching supervision and other businesses. At the same time, with the help of cloud technology and big data technology, it can collect and summarize valuable data in the teaching process and conduct intelligent analysis, It not only greatly improves the informatization degree of traditional teaching management, but also provides data support for teaching management and decision-making.

3 Smart classroom perception system

Smart classroom perception system is the core of smart classroom [4]. It can broadcast, record and analyze the courses in the classroom in real time. High definition cameras and pickups are deployed at the front end of the classroom to record the classroom teaching process in real time. Teachers' electronic courseware such as PPT, word and video can be collected through courseware collection software. At the same time, the video and audio stream of the course can be pushed to the cloud for online teaching activities.

3.1 Signal acquisition

Use cameras to provide the highest quality video while reducing deployment difficulty and cost. Intelligent tracking camera is optional. The built-in cable is the latest tracking algorithm to realize a variety of intelligent tracking and switching strategies, and the tracking strategy can be configured in the background. One machine can realize analysis and tracking, which not only improves the quality and effect of the course, but also greatly reduces the cost.

Headworn microphone is used in the audio classroom, omnidirectional polar microphone is used for students, and intelligent digital noise reduction function is built to ensure the audio quality in the ordinary undecorated classroom. The teacher courseware is collected by software, which can completely record the teacher's PC screen content, including PPT, video, word and PDF documents, and realize dynamic frame rate adjustment (support 25 frame acquisition). At the same time, it can collect local PC sound.

3.2 Intelligent perception

Including identity recognition, classroom behavior recognition, classroom behavior timeline analysis, teacher-student interaction analysis, intelligent speech analysis, attention analysis, participation analysis, doubt analysis, activity analysis, teacher-student emotion recognition, attendance statistics, attendance rate analysis, student seat analysis, teacher trajectory analysis, blackboard content recognition, S-T analysis, knowledge point recognition, high-frequency word recognition Automatic knowledge point index, automatic classroom behavior index, automatic analysis according to class schedule, etc; Support 4K camera electronic PTZ; Normal recording and broadcasting, automatic recording according to class schedule, multi-channel recording, teacher tracking, student tracking, manual control of camera, control of at least 8 preset positions, etc; Schedule management, section template, schedule import, course status monitoring, course information query, etc; Course management, multi type resource management such as pictures, videos and documents, diversified function operations such as download, preview, deletion and upload, resource status monitoring, resource information query, etc.

3.3 Intelligence analysis

Relying on the big data collection platform, real-time analysis of teaching effect and learning feedback are carried out. Better assist teachers and students in Futian District in self-learning and educational supervision, evaluate the teaching quality, and adjust the teaching methods and teaching contents in real time according to the analysis conclusions.

Smart classroom perception system is enabled by ai artificial intelligence technology, complies with teaching theory [5], intelligently senses every behavior of classroom teaching based on a large number of mature teaching models, and comprehensively collects the status data of participant groups and all data of teaching process. By identifying the emotions and behaviors of teachers and students in each school, analyzing the participation of students in the classroom and the teaching situation of teachers, locating the individual learning differences through identity recognition, and obtaining a large amount of classroom teaching data [6].

Through this system, colleges and universities in Futian District can obtain a large number of teachers' class situation data, such as teachers' knowledge points, emotions and various behaviors during lectures. For students, we can also see the enthusiasm and participation of each class. And the learning of individual students.

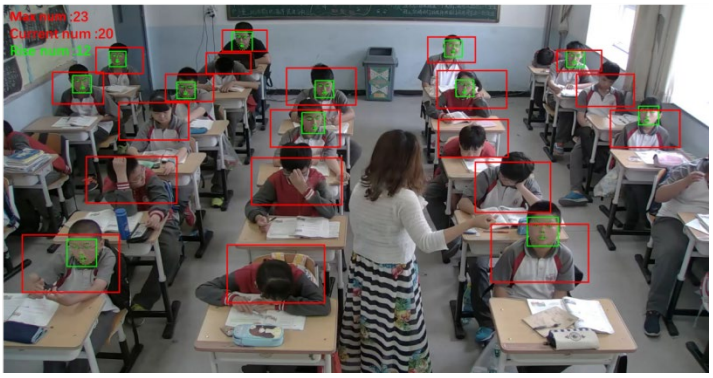

Fig. 3. Smart classroom face attendance function

Through the artificial intelligence face recognition detection algorithm, the camera installed in the classroom will recognize the number of students in the teaching room, which can be used as a reference for classroom utilization, student class statistics, student learning status, teaching supervision, teaching and research, and teacher evaluation.

4 System innovation

For teachers in Colleges and universities in Futian District, they can only see their own courses after class. We will record each lesson. What we see now is the actual record of the course in a smart classroom, including the recorded videos of 4 camera stands and 1 teacher machine. In the process of looking back, you can also synchronously see the behavior data of teachers and students in the classroom through intelligent analysis.

For each course, we will also generate important course analysis data of this course, which is more detailed than the live broadcast process. On the left is the detailed data of classroom behavior analysis, which identifies the changes of teachers' and students' emotions, expressions and actions through face capture, motion capture and other technologies. At the same time, it supports automatic identification and analysis of at least 14 teacher-student behaviors, including behavior statistics, teacher behavior statistics, student behavior statistics, teacher activity rate statistics, teacher language rate statistics, student activity rate statistics, student language rate statistics, etc.

Classroom real-time analysis: for ongoing courses, support real-time automatic intelligent analysis, including teacher-student identity recognition, teacher-student emotion recognition, teacher-student behavior recognition, speech recognition, knowledge point recognition, attention analysis, teacher-student classroom behavior timeline analysis, participation analysis, etc;

Result data analysis: including teacher-student identity recognition, teacher-student classroom behavior recognition, teacher-student classroom behavior timeline analysis, teacher-student interaction analysis, speech analysis, attention analysis, participation analysis, doubt analysis, activity analysis, teacher-student emotion recognition,

attendance statistics, attendance rate analysis, student seat analysis, teacher trajectory analysis, blackboard content recognition, S-T analysis Knowledge point recognition, high-frequency word recognition, automatic knowledge point index, automatic classroom behavior index, etc.

Identification of teachers and students: recognize faces according to face recognition technology, and compare them with the identity information in the database to generate corresponding identity information of teachers and students.

Classroom behavior recognition of teachers and students: recognize the changes of teachers and students' emotions, expressions and actions through face capture, motion capture and other technologies. At the same time, it supports the automatic identification and analysis of at least 14 teacher-student behaviors, and carries out statistics of different dimensions such as curriculum, teachers and students, including behavior statistics, teacher behavior statistics, student behavior statistics, teacher activity rate statistics, teacher language rate statistics, student activity rate statistics, student language rate statistics, etc

Emotion recognition between teachers and students: recognize individual expressions in the classroom through face recognition technology and convert them into emotions. Teachers' emotions include nature, happiness, anger, sadness and disdain, while students' emotions include concentration, happiness, doubt, resistance and disdain

Analysis of teacher-student interaction: according to the actual situation of teacher-student interaction, the teacher-student interaction behavior is divided into different degrees of interaction, which supports the statistics of general interaction behavior, complex interaction behavior and inefficient or ineffective interaction behavior, and supports three-dimensional modeling analysis and two-dimensional plane analysis according to classroom behavior, classroom speech and classroom organization

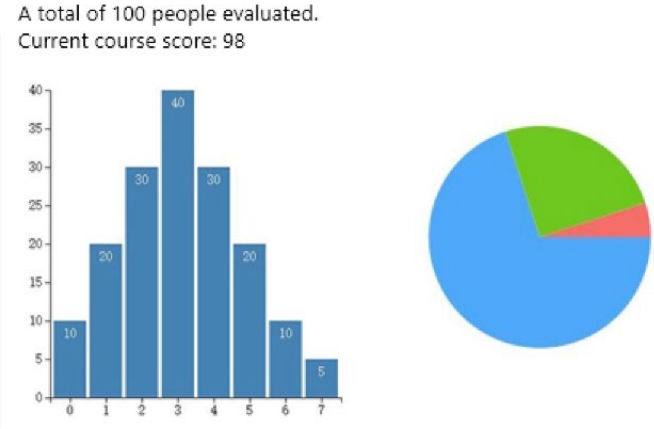

Fig. 2. Scoring table of classroom teaching quality

Blackboard content identification: automatically and regularly intercept the pictures of blackboard content. In order to avoid the loss of blackboard content, it can be automatically intercepted according to the time period, and support the storage of multiple blackboard pictures

Speech analysis: analyze the speech in the classroom in real time, and automatically convert the speech into text

High frequency word recognition: Based on speech recognition, automatically count high frequency words, make summary statistics, and realize chart display, ranking, frequency and display, etc

Knowledge point recognition: establish a knowledge base, automatically recognize knowledge points and intelligently intercept them based on speech recognition, which can not only display in real time, but also summarize statistics, so as to realize chart display, coverage statistics, number statistics, etc

Automatic knowledge point index: support to automatically generate an index of knowledge points and the time of occurrence, so as to facilitate purposeful video viewing

Automatic classroom behavior index: it supports automatic indexing of classroom behavior and occurrence time, so as to facilitate purposeful viewing of videos

Attention analysis: identify students' attention through expression analysis and action analysis, and conduct comprehensive statistics to obtain students' individual attention analysis and class overall attention analysis, reflecting students' attention in class

Participation analysis: Students' participation analysis is obtained through the capture of students' behavior and teachers' behavior. Students' participation in classroom activities is obtained through the analysis and comparison of students' individual participation and the participation of the class as a whole

Doubt degree analysis: the doubt degree of individual students is obtained through expression recognition transformation, and the individual doubt degree is summarized to obtain the overall doubt degree. Through the doubt degree analysis of individual students and the doubt degree analysis of the whole class, the overall acceptance degree of students for knowledge is obtained

Activity analysis: through the students' behavior data in the classroom, get the students' activity, especially the overall activity, and reflect the students' classroom behavior activity in the classroom

Student attendance statistics and attendance rate analysis: automatically analyze and count the attendance students according to face recognition and identity recognition, obtain the class attendance personnel through educational administration information, obtain the absent personnel, and automatically count the attendance rate

Student seat analysis: automatically analyze the position and identity of each student in the classroom through identity recognition and spatial position recognition, and automatically generate the classroom plan, including each student's seat and identity, to form the seat distribution map

Teacher track analysis: automatically analyze the teacher's activity track in the classroom through identity recognition and spatial position recognition, draw the teacher's activity track map through regular sampling, divide the classroom plane into multiple meaningful areas, count the track distribution of teachers in each area, and analyze the teacher's teaching habits

S-T analysis: automatically count the teacher's activity behavior and student's activity behavior, automatically generate S-T diagram to support teaching mode analysis,

and automatically generate RT-CH diagram to obtain practice, teaching, dialogue, hybrid and other teaching modes, and support user-defined data sampling interval.

5 Conclusion

Through the construction of prediction system, form a digital application management environment, intelligent teaching environment, characteristic school-based education and teaching resource construction environment and a network platform with cloud computing ability, and finally build an open, diversified, humanistic, intelligent, efficient, safe and harmonious education cloud platform, so as to provide strong support for schools in Futian District to achieve strategic development goals, Realize the overall informatization of teaching and research, scientific research, teaching, management and service, so as to improve the teaching quality, improve the talent training level and optimize the management process. Make the overall level and application level of informatization consistent with the business development orientation of the school, improve the core competitiveness of the internal school, and realize the high-quality and efficient sustainable development of the school.

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