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Optimizing Teachers' Teaching Methods and Students' Learning Styles with Computer Vision Analysis

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Abstract

With the development of big data, blockchain, and AI technology, artificial intelligence has developed rapidly, and its practical application in the field of education has gradually emerged. However, the current mainstream education mode is still offline, and the evaluation of teachers' classroom teaching quality has always remained in the original stage of evaluation by experts in the classroom. Therefore, the evaluation of teachers' classroom behavior and students' classroom behavior is purely based on empirical observation and induction, lacking logic and comprehensiveness, which is not conducive to the optimization of teachers' teaching methods and students' learning methods. Given these problems, this paper proposes a computer vision analysis technology based on deep learning to analyze classroom teachers' teaching behavior and students' behavior, to solve the above problems and take an important step for large-scale, high-precision and high-performance AI intelligent teaching evaluation and supervision.

KEYWORDS: teacher behavior, Student behavior, Classroom teaching behavior, Computer vision, Teaching video

1 INTRODUCTION

This study adopts the research method of combining literature research with experimental research. By constructing a deep learning method based on computer vision and voice, the classroom teaching behavior is quantitatively analyzed, and then the experimental effect is improved through a certain model fusion method. The automatic recognition of classroom teacher behavior is realized through an accurate and fast model. Apply it to classroom teaching evaluation to help teachers and students optimize teaching methods and student learning methods. The main work of this paper is as follows:

(1) This paper reviews the development of computer vision analysis technology, analyzes and absorbs advanced methods at home and abroad, combines the classroom teaching scene of Chinese schools, and proposes an efficient and accurate computer vision analysis method based on deep learning. This method uses a convolution neural network RNN as the main network

and combines the common S-T classroom teaching analysis, face recognition technology, and other methods in target detection, to obtain more efficient and accurate results than traditional methods.

(2) Analyze and summarize the current teaching effect of classroom education teachers and the pain points and shortcomings of students' learning methods, especially the shortage of teachers' classroom teaching methods, students' classroom learning methods, teacher-student interaction, and students' attention. This paper analyzes and summarizes the classroom teaching and student behavior automatic recognition system based on computer vision, and uses it as a reference standard for teacher-classroom teaching reform and student learning method optimization.

(3) At the end of this paper, using the data collected by computer video in the classroom, the implementation path of the system is analyzed, as well as the difficulties in the implementation of the system and the areas for improvement.

2 RESEARCH SIGNIFICANCE

The important method and key link between education and teaching reform and teachers' professional development lie in classroom teaching research. The core content of classroom teaching research is research on classroom teaching behavior. The effectiveness, scientificity, and rationality of classroom teaching behavior play a key role in teaching effect. Therefore, this research has certain practical significance and value both in theory and practice. To sum up, this study has the following significance: (1) In terms of theory, this paper first summarizes and analyzes the current situation of relevant research in the field of classroom teaching analysis at home and abroad through the literature review research method, and points out the problems and shortcomings in the current information-based classroom teaching process, and proposes a new student-centered approach, The teacher-led automatic solution for classification and identification of classroom teaching behavior is suitable for intelligent and automatic processing of classroom teaching behavior analysis under the condition of massive big data. (2) In practice, this research uses new technologies (big data and deep learning) and methods (computer vision analysis) to quantify the classroom teaching process, and analyze and process the quantified results, to a certain extent, help teachers and students understand the teacher's teaching behavior and students' learning behavior and interaction in a more efficient, convenient and targeted way, Let teachers have enough time to reflect on the shortcomings and problems in their teaching process according to the student's performance in class. At the same time, the rapid development of information technology makes the analysis of classroom teaching behavior more and more automatic and intelligent. The massive computing power, processing speed, analysis accuracy, and application scale that technology can provide all reflect the application value and practical feasibility of the research.

3 LITERATURE REVIEW

The study of teaching behavior in China has never stopped since ancient times. The earliest can be traced back to China's Learning Record, where there are records of "the combination of information and information" and "the combination of observation and kindness". In Song

Su, the background of big data in the application of AI technology in education also wrote [5]. In modern educational technology science, foreign research can be traced back to the late 1990s. The scholar Kratz first put forward the concept of teaching behavior characteristics, thus opening a new era of teaching behavior research. In the 1960s and 1970s, the topic of classroom teaching behavior research ushered in a prosperous period of development and reached its peak. More and more researchers have joined the wave of teaching behavior. Qi Xiaotong, Zhu Wenlong, Mi Yatian, Liu Qinlei and Liu Ke (2021) analyzed the impact of the combination of face recognition and AI+educational technology on the innovation and reform of the classroom education industry in the Research on the Impact of the Combination of Face Recognition and AI+educational technology on the innovation and reform of the education industry [2]. In "Application of AI+Education Based on Big Data", Qiu Junling (2018) summarized the current situation of AI+education, constructed the application of AI+, and briefly described the functions of AI+teaching, which let us know how to obtain students' personalized teaching plans through the analysis of AI platform, improve teaching quality, and realize each student's needs for teachers' attention [3]. Ma Yunpeng (2020) outlined in "AI Brings a New Face to School Education" that AI enabling education is attracting great attention worldwide [4]. Yu Minghua, Feng Xiang and Zhu Zhiting analyzed the significance of the application of AI technology in the field of education under the background of big data in their book "Educational Application and Innovation Exploration of Machine Learning in the Vision of AI", and focused on the specific application strategies [11].

4 RESEARCH METHODS

This research adopts the research method of combining literature research and experimental research. First, through investigating the relevant domestic and foreign literature on teaching behavior, teachers' classroom behavior, video analysis, voice recognition, and other technologies, and combing its development context, we can understand the current situation and research process in the research field, to learn from the relevant research experience of predecessors to maximize our research efficiency. Secondly, through the construction of a deep learning method based on computer vision and voice, the quantitative analysis of classroom teaching behavior is carried out, and then the experimental effect is improved through a certain model fusion method, to realize the automatic recognition of classroom teachers' behavior through a model with both accuracy and speed.

5 COMPUTER VISION CLASSROOM BIG DATA ANALYSIS MODEL

Classroom big data computer vision analysis aims at normal teaching video data, combines AI technology, recording, and broadcasting system with the curriculum platform, establishes an intelligent data model, and through data analysis, establishes a classroom portrait (as shown in Figure 1), which concretely shows the classroom teaching situation of each college, and provides the auxiliary basis for classroom management, teachers, and colleges to comprehensively understand the classroom teaching situation.

From the big data analysis model of the computer vision classroom, we can see that the four stages of collection, matching, analysis, and integration are ascending from low to high level by

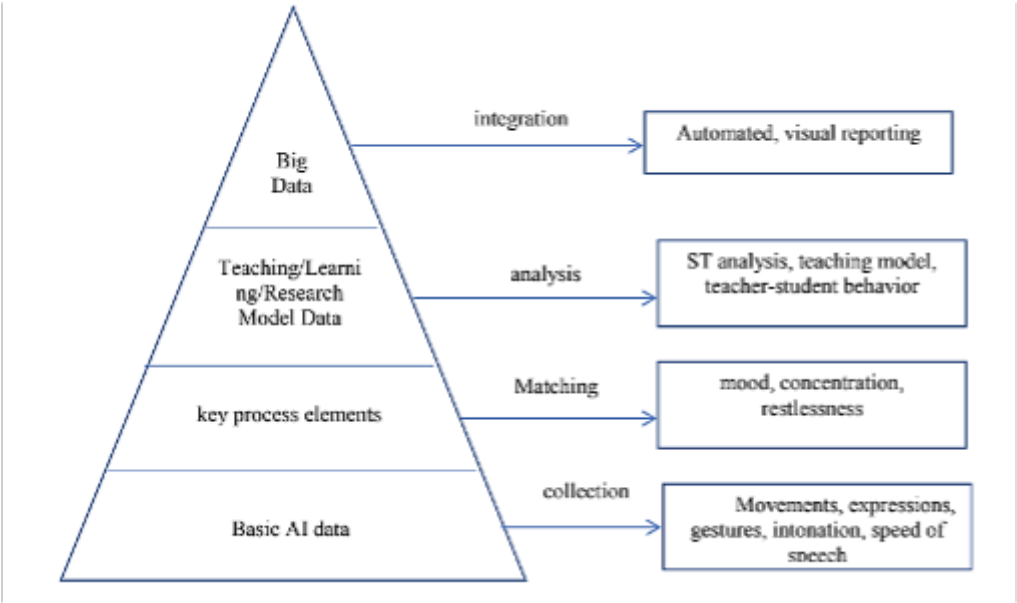

Figure 1: *Classroom big data AI analysis model*

level. The whole analysis process first collects basic AI data such as action, expression, gesture, intonation, and speech speed, matches key process elements such as emotion, attention, and restlessness, and then integrates big data to form an automatic and visual report based on the analysis of teaching, learning, and research model data such as ST, teaching mode, and teacher-student behavior.

5.1 The collection process of big data analysis model in a computer vision classroom

The collection and matching process in the classroom big data computer vision analysis model is mainly to collect the actions, expressions, gestures, intonation, and speed of teachers and students, and match key process elements such as emotion, attention, and restlessness through technology[2]. The main technologies used in this process include face recognition, expression detection, speech recognition, etc.

5.2 System architecture

Classroom big data computer vision analysis not only involves the concurrent analysis and processing of a large amount of data, but also involves data collection, rule mining, and knowledge sorting[3]. In the architecture of the computer vision analysis system (as shown in Figure 2), the recording and broadcasting system, as the information portal, can intelligently obtain the behavior data of teachers and students in the classroom through the use of artificial intelligence technology and obtain the big data of teaching information through the matching and integration of the data platform[18][19][20].

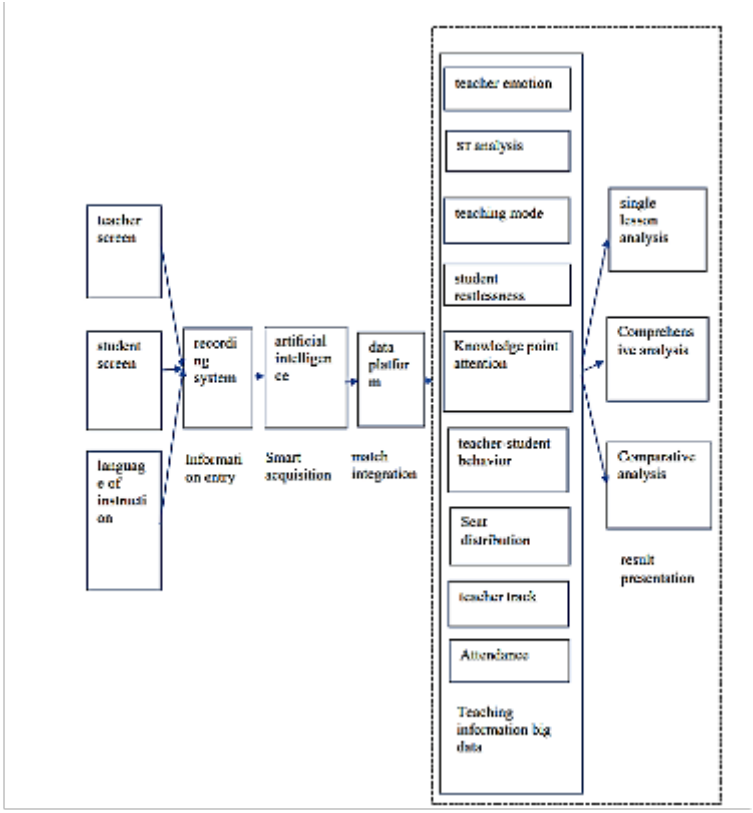

Figure 2: *Architecture of Computer Vision Analysis System*

5.3 Analysis elements of computer vision analysis model under classroom big data

1. Classroom behavior analysis

Classroom behavior analysis is to analyze teaching behavior[6], classroom atmosphere, and teaching style. Teaching behavior includes teacher behavior and student behavior. According to the characteristics of normal classroom teaching, teachers' behaviors are divided into blackboard writing, teaching, inspection, and teacher-student interaction, while students' behaviors are divided into response, reading and writing, listening, and raising their hands. Through the analysis of teaching behavior, record the behavior changes of teachers and students at different times in the classroom[7][8].

2. Analysis of teaching type

The analysis of teaching type includes class type, ST analysis, and teaching mode analysis. The type of lesson is to analyze the type of this lesson according to the teaching behavior of teachers and students. The type of lesson is divided into regular lessons and examination lessons. S-T analysis[9], namely the Student Teacher analysis method, is used to analyze the interaction between teachers and students in the teaching process. It is matched with the analysis of teaching mode, which is used to qualitatively evaluate teachers' teaching mode. These two analysis tools are relatively mature and commonly used teaching analysis methods at home and abroad. Teaching mode analysis is the specific application of the S-T teaching analysis method. The new teaching mode is judged according to the Rt Ch diagram by calculating Rt (teacher's teaching behavior share) and Ch (teaching behavior conversion rate) (as shown in Figure 3).

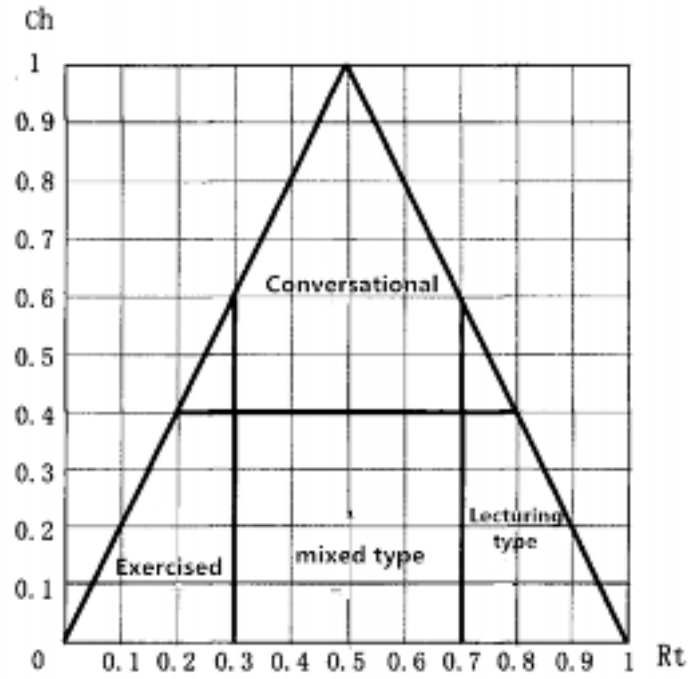

Figure 3: *Rt - Ch Diagram*

The teaching mode is determined according to the values of Rt and Ch. If Rt *leq* 0.3, it is a practice teaching mode, Rt $\geq$ 0.7 is a lecture teaching mode, Ch $\geq$ 0.4 is a dialogue teaching

mode, 0.3<Rt<0.7 and Ch<0.4 are mixed teaching modes.

(3) Listening state analysis

The analysis of the listening state refers to the analysis of students' arrival, emotion, and class participation, mainly based on the methods of portrait recognition and facial expression recognition.

5.4 Key technologies in the analysis process

1) S-T analysis method

S-T classroom analysis method is an analysis system that can directly express teaching characteristics. By objectively and completely recording the behavior of students (S) and teachers (T) in the classroom and conducting data analysis, the past experience and sensory teaching behavior and evaluation are quantitatively processed, so that teachers can intuitively grasp the gains and losses in classroom teaching, and make up for deficiencies and gradually improve.

In this study, S-T behavior coding is carried out using the precise teacher talk time obtained from ASR. By constructing S-T interactive coding, full automatic variable length S-T double coding is realized; The S-T analysis method based on duration is proposed to automatically generate the time change curves Rt (t) and Ch (t) of the proportion of teachers' dominant behavior Rt and teacher-student interaction rate Ch; Using Rt (t) and Ch (t) to model teaching activities, the continuous teaching process is deconstructed into a sequence of teaching activities; Through algorithm integration, a lightweight fully automatic visual classroom teaching process analysis software is developed[10].

S is the abbreviation of Student, T is the abbreviation of Teacher, and S-T analysis is the analysis of teachers and students. Through the analysis of classroom teaching videos, the teaching process is sampled at a certain sampling frequency, and then the obtained teaching sample behavior is coded and recorded into S-T behavior, and further drawn into the S-T curve. On this access, a series of indicators are analyzed, such as the occupancy rate of classroom teachers' behavior Rt, the conversion rate of teachers' and students' behavior Ch, And draw the Rt Ch change curve to determine whether the class type is teacher active or student active, or mixed class.

In this method, the teacher-student interaction is first coded with variable duration based on activities to reduce the workload of manual coding. However, to reduce the impact of large differences in coding duration on the subsequent S-T analysis, the smaller average coding duration and 30 seconds should be taken as the floating duration for subdivision coding. Based on the S-T behavior code, S-T analysis mainly uses the following variables: N Total number of behavior samples in teaching process; N_T: total number of T behaviors; NS: total number of S behaviors; The percentage of T activities is abbreviated as Rt, which represents the proportion of T activities to all teaching activities in the whole classroom implementation process, and the percentage of total switching of classroom teaching activities Ch This parameter represents the ratio of the total switching number of S and T activities in the classroom teaching process to the total number of teaching activity records. g (continuous number), the proportion of teacher-led behavior based on frequency Rt and teacher-student interaction rate Ch can be solved by the following formula:

$$Ch = \frac{g-1}{N} \tag{1}$$

$$Rt = \frac{N_T}{T} \tag{2}$$

Any kind of teaching behavior, learning style, and emotional experience of teachers and students in class all reflect a kind of educational idea. A focused classroom is not only the trend of current educational research, but also the core of school-based research and training to improve teachers' literacy. Therefore, the use of effective classroom observation methods such as S-T analysis can help teachers better reflect on teaching and promote their professional development.

(2) Cyclic neural network

1. Artificial neural network

An artificial neural network is a nonlinear and adaptive information processing system composed of a large number of interconnected processing units[10]. It is proposed basis on modern neuroscience research results. It uses perceptron to simulate neural nodes and attempts to process information by simulating the way of brain neural network processing and memorizing information.

2. Convolution neural network For the input with too many eigenvalues, such as images, if the ordinary fully connected neural network is used, it will produce parameters of a very large order of magnitude and cannot be trained. Therefore, the convolutional neural network can be used to solve these problems[11]. A convolutional neural network is the main model used in face detection in this paper. A convolutional neural network is a kind of feedforward neural network with convolution computation and depth structure. At present, it is widely used in deep learning research in the image, voice, and other fields, and has huge energy. Breakthroughs have been made in these fields[12]. Different from the fully connected structure of traditional neural networks, the hidden layer of convolutional neural networks generally includes the convolutional layer, pooling layer, fully connected layer, and other basic network layers, in addition to the input and output layers.

This paper proposes an RNN structure that deepens the depth of the network using a jump connection. By vertically deepening the network, the network can ensure that the long time series can be modeled while the network still performs well, to solve the problem of low recognition accuracy caused by the long video of classroom teaching behavior.

The modeling layer of recurrent neural networks (RNN), which can realize time series, is brilliant in the field of natural language processing and has been successfully extended to several corresponding fields. The RNNs network is mainly used to process sequence data, so it is brilliant in the NLP field. In the image field, researchers also conducted migration research on it and found that the effect in video is good. As we all know, the timing information of its context is particularly important in the video, and it is naturally thought of as a sharp tool to capture sequence information, but it generally has the problem of gradient disappearance[13] [14]. With the deepening of the network, this phenomenon becomes more and more obvious, and training is also increasingly difficult. The main structure of RNNs is shown in Figure 4 below.

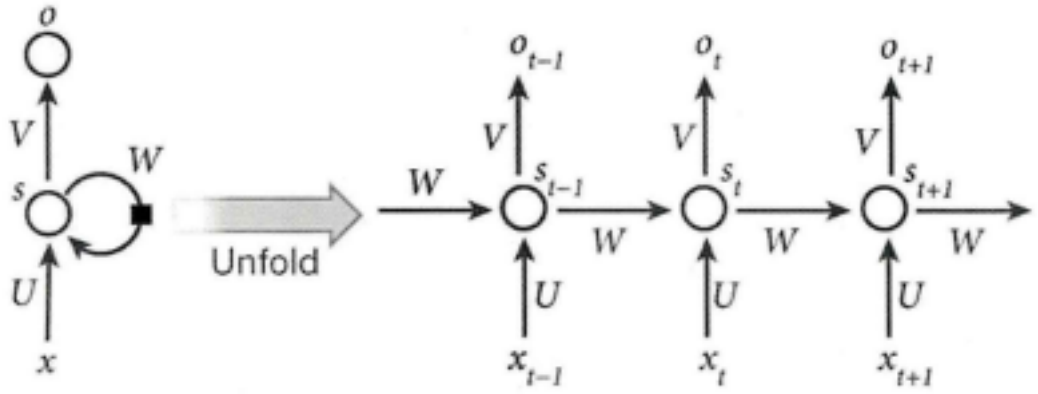

Figure 4: *Main Structure of RNNS*

In theory, RNNS can model time series of any length. Because it takes the current time point and historical information as input, it can save time series information, output it to the next layer as historical information, input it to the next layer, and then transfer it layer by layer. However, in the actual use process, due to the problem of computational complexity, usually only the impact on the adjacent time units is considered, that is, the current state is related to the previous states rather than all the historical states.

The gain brought by the deepening of the neural network is very good, but there are also many problems. This research captures long-time context information by improving and deepening the RNN network and captures sequence context information of video frames and representation information of each structure by designing the timing layer and representation layer respectively. For RNN networks, the network can be deepened directly by stacking, but it is difficult to train the two information flows mentioned above cooperatively. The time use experiment results also show that it is difficult to train. Therefore, generally, shallow RNN networks are used to extract the characteristics of CNN networks, and then they are trained as the input of RNN networks. However, such networks are not end-to-end networks.

The challenge lies in how to make the two information flows can be trained independently and cooperatively as much as possible. For the representation layer, the CNN network structure is used to extract the input frames separately, while the timing information is captured through the RNN network. As shown in Figure 5, R represents the characterization unit, and T represents the timing unit. Information is extracted through the characterization unit R, and the timing unit T encodes the timing information. It is the input of layer i at the time stamp t. It is designed as a conventional CNN network to extract features. It is represented by the following formula 3, which represents the parameters of R at layer i, and R is a ReLU (Conv (.)) function.

$$O'_{i,t} = R(O'_{i-1,t}, \phi_i) \tag{3}$$

The temporal flow is represented by Formula 4, which represents the memory state of layer i at the time stamp t, and represents the parameter of layer i of T, where T is a sigmoid (Conv

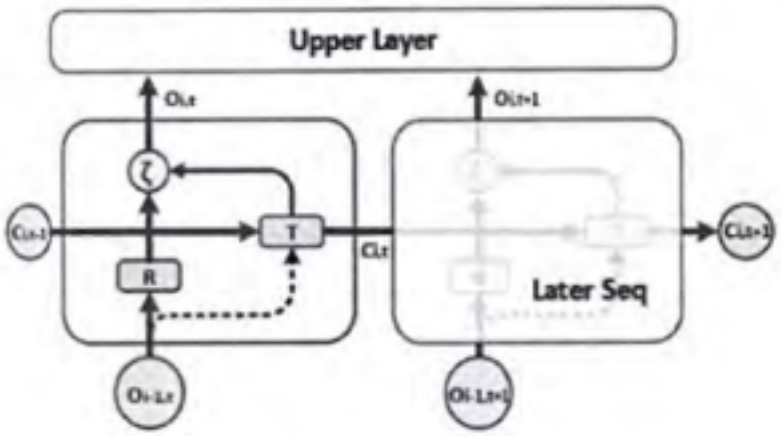

Figure 5: *Structure of two-layer information flow*

(.)) function.

$$C_{i,t} = T(C_{i,t-1}, O'_{i-1,t}\varphi_i) \tag{4}$$

$$O_{i,t} = \xi(O'_{i,t}, C_{i,t}) \tag{5}$$

Use Formula 5 to fuse two information flows.

In addition, for the difficult problem of training, when the network starts, it is hoped that it can learn as much as possible to represent the flow information and less time sequence information, and then learn the time sequence information when the network deepens[15][16][17]. At the same time, it also uses a method similar to Dropout to reduce the training complexity.

The structure diagram of behavior and speech recognition network is shown in Figure 6. The basic network is used for feature extraction, and then the RNN network is used for time series modeling. At the same time, in order to deepen the network, the jump connection structure is used for depth deepening, and finally the full connection layer is added for category classification.

The network structure of the model uses the basic network for feature extraction and then uses the RNN network for time series modeling. At the same time, to deepen the network, the jump connection structure is used to deepen the depth. Finally, the full connection layer is added to classify the categories. In short, it is to extract the spatial appearance information of a single frame image in the video sequence through CNN and then obtain the time information through the RNN network. However, because there are problems such as gradient disappearance when the RNN network carries out long-time sequence extraction modeling, to improve this problem, the shortened structure in the Resnet network is introduced to deepen the network, so that the RNN model can carry out long sequence time modeling, that is, it can capture Spatio-temporal information.

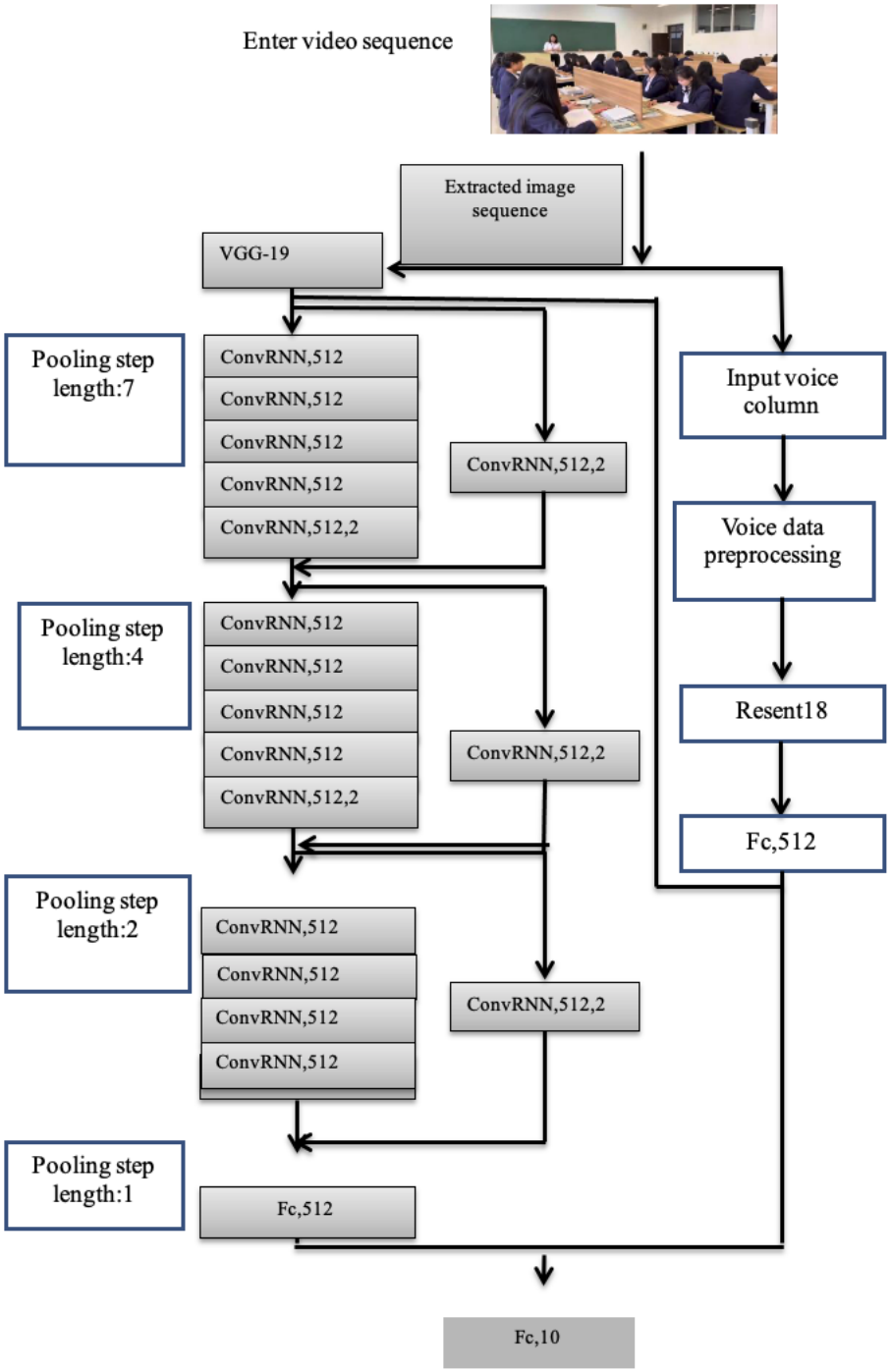

Figure 6: *Structure diagram of behavior and speech recognition network*

Table 1: *Basic information of research objects*

	1	2	3
content of courses	system management	system management	system management
class	Accounting 18-2	Accounting 17-1	Accounting 18-3
teacher	A	B	C

6 USE S-T TO ANALYZE CLASSROOM TEACHING IN SECONDARY VOCATIONAL SCHOOLS

6.1 Overview of research objects

The teaching case of this study comes from the secondary vocational school accounting computerization classroom. The "system management" course collects the teaching process of teachers A, B, and C in two different grades, namely, 17 and 18. All the teaching processes of the three teachers are conducted in the accounting computerization training room, among which, male teacher A, the teaching class is 2 classes, and they have been teaching for about 20 years. Female teacher B, the teaching class is 1 class, and she has been teaching for about 10 years. Female teacher C, teaching class 2, teaching for about 3 years. A and B in this survey come from the same school and teach different grades respectively. Teacher C is from another school. The textbook used by the two secondary vocational schools is the book published by Hebei Science and Technology Press.

This research records and collates relevant data by repeatedly watching the teaching videos of the three teachers, which helps teachers analyze the basic structure of the classroom, adjust teaching ideas in time, and optimize the teaching process. Before class, debug the video equipment and adjust the shooting angle so that the whole class can be shown on the equipment screen. Press the end key after class to back up the video. In this recording, three classes of three teachers were selected for observation and analysis. The class time of the three teachers was 41 minutes. The behaviors of teachers and students were recorded at 10-second intervals. Then the S-T data record form was manually filled in. Each teacher recorded 246 S-T data.

6.2 Description of the teaching process of different teachers in the same course

The research on the classroom teaching behavior of the three secondary vocational teachers will use the S-T analysis method to analyze the data of the three teachers' teaching videos through the process description and draw the corresponding conclusions based on the situation reflected in the questionnaire and interviews. By repeatedly watching the teaching video, we can summarize and sort out the classroom teaching process of three computerized accounting classes.

The teacher first reviews the knowledge related to the new lesson by asking questions. Please answer the source of the accounting software. Manual accounting procedure? What are the characteristics of commodity accounting software? Ask the students to think about these four questions and discuss them in groups, and then lead to the content of this lesson through the above four questions. The teacher explains the functions of the system management

and checks the effect of students' previews before class. What aspects does the operator's management include? It is concluded that operator management includes adding operators, modifying operators, logging off, and deleting operators. The teacher emphasizes the note that students take notes. In system management, each operator number is unique. Even in different A/C sets, the operator number cannot be duplicated. Work in groups to discuss the differences between the authority of the A/C set supervisor and the general authorization. After the teacher commented on the results of the group discussion, the teacher emphasized the following precautions: students take notes. Only the A/C set supervisor has the authority to modify the A/C set, while the system administrator is only responsible for creating, backing up, and restoring the A/C set. What are the aspects of A/C set management? Students answer that A/C set management includes the creation, modification, backup, deletion, and restoration of A/C sets. How to enable the teacher question system. There are two ways for students to answer and set the system to enable. The first method is to enable the system immediately after account creation by the system administrator. The other method is to log in to the system management page to enable the system after account creation by the A/C set supervisor. The teacher emphasized the following precautions: students take notes, and the A/C set supervisor and system administrator have permission to enable the system. Students practice computer operation. In the process of practice, teachers will actively ask students about the progress of the operation. Teachers will give individual explanations for operations that students cannot. The teacher asked the students about the harvest and experience of this lesson. Let the deskmates talk freely with each other first, then invite individual students to speak, and the teachers will supplement the deficiencies. Let the students summarize the content of this lesson, consolidate and improve it, and list blackboard writing to strengthen the impression of students on theoretical knowledge.

6.3 S-T Data Record Form of Secondary Vocational School

Teacher A uses direct import. Two minutes before the beginning of the class, the teacher directly explained the purpose and requirements of this lesson, as well as the important contents of each part, which attracted the attention of students. Teachers use PPT to teach new knowledge for 2-25 minutes in the classroom, and students practice freely for 25-41 minutes in the classroom to find problems in inquiry. For the problems encountered by students in the process of operation, the teacher shall provide independent guidance. After analyzing teacher A's teaching video, we can get the relevant S-T table (as shown in Table 2).

The teacher uses a question introduction. First, he puts forward a question related to the life situation to stimulate students' thinking. Then let the students preview and think about the content to be learned in this lesson with questions, and then the teachers and students will conduct an interactive inquiry. The teacher opens the broadcast demonstration function, explains the theory, and demonstrates the operation steps on the computer at the same time. In this process, let the students repeat the operation behavior that the teacher just said. Teachers demonstrate the process of adding, modifying, deleting, and canceling operators, emphasize the precautions and let students practice. The teacher emphasized that the operator can only log off his/her identity through the logout function. If it is enabled, he/she cannot delete it. While the system administrator is responsible for the daily management of operators, the

Table 2: *S-T table (Teacher A)*

Time	10s	20s	30s	40s	50s	60s	g	Time	10s	20s	30s	40s	50s	60s	g
1min	S	S	T	S	T	T	4	22min	T	S	S	T	T	60s	4
2min	T	T	T	T	T	T	0	23min	T	T	S	S	S	T	3
3min	T	S	S	S	T	T	2	24min	T	T	T	T	T	T	0
4min	T	T	T	T	T	T	0	25min	T	T	T	T	T	T	0
5min	T	T	T	T	T	T	0	26min	S	S	S	S	S	S	0
6min	T	T	T	T	T	T	0	27min	S	T	T	T	S	S	2
7min	T	T	T	T	T	T	0	28min	S	S	T	T	T	S	2
8min	T	T	T	T	T	T	0	29min	S	S	T	T	T	T	1
9min	T	T	T	T	T	T	0	30min	S	S	T	T	T	T	2
10min	T	T	T	T	r	T	0	31min	S	T	T	T	s	S	3
11min	T	T	T	T	T	T	0	32min	S	T	T	T	T	S	2
12min	T	T	T	T	T	T	0	33min	S	S	T	T	S	S	2
13min	T	T	T	T	S	S	1	34min	S	S	T	T	S	S	2
14min	T	T	T	T	T	T	0	35min	T	T	S	S	T	T	3
15min	T	S	S	T	T	T	2	36min	S	S	S	T	T	S	3
16min	T	T	T	T	T	T	0	37min	S	T	T	T	S	S	2
17min	T	T	T	T	T	T	0	38min	S	S	T	T	S	S	2
18min	T	T	T	T	T	T	0	39min	S	S	T	T	S	S	2
19min	T	S	S	S	S	T	2	40min	S	T	T	T	T	S	2
20min	T	S	S	T	T	T	2	41min	S	S	S	S	T	T	1
21min	T	T	T	T	S	S	1								

A/C set supervisor has no authority to manage operators. The teacher opened the broadcast demonstration

function, which fully motivated the students. The teacher uses the broadcast function to lead students to learn each module, and then they will immediately start to operate and practice. The teacher inspects the task operation of each student while patrolling, and provides independent guidance for the problems of a small number of students. Given the common problems of most students, the teacher will use the console to pause the computer operation of all students, and the teacher will give a centralized explanation. In the process of operation, cooperation and mutual assistance are carried out in groups. Students who operate fast in groups help students who operate slowly and mobilize all students to participate in classroom activities. Students will discuss in groups to explore what functions the system administrator and A/C set supervisor have and the differences between them. Conclude the discussion by students; Although both the A/C set supervisor and the system administrator can set operator permissions, the size of the operator permissions they set is different. The system administrator can set an operator as the A/C set supervisor, but the A/C set supervisor has no permission to change another operator into an A/C set supervisor. At the same time, all permissions of operators can be set by the system administrator, but the A/C set supervisor can only set the permissions of an operator within the A/C set range. Teachers demonstrate the process of adding the enterprise's A/C set information, unit information, accounting type, and basic information in the software system, and let students practice. After most of the students have finished, randomly check several students to demonstrate the specific operation process on the stage. Let them use the demo function of the console to operate step by step, and let the rest of the students find out the mistakes in the process of operation. When learning

Table 3: *S-T table (Teacher B)*

Time	10s	20s	30s	40s	50s	60s	g	Time	10s	20s	30s	40s	50s	60s	g
1min	T	T	S	S	T	T	3	22min	T	T	S	S	T	S	4
2min	S	S	T	T	T	T	2	23min	T	T	T	S	S	S	2
3min	T	T	T	T	T	T	0	24min	T	S	T	T	S	S	4
4min	T	T	T	T	T	T	0	25min	T	T	S	S	T	T	4
5min	S	S	S	T	T	T	2	26min	T	T	S	S	T	T	3
6min	T	T	T	T	T	T	0	27min	S	T	T	S	S	S	3
7min	T	T	S	S	S	T	2	28min	T	T	S	S	S	T	3
8min	T	T	T	T	T	T	0	29min	T	S	S	S	T	T	2
9min	S	S	T	T	T	T	2	30min	S	T	T	S	T	T	4
10min	T	S	S	T	T	T	2	31min	S	T	T	S	S	T	3
11min	T	T	T	T	T	r	0	32min	S	S	T	S	T	S	5
12min	T	S	S	S	T	T	2	33min	T	T	S	S	T	S	4
13min	T	T	T	T	S	S	1	34min	T	S	S	T	T	S	4
14min	T	T	S	S	T	T	2	35min	T	T	S	S	S	T	3
15min	T	T	S	S	T	T	2	36min	S	S	T	T	T	S	3
16min	S	S	T	S	S	T	4	37min	S	T	T	S	S	T	3
17min	S	T	S	S	S	S	3	38min	T	S	S	S	S	T	2
18min	T	T	S	S	S	T	3	39min	S	T	T	S	S	S	3
19min	S	T	T	S	S	S	3	40min	T	T	S	S	S	T	3
20min	T	S	S	S	T	T	3	41min	T	T	T	S	S	S	2
21min	S	T	S	T	T	S	5								

the knowledge of System Enabling, the teacher emphasized that both the A/C set supervisor and the system administrator have permission to enable the system.

The teacher asked the students to talk about the harvest of this lesson, to consolidate the theoretical knowledge learned in this lesson and enhance the student's ability to summarize problems.

Teacher B adopts review and introduction. In the first five minutes of the class, teachers introduce new lessons by reviewing old knowledge, which is conducive to consolidating students' existing learning achievements, promoting the transfer of knowledge, and reducing the cognitive difficulty of new knowledge. The 5-20 minutes in the classroom are for teachers to teach new lessons, 20-35 minutes for free operation, to explore and find problems, and teachers to give individual guidance. At the end of 35-41 minutes, under the guidance of teachers, teachers and students summarized the contents of this lesson together and emphasized the key points and difficulties of this lesson again. After analyzing the teaching video of teacher B, we can get the relevant S-T table(as shown in Table 3).

Teacher C adopts the problem-leading teaching method. Four minutes before the beginning of the class, the teacher raised questions related to the life situation, let students take the questions to study independently, stimulate students' curiosity and exploration consciousness, mobilize students' enthusiasm for learning, and students' interest very strong. The 5-35min class is the stage of the teaching process, which adopts the integration of theory and practice, and combines theory with practice. Combined with project teaching and task-driven method, the theory is introduced while the practical operation is transferred. The teacher will also complete practical training in teaching. 35-41min The teacher asks students to sum up the content of this lesson. After analyzing the teaching video of teacher C, we can get the relevant

Table 4: *S-T table (Teacher C)*

Time	10s	20s	30s	40s	50s	60s	g	Time	10s	20s	30s	40s	50s	60s	g
1min	T	T	S	S	S	S	2	22min	S	T	S	S	S	S	2
2min	T	S	S	S	S	S	2	23min	S	S	S	S	S	T	1
3min	S	S	S	S	S	S	0	24min	S	S	T	T	S	S	3
4min	T	S	S	S	S	T	3	25min	T	T	S	T	T	T	3
5min	S	T	T	T	T	T	2	26min	S	T	T	T	T	S	3
6min	T	T	S	S	T	T	2	27min	T	T	T	T	T	T	o
7min	T	T	S	S	S	T	2	28min	T	T	S	T	T	T	3
8min	T	S	T	S	T	S	6	29min	T	S	S	T	T	T	2
9min	T	S	S	T	S	S	4	30min	T	T	T	T	T	T	o
10min	T	S	T	T	S	S	4	31min	T	T	T	S	S	T	2
11min	T	S	T	S	T	S	6	32min	S	T	S	S	S	T	4
12min	T	T	S	S	T	S	4	33min	S	S	S	S	S	S	0
13min	T	S	S	T	S	T	5	34min	S	S	S	T	T	S	2
14min	T	T	S	T	T	S	3	35min	T	T	T	S	S	T	3
15min	T	S	T	S	T	S	6	36min	T	T	S	S	T	T	2
16min	T	T	S	T	T	S	4	37min	T	S	T	T	T	S	3
17min	T	T	T	T	T	S	2	38min	T	T	T	S	T	T	3
18min	T	T	S	T	T	T	3	39min	S	T	T	T	S	S	3
19min	S	T	T	S	T	T	4	40min	T	T	S	T	T	S	4
20min	T	T	T	S	T	T	2	41min	T	T	T	T	T	T	4
21min	S	S	S	T	T	S	3								

S-T table(as shown in Table 4).

6.4 S-T Chart Analysis of Secondary Vocational School

In teacher A's classroom, there are 175 teachers' behaviors T, and 74 students' behaviors S, with a g of 52. The proportion of teachers' behaviors Rt is 0.711, and the proportion of students' behaviors Ch is 0.207. Calculate the teaching video of teacher A to get the relevant S-T diagram.

In teacher B's classroom, there are 139 teachers' behaviors T, and 107 students' behaviors S, with a g of 105. The proportion of teachers' behaviors Rt is 0.565, and the proportion of students' behaviors Ch is 0.422. Calculate the teaching video of teacher B and get the relevant S-T diagram.

In the classroom of teacher C, there are 136 teacher behaviors T, 110 student behaviors S, and 95 g; the proportion of teacher behaviors Rt is 0.552, and the proportion of student behaviors Ch is 0.382. Calculate the teaching video of teacher C to get the relevant S-T diagram.

The S-T curve can accurately reflect the teaching process of the three classes. The horizontal line segment in the S-T curve represents the teacher's behavior, and the vertical line segment represents the student's behavior. The longer the line segment is, the longer the behavior lasts. If the vertical line segment is more than the horizontal line segment, it indicates that the student's behavior is dominant during this period. If the horizontal line segment is more than the vertical line segment, it indicates that the teacher's behavior is dominant during this period. If it is a diagonal line, it indicates the dialogue between teachers and students. If the vertical line segment and the horizontal line segment appear alternately many times, it indicates that

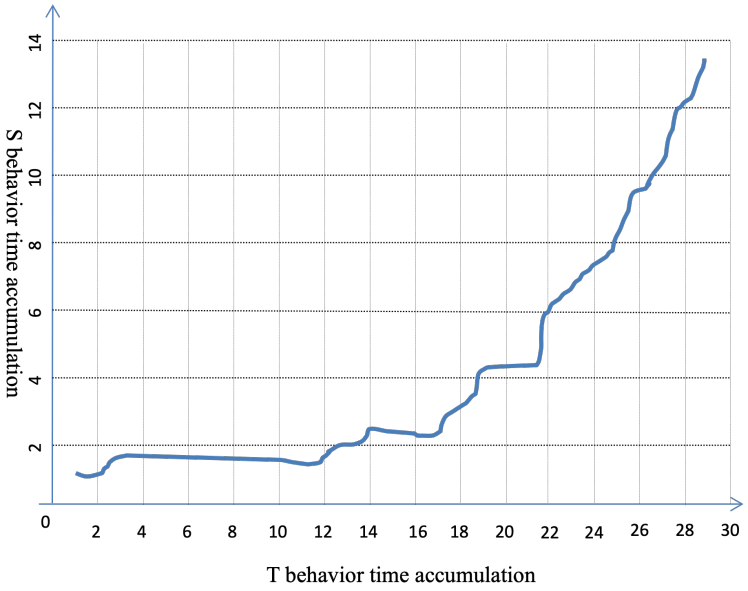

Figure 7: *S-T Chart Teacher A*

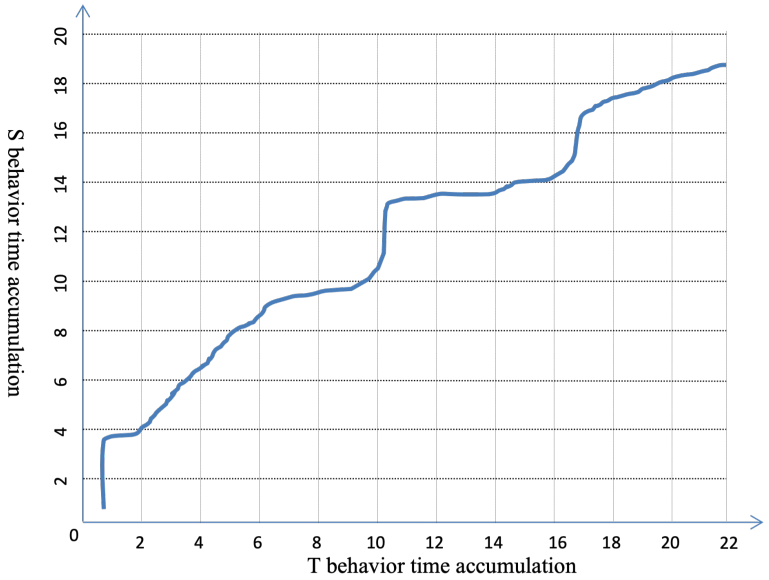

Figure 8: *S-T Chart Teacher B*

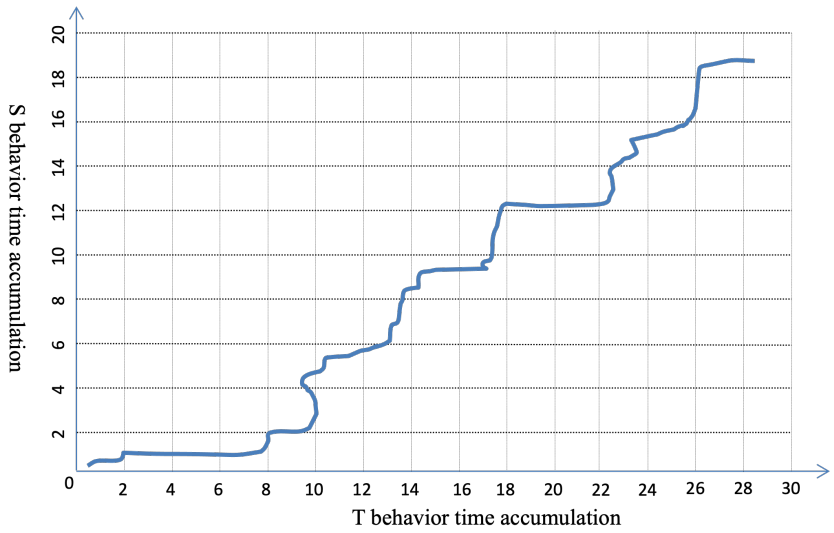

Figure 9: *S-T Chart Teacher C*

there are many teaching forms between teachers and students during this period. Comparing the S-T curves of the three teachers, it can be found that teacher A has more horizontal line segments than teacher B and teacher C, indicating that teacher A's behavior takes up more time in the classroom. By contrast, in teacher C's classroom teaching, the time occupied by teacher activities is equivalent to that occupied by student activities.

It can be seen from teacher A's S-T diagram that the length of teacher A's horizontal line segment is significantly longer than the length of the vertical line segment, indicating that teacher A's teaching behavior accounts for the majority, there is less dialogue between teachers and students in the classroom, and students have less time for independent practice. At the same time, there is a lack of communication and interaction between students, teachers' management and monitoring are insufficient, and classroom discipline is loose.

From the S-T diagram of teacher B, it can be seen that there are not many vertical and horizontal lines but more diagonal lines, which indicates that the interaction between teachers and students is more frequent. Before class B, the teacher carefully designed the review and introduction. The teacher introduced the new lesson by reviewing the old knowledge, creating a transfer situation for the students. In the teaching process, teacher B uses more question strings to throw out a question for students to think about and answer, and then the teacher explains and summarizes. The teacher completes the teaching of knowledge points through multiple questions and explanations. Stimulate students' enthusiasm by asking questions, and lead students to learn the contents needed for this lesson. Although students' enthusiasm for discussion throughout the lesson is high and the classroom atmosphere is very active, teacher B has not left enough time and space for students to digest and summarize knowledge after the interaction due to the frequent interaction between teachers and students during the teaching of new lessons. In teacher B's class, there is a phenomenon of "full questioning", and students will feel that the rhythm is too tight to adapt. At the same time, there will be a feeling of "one question and one answer" fatigue.

It can be seen from Teacher C's S-T diagram that in Teacher C's classroom, student behavior

has increased significantly in the first few minutes of the classroom, but the teacher's behavior has not changed much. This is because the classroom adopts the teaching mode of "learning before teaching", and students learn by themselves, so the cumulative time change in student behavior is large. In the middle stage of teaching, the behavior of teachers and students shows a relatively gentle growth trend, which indicates that the interaction between teachers and students is good. Immediately followed by the growth of students' behavior, teachers' behavior did not change much, and then teachers' behavior increased, but students' behavior did not change. The vertical line segment and the horizontal line segment are frequently interlaced twice. This is mainly because teachers adopted the integrated teaching of theory and practice, combining theory with practice. While teacher C is talking about theory, he also lets students practice. Students need to complete the computer operation immediately after self-study and teacher explanation, and then the teacher will explain and practice, review and summarize the classroom. In the process of teaching, Teacher C has obvious vertical line segments and horizontal line segments connected, indicating that the teacher has systematically explained the precautions before the students' computer operation, or summarized the students' error-prone points after the computer operation. At the end of the class, teacher C ends the lesson by teaching knowledge points. In the first few minutes of the formal class, there are long horizontal lines in the teacher's behavior, which indicates that the teacher is taking time to summarize and summarize knowledge and ends the lesson by interacting with students. On the whole, the S-T diagram of teachers shows that the accumulated time of teachers' behavior and students' behavior is equal, and there is no special disparity between teachers' behavior and students' behavior, which indicates that the teaching interaction in this classroom is good. As commented by Professor Wu Junming, "The whole class continuously guides students to think and solve problems seriously, which is widely praised by teachers who observe and observe".

6.5 Rt -Ch Chart Analysis of Secondary Vocational School

S-T analysis divides the teaching mode into four categories according to the two parameters of Rt and Ch: if the teaching mode is mainly student behavior, and the interaction between teachers and students is low, it is practice teaching mode; If it is based on teacher's behavior and the interaction between teachers and students is low, it is a teaching mode; If the proportion of students' behavior and teachers' behavior is equal, and the degree of interaction between teachers and students' activities is high, it is a dialogue teaching mode; If the proportion of students' behavior and teachers' behavior is equal, and the degree of interaction between teachers and students' activities is low, it is a mixed teaching mode.

Calculate the Rt and Ch values according to the data, and you can get the Rt Ch diagram. For each lesson, you can find the teaching mode corresponding to this lesson in the Rt 4Ch diagram. The data of teacher A is Rt=0.711, Ch=0.207, the data of teacher B is Rt=0.565, Ch=0.422, and the data of teacher C is Rt=0.552, Ch=0.382. According to the Rt and Ch data of the three classes, the Rt and Ch values are taken as abscissa and ordinate respectively, and teacher A, teacher B, and teacher C will fall into the corresponding teaching mode.

In the Rt Ch diagram, we find out the coordinate (0.711, 0.207), and we can see that the teacher's teaching mode is teaching, which indicates that the class is dominated by teacher

A, and the degree of interaction between teachers and students is low. Through the Rt and Ch data of teacher A, we can find that there are many teachers' behaviors, but relatively few students' behaviors. This shows that the initiative of the classroom is mainly in the hands of teachers and that students' behaviors only account for 0.207. This shows that only a few people think about the problems raised by teacher A, while most people speak almost nothing, only passively accept knowledge and mechanical exercises, and lack classroom discussion and collaborative learning. The new classroom teaching advocated by the constructivism theory emphasizes that "students should cooperate and explore, and teachers and students should fully communicate and discuss". Although there is also communication and interaction between teachers and students in the teaching process of teacher A, it is only limited to the teaching form of "students ask questions in the process of computer operation, and teachers answer", which does not fully stimulate students' interest in learning and create an interactive learning atmosphere, The whole classroom atmosphere is relatively dull. The modern classroom should reflect the concept of "students as the center and teachers as the main body", strengthen the communication and interaction between teachers and students, guide students to actively think about problems, enable each student to participate in the classroom, return the classroom to students, and make students become the masters of the classroom.

In the Rt Ch diagram, we find out the coordinate (0.565, 0.422), and we can see that the teaching mode of teacher B is dialogue, which shows that the proportion of student behavior and teacher behavior is equal, and the interaction between teachers and students is more frequent. Dialogue teaching refers to the process in which various subjects in the classroom constantly solve problems in the classroom through communication, to establish a harmonious relationship between them and improve teaching quality. 2]. The classroom teaching behavior of this class is mostly based on questioning behavior, and the dialogue teaching mode is conducive to establishing a harmonious teacher-student relationship. Through the Rt and Ch data of teacher B, we can find that student behavior accounts for 0.422, which indicates that the classroom also fully reflects the main position of students. However, the frequent conversion of teachers' and students' behaviors will make students feel that the classroom rhythm is too tight to adapt, and will also produce a sense of fatigue of "one question and one answer". Some types of courses may be more suitable for teachers to let students practice and operate by themselves to find problems after they have explained the essentials of the operation process. Students also said in the interview that the course in accounting computerization is more suitable for students to practice on the computer. Too much interaction between teachers and students in the classroom will affect the progress of operation and the effect of learning. Given this situation, teachers should choose the most appropriate interaction mode according to the characteristics and actual situation of the subject, to achieve the ideal teaching effect in the classroom.

In the Rt Ch diagram, we find the coordinates (0.552, 0.382), and we can see that the teaching mode of teacher C is mixed, which shows that the proportion of students and teacher's behavior is equal, and the degree of interaction is low. Through the Rt and Ch data of teacher C, we can see that this point is very close to the dialogue model, so we can judge that the teacher-student interaction in this class is better. The mixed teaching mode can better highlight the students' dominant position. Teacher C can better grasp the rhythm of

classroom teaching, practice the classroom teaching mode with students as the main body and teachers as the leading role, and flexibly adjust the teaching progress and teaching plan in the implementation process, greatly arousing enthusiasm and initiative of students, and promoting students to better master knowledge and skills.

7 CONCLUSION AND PROSPECT

In recent years, research on computer vision analysis and education is gradually becoming hot. As the main teaching site of daily teaching, classroom teaching basic research has emerged in an endless stream, but the research based on artificial intelligence is relatively few. On this basis, this paper has conducted relevant research on the automatic recognition of teachers and students in classroom teaching, hoping to achieve a high-precision automatic recognition model, It will further the automatic analysis of education and teaching to truly improve and even liberate the traditional human analysis, and make corresponding contributions to the new automated, scientific, intelligent, data-driven teaching methods for teachers and learning methods for students.

7.1 Conclusion

This paper has carried out research and discussion around the hot topic of "computer vision analysis", and built the idea of classroom big data computer vision analysis system architecture for the optimization of classroom teachers' teaching methods and students' learning methods. This paper makes a detailed study of AI intelligence analysis of classroom data and tries to apply it to classroom teaching reflection, which shows a certain feasibility in the experiment. It has a certain reference value for the teaching methods of classroom teaching and students' learning methods.

7.2 Prospect

The integration of artificial intelligence into education has become a development trend. After sorting out the evolutionary path of the computer vision analysis model for classroom analysis, this paper constructs an AI-based classroom model analysis framework from the aspects of classroom teachers' class situation and students' class feedback and applies AI technology to practical applications. However, we must recognize that when applying AI technology to classroom teaching analysis, we still face the following difficulties: First, the academic community has not yet formed a unified evaluation standard for the analysis indicators and reference thresholds of classroom teaching characteristics; Second, classroom teaching analysis focuses on "teaching", and focuses on a single subject. The analysis technique that focuses on "learning" and applies to multiple subjects and multiple courses remains to be explored; Third, the lack of open and labeled teaching data sets leads to the exploration of automatic analysis of classroom teaching limited to a large number of data classifications and statistics. The follow-up research needs to further combine the latest research results of natural language understanding, computer vision, and education big data, improve the comprehensiveness and accuracy of teaching data collection and look forward to providing new ideas and methods for AI to support teaching analysis.

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