OPTIMIZING TEACHING METHODS AND STUDENT LEARNING STYLES USING COMPUTER ANALYSIS

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MASTER OF SCIENCE

IN DIGITAL INNOVATION AND FINANCIAL TECHNOLOGY

GRADUATE SCHOOL

CHIANG MAI UNIVERSITY

MARCH 2023

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AN INDEPENDENT STUDY SUBMITTED TO CHIANG MAI UNIVERSITY IN PARTIAL FULFILLMENT OF THE REQUREMENTS FOR THE DEGREE OF MASTER OF SCIENCE
IN DIGITAL INNOVATION AND FINANCIAL TECHNOLOGY

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24 March 2023

ACKNOWLEDGEMENT

After months of hard work, my IS research is almost finished. First of all, I would like to thank Dr.Somsak Chanaim and Dr.Ahmad Yahya Dawod for their help and guidance in my writing process.

Then I would like to thank all the teachers who have taught me. They are all excellent professionals and I have learned a lot from them. I also would like to thank my senior schoolmates, who have helped me throughout my study and always answered my questions patiently.

Finally, I would like to thank my parents for their spiritual and material help.

Yumei Wang

หัวข้อการค้นคว้าอิสระ	วิธีการสอนของครูที่เหมาะที่สุดและรูปแบบการเรียนรู้ของนักเรียนด้วยการวิเคราะห์คอมพิวเตอร์วิทัศน์
ผู้เขียน	นางสาว หยูเหมย หวัง
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บทคัดย่อ

ด้วยการพัฒนาข้อมูลขนาดใหญ่ บล็อกเชนและเทคโนโลยีปัญญาประดิษฐ์ การประยุกต์ใช้ปัญญาประดิษฐ์ ในด้านการศึกษาได้ค่อยๆเกิดขึ้น ปัญญาประดิษฐ์ได้เปลี่ยนวิธีการผลิต วิธีการใช้ชีวิต และวิธีการคิด โดยเฉพาะอย่างยิ่งให้โอกาสใหม่สำหรับการพัฒนานวัตกรรมการศึกษา อย่างไรก็ตาม ในปัจจุบันรูปแบบการ ศึกษาของโรงเรียนส่วนใหญ่ยังคงอยู่ในชั้นเรียน และการประเมินคุณภาพของการสอนการสอนในชั้นเรียนของครูอยู่เสมอในขั้นตอนดั้งเดิมของการประเมินจากผู้เชี่ยวชาญในห้องเรียน ยังเป็นการสังเกต และการคาดการณ์เชิงประจักษ์การขาดตรรกะและความครอบคลุม และไม่เอื้อต่อการเพิ่มประสิทธิภาพของวิธีการสอนของครูและวิธีการเรียนรู้ของนักเรียน ดังนั้น การวิจัยนี้ศึกษาเทคโนโลยีการวิเคราะห์ด้วยภาพคอมพิวเตอร์โดยใช้การเรียนรู้อย่างลึกซึ้งใช้ลักษณะที่ถูกต้องและเป็นจริงและนำไปใช้กับการประเมินการสอนในชั้น เรียนเพื่อช่วยให้ครูและนักเรียนเพิ่มประสิทธิภาพวิธีการสอนและวิธีการเรียนรู้ของนักเรียนงานหลักของการศึกษานี้มีดังนี้

(1) มองย้อนกลับไปถึงการพัฒนาเทคโนโลยีการวิเคราะห์การมองเห็นคอมพิวเตอร์การวิเคราะห์ และดูดซับวิธีการขั้นสูงทั้งในและต่างประเทศรวมกับฉากการสอนในชั้นเรียนของโรงเรียนจีนเสนอการเรียนรู้อย่างลึกซึ้ง การเรียนรู้อย่างลึกซึ้งวิธีการวิเคราะห์ภาพคอมพิวเตอร์ที่แม่นยำและแม่นยำ วิธีนี้ใช้เครือข่ายปัญญาประดิษฐ์ อาร์เอ็นเอ็น เป็นเครือข่ายหลักการรวมวิธีการเช่นการวิเคราะห์การสอนในชั้นเรียนเอส-ที และเทคโนโลยีการจดจำใบหน้าที่ใช้กันทั่วไป ในการทดสอบเป้าหมายเพื่อให้ได้ผลลัพธ์ที่มีประสิทธิภาพและแม่นยำกว่าวิธีการดั้งเดิม

(2) วิเคราะห์และสรุปการขาดผลการเรียนการสอนและวิธีการเรียนรู้ของนักเรียนของการศึกษาในชั้นเรียนโดยเฉพาะอย่างยิ่งสำหรับวิธีการสอนในชั้นเรียนของครูวิธีการเรียนรู้ห้องเรียนนักเรียนการแลกเปลี่ยน แบบโต้ตอบของครูและนักเรียนขาดความสนใจการวิเคราะห์และสรุปการสอนในชั้นเรียนและระบบการจดจำพฤติกรรมของนักเรียนอัตโนมัติตามวิสัยทัศน์ของคอมพิวเตอร์

และใช้สิ่งนี้เป็นมาตรฐานอ้างอิงสำหรับการปฏิรูปการสอนในชั้นเรียนของครูและการเพิ่มประสิทธิภาพวิธีการเรียนรู้ของนักเรียน

(3) การใช้ข้อมูลที่รวบรวมโดยวิดีโอคอมพิวเตอร์ในห้องเรียนห้องเรียนเส้นทางการใช้งานของระบบนี้จะถูกวิเคราะห์การทดลองแสดงให้เห็นว่า การศึกษาครั้งนี้มีความเป็นไปได้บางอย่างมันมีค่าอ้างอิงที่แน่นอน สำหรับวิธีการสอนของการสอนในชั้นเรียนและวิธีการเรียนรู้ของนักเรียน

คำสำคัญ: พฤติกรรมของครู; พฤติกรรมของนักเรียน; พฤติกรรมการสอนในห้องเรียน; คอมพิวเตอร์วิทัศน์; การวิเคราะห์เอส-ที

Independence Study Title	Optimizing Teaching Methods and Student Learning Styles Using Computer Analysis
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ABSTRACT

With the development of big data, blockchain, and artificial intelligence technology, the actual application of artificial intelligence in the field of education has gradually emerged. Artificial intelligence has profoundly changed production methods, lifestyle, and thinking methods, especially providing new opportunities for the innovative development of education. However, at present, most school education models are still offline, and the evaluation of the quality of teaching of teachers' classroom teaching has always stayed at the original stage of the evaluation of classroom experts. It is a purely empirical observation and induction, lacks logic and comprehensiveness, and is not conducive to the optimization of teachers' teaching methods and student learning methods. Therefore, this article studies the computer visual analysis technology based on deep learning, uses its accurate and real-time characteristics, and applies it to the evaluation of classroom teaching to help teachers and students optimize teaching methods and student learning methods. The main tasks of this study are as follows:

(1) Looking back on the development of computer vision analysis technology, analyzing and absorbing advanced methods at home and abroad, combined with the classroom teaching scene of Chinese schools, proposed deep learning based on deep learning, accurate and accurate Computer visual analysis method. This method uses a convolutional neural network RNN as the main network, combining methods such as S-T classroom teaching analysis and face recognition technology commonly used in target testing, to obtain more efficient and accurate results than traditional methods.

(2) Analyze and summarize the lack of teaching effects and student learning methods of classroom education, especially for teachers 'classroom teaching methods, student classroom learning methods, teacher-student interactive exchanges, and students' lack of attention. Analysis and summary of the classroom teaching and automatic student behavior recognition system based on computer vision, and used this as a reference standard for teacher classroom teaching reform and student learning method optimization.

(3) Using the data collected by computer videos in the classroom, the implementation path of this system is analyzed. The experiment shows that this study has certain feasibility. It has a certain reference value for the teaching methods of classroom teaching and the learning method of students.

Key words: Teacher behavior; Student behavior; Classroom teaching behavior; Computer vision; S-T analysis

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LIST OF ABBREVIATIONS

AI	Artificial Intelligence
S-T	Students and Teachers
CNKI	China National Knowledge Internet
Rt	Teacher's teaching behavior share
Ch	Teaching behavior conversion rate
NMS	Non-maximum suppression
ASR	Automatic Speech Recognition
RNN	Recurrent neural network
CNN	Convolutional Neural Network

CHAPTER 1

INTRODUCTION

1.1 Research Background

In recent years, with the rapid development of Internet technology and the explosive growth of artificial intelligence technology, the era of the Internet of everything is coming, and People's Daily use of Internet devices generates massive behavioral data. Unknowingly, people have entered an era surrounded by massive data, data has been integrated into People's Daily life, and play a role in various aspects. The rise of artificial intelligence technology also provides unlimited possibilities for the development and utilization of these data, such as digital image technology, video analysis technology, speech recognition technology, natural language processing technology, brain science, and cognitive technology, etc. which help people perceive the world and make predictions and even decisions about certain behaviors. In the long-running process of the traditional classroom teaching management system of primary and secondary schools and colleges, a large number of log records, login records, personal information, and other text information will be generated and simply mined and processed. The emerging information technology brings not only the growth of data volume and the diversification of data types to the traditional education and teaching management system, but also provides the possibility to explore the teaching model and explore the potential teaching methods. Generally speaking, teaching courseware, questionnaires in class, homework, and other text data together constitute the traditional classroom teaching data, while the main contribution of the emerging information technology-based classroom teaching data is to provide diversified and multi-dimensional teaching data. For example, students' in-class video and image information, voice discourse information, login logs in the teaching management system, resource information, learning behavior, learning interaction, sound, after-class forum, etc. The modern information-based classroom teaching management system can meet the big data generated in the growing teaching process only if it has the ability to intelligently process

diversified and multi-dimensional data and integrate, analyze and mine multiple data. Therefore, in the current teaching situation, the AI-based intelligent classroom teaching analysis system also needs to have the function of extracting diversified information such as students' learning behavior, body behavior, teachers' teaching behavior, and interactive behavior in class. Including intelligent routine classroom monitoring, voice information extraction, teaching management platform, teaching decision, and evaluation, etc. Computer vision technology, speech recognition technology, and emotional computing in the field of artificial intelligence make it possible for modern intelligent classroom teaching management systems to process these diversified classroom teaching data. It is also one of the important directions to combine education with big data and artificial intelligence technology in the future. However, the traditional classroom teaching evaluation is time-consuming and arduous, requiring a huge investment of manpower and material resources, but the results are counterproductive and the results are generally not obvious. In classroom teaching, artificial intelligence, big data, and other technologies are urgently needed to provide new impetus for diversified, intelligent, and large-scale classroom evaluation. Teachers' behavior and students' behavior play a significant role in the teaching process. Students are the main body of the classroom, and teachers dominate the classroom. Therefore, the behavior of teachers and students is particularly important.

1.2 Problem Statement

1.2.1 Data Of Students' Evaluation of Teaching Quality of The Courses and Their Teachers

In the three years from 2020 to 2021, students of Yunnan Vocational College of foreign language and affairs have summarized the teaching quality evaluation results of their courses and teachers as follows:

Table 1.1 Summary of students' evaluation results on the teaching quality of the course and their teachers

Degree of satisfaction	Satisfaction (above 8.5 points)	Basic satisfaction (7.5-8.5 points)	Unsatisfactory (below 7.5)
2020	70%	22%	8%
2021	70%	21.3%	8.7%
2022	71.3%	19.8%	8.9%

In the past three years, the courses offered by Yunnan Vocational College of Foreign Languages and its teachers are relatively stable. Although students in different classes have different feelings and teachers have different annual teaching performances, the scores obtained in different years are also different. However, the high positive correlation between the scores of students' evaluation of teachers' quality in these three years indicates that the statistical results of this survey are scientifically based. As can be seen from the table1. 1, the proportion of courses with scores below 7.5 and their teachers remains high. Some students collectively request the school to replace such teachers, which also puts forward higher requirements for the school's management of teachers. Therefore, the school must find a good solution as soon as possible and take more effective measures to solve this kind of problem. Students recognize teachers with high teaching quality for similar reasons. For example, teachers can perform excellent basic teaching qualities in teaching work, be competent for the teaching work of the courses they undertake, have a serious and responsible teaching attitude, have rich teaching experience, have good teaching effect, and have a harmonious relationship between teachers and students. There are often different reasons. We must

make a specific analysis of the specific problems to reach a correct conclusion according to the actual situation.

1.2.2 Problems In The Classroom of Teachers' Teaching Methods

(1) Part of the teacher's lack of attention to the learning state of the students, just lower the head of the lecture or look up at the day, the students are not focused on the lecture regardless of whether the individual teacher standing the platform for 45 minutes not willing to go down to pay attention to the students (all teachers should learn to use an electronic pen, as far as possible to reduce the puppet on the platform to explain) [3].

(2) class, self-study discipline, the gap between classes is too big, some classes are messy, some classes are quiet (except orderly cooperation discussion); Some students in some classes can not be put into the study, bow, bow, or do small movements. Some tutors do not take the initiative to understand the situation of students' independent learning, do not give guidance when appropriate, and do not encourage students to question the difficulties, self-study class efficiency is low [3] [5].

(3) In some classes, the teacher talked too much and said too much on behalf of the students. After the question was thrown out, the students could not leave time to think, and then they asked questions. When asking questions, only one student was found, and the answers were not accurate or complete. This phenomenon has cultivated students' inertia, over time, students will lose the motivation of active brain, and active thinking, accustomed to passive listening, and even don't listen (especially downstream students, they think: anyway, the teacher does not ask me, simply don't listen to), therefore, in a sense, the emergence of lazy students, stupid students, and the teacher's teaching methods, methods are closely related [5].

(4) some teachers bring the problem of chattering into the classroom, commandeering the right to speak, a full room, a full room, have their own all say and then fast feeling, otherwise, in this case, the efficiency is the lowest, because the students passively listen (some students did not listen to their brains, mouth, hands on the opportunity, Therefore, it is difficult to translate their knowledge (resulting in re-consolidation after class, real compensation, increasing the burden of students). Theory and practice have proved that: with the use of multiple senses, learning

efficiency is the highest. Many of our classrooms only use the students' hearing organs and the teacher classroom teaching greed fast, does not understand does not grasp the students' knowledge of the situation, "do not eat" and "can not eat hard jam" the result is that the students know a little, even the top students know little, middle and downstream students are confused not to know north and Southeast and west in this case, Rather than talk about three questions to make the students confused, it is better to talk about a lot all students clearly, so in the teaching process, teachers should accurately understand the learning situation, timely control the degree of knowledge absorption of students, as far as possible to let the vast majority of students grasp the knowledge rather than let a small number of students get knowledge [3] [5].

1.2.3 Problems of Students In Class

1. Lack of enthusiasm, some students lack learning initiative and do not preview the new lesson before class, so learning passively. Passive listening in class, unable to grasp the key points. No good habits of preview, study, and consolidation have been formed. Therefore, many students' learning is limited to listening to the teacher in class, where the teacher said to hear where what the teacher said to listen to what, before class did not preview, lectures can not find the key points, busy in-class notes, but ignore the teacher's analysis and summary, did not really understand the content, but just move the conclusion to their notebooks. The encounter does not understand will not ask, just used to accumulate problems and wait for the teacher to explain, the result is accumulated [6].

2. Can not learn the method, mainly manifested in not paying attention to the lecture, did not make clear the teacher's explanation of the context of knowledge, ignoring the teacher's analysis of the connotation of the concept, can not find the key and difficult points, not clear thoughts and methods finally get only a lot of notes and a little knowledge or unable to start the problem, even some people do not take notes. After class, they could not summarize and sort out the knowledge they had learned in time, but they just did mechanical imitation and rote memorization. Also, some classes do not listen to, their own set, the result is twice the effort, and the effect is small [4].

3. class attention is not focused, easily affected by the students next to the class is a normal thing, after all, they will always happen in a day of playing a lot of interesting things, such as playing a game in the mind, the students said that today there is fun, there

is delicious food and so on, it is easy to make their minds wander. Make them not concentrate in class, and always think about something unrelated to the study. This will affect their academic performance, because most of the content in the textbook is linked to each other, as long as one step behind, it will be difficult to keep up with the teacher's thinking, and even give up this part [5]. Some students do not like to raise their hands to answer questions, not confident, introverted characters.

1.2.4 Research Question

1. How can computer analysis be used to accurately assess the effectiveness ofa teacher's teaching method?

2. How do apply methods can be used to determine the best learning style for a particular student?

3. How can computer analysis be used to develop an effective learning plan for each student?

4. How can computer analysis be used to improve teachers' teaching methods in order to better meet the needs of students with different learning styles?

5. How can computer analysis be used to measure the impact of a teacher's teaching method on student performance?

1.3 Objectives of The Study

1. To investigate the potential of computer analysis to optimize the teaching methods of teachers and the learning styles of students.

2. To review the current research on computer analysis of teaching methods and learning styles, and analyze the potential of computer analysis to optimize teaching methods and learning styles.

3. To discuss the potential implications of computer analysis on teaching methods and learning styles, and outline potential strategies to maximize the effectiveness of computer analysis.

4. To suggest potential areas for further research and identify the limitations of computer analysis of teaching methods and learning styles.

1.4 Solutions

Starting from the analysis and research status of classroom teaching behavior at home and abroad, this research proposes a computer vision analysis model to solve these problems. The model uses cameras to capture the teaching process of teachers and the learning process of students in class, captures key frames according to the time interval of 3 seconds, and then sends them to the deep neural network for testing and identification (the whole process is shown in Figure 1. 1). This model 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, it helps teachers and students to know what teachers do, say, think, learn and feel in class more efficiently, conveniently, and pertinently. Then, through AI intelligence analysis, teachers can find out the teaching problems, find the teaching mode suitable for students and themselves, and constantly improve their abilities

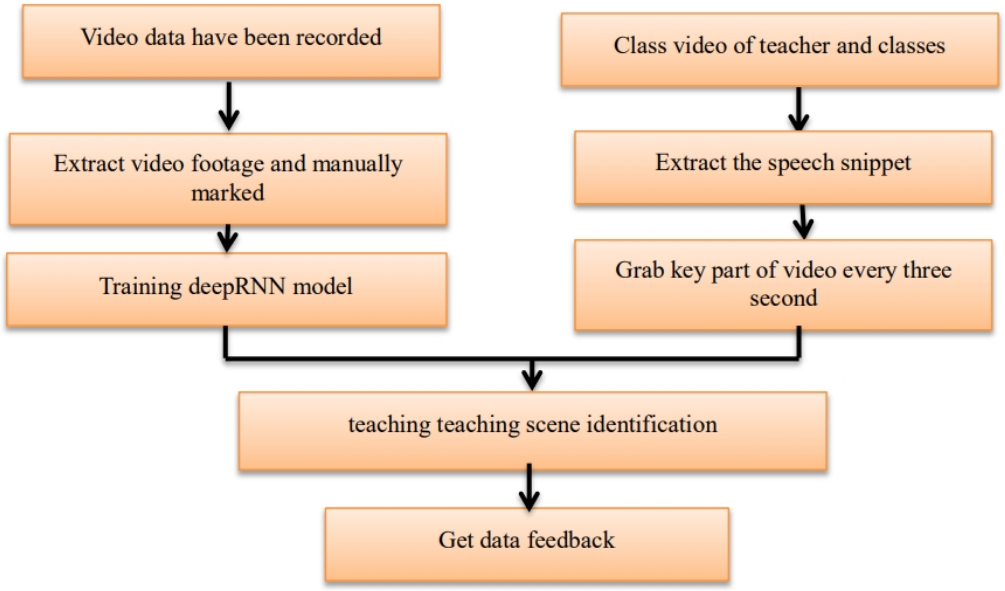

Figure 1.1 Deep Circulation neural network classroom work diagram

It can also collect and analyze the classroom and learning data of each student through computer vision, monitor the learning effect and make timely evaluations through the computer vision intelligent analysis system, diagnose the problems in learning, accurately analyze the learning style and characteristics of each student, improve the daily learning style and behavior, and cultivate the intelligent learning style of students. Just as a media streaming service ADAPTS to user behavior and suggests items viewers are likely to enjoy, computer vision analysis systems can be used to recommend appropriate learning materials to students to fit their learning patterns. Personalized learning helps each student learn at his or her own pace and focus on the subject areas that interest them most. The next step in personalized learning will allow teachers to collect data and build an approach that works for each class, rather than reusing the same lessons every year.

1.5 Research Significance

The important method and a key link between education and teaching reform and teacher professional development lie in classroom teaching research. The core content of classroom teaching research lies in the study of classroom teaching behavior. The effectiveness, scientificity, and rationality of classroom teaching behavior play a key role in the teaching effect. Classroom teaching analysis refers to the quantification, analysis, and processing of teachers' and students' behavior in classroom teaching so that teachers can help reflect on and improve their unreasonable teaching behavior in the teaching process. No matter what method is adopted to study teaching behavior, it is essentially a quantitative analysis of the classroom teaching process and further improvement and enhancement of the teaching process based on the analysis results. Therefore, this study has certain practical significance and value in both theory and practice. In conclusion, this study has the following significance:

In terms of theory, this research first analyzes and summarizes the current situation of relevant research at home and abroad in the field of classroom teaching analysis through the literature review research method, and points out the existing problems and shortcomings in the current information-based classroom teaching process, and proposes a brand new student- dominated, teacher-led automatic solution for

classification and identification of classroom teaching behavior. It is suitable for intelligent and automatic processing of classroom teaching behavior analysis in the case of a large amount of data.

In practice, this study quantifies the classroom teaching process with the help of new technologies (big data and deep learning) and methods (computer vision analysis), and analyzes and processes the quantified results. To a certain extent, it helps teachers and students to learn more efficiently, conveniently, and pertinently about teachers' teaching behaviors and students' learning behaviors and interactions in the course of the class, so that teachers can have enough time to reflect on the shortcomings and problems existing in their teaching process according to 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 capacity, processing speed, analysis accuracy, and application scale provided by technology all reflect the application value and practical possibility of research.

This research studies the computer vision analysis technology based on deep learning makes use of its accurate and real-time characteristics, and applies it to the evaluation of classroom teaching, to help teachers and students optimize the teaching method and student learning method. The main work of this research is as follows:

Reviewed the development history of computer vision analysis technology, analyzed and learned advanced methods at home and abroad, combined with the classroom teaching scene of Chinese schools, and proposed an efficient and accurate computer vision analysis method based on deep learning. This method uses a convolutional neural network RNN as the main network and combines S-T classroom teaching analysis and face recognition technology commonly used in object detection, to obtain more efficient and accurate results than traditional methods.

Analyze and summarize the pain points and deficiencies of teachers' teaching effects and students' learning methods in current classroom education, especially the deficiencies of teachers' classroom teaching methods, students' classroom learning methods, teacher-student interaction and communication, and student's attention. This research analyzes and summarizes the classroom teaching and student behavior

automatic recognition system based on computer vision, and takes it as the reference standard for teachers' classroom teaching reform and students' learning method optimization.

At the end of this research, using the data collected by computer video in the classroom, the implementation path of the system is analyzed, as well as the difficulties of the implementation of the system and where to look for improvement.

1.6 Main Contributions of the Research

The main contribution of this research is to analyze the teaching methods and students' learning styles in order to optimize the teaching and learning process. The research utilizes computer analysis to evaluate the effectiveness of the teaching methods and students' learning styles. The computer analysis includes data gathering, data analysis, data interpretation and reporting. The research also provides potential solutions to improve the teaching and learning process. The study also provides suggestions on how to implement the solutions in an effective manner. The study also discusses the implications of the research findings. The research provides insight into the effectiveness of the teaching and learning process and can be used as a reference for future research and improvements in the field.

1.7 Research Scope And Method

1.7.1 Research Scope

The scope of this research research is to analyze the effectiveness of optimizing teachers' teaching methods and students' learning styles with the help of computer analysis. It will examine how computer analysis can provide insights into the teaching and learning process and how it can be utilized to improve the overall performance of teachers and students. The research will also explore different computer-aided techniques and technologies used in teaching and learning, such as artificial intelligence, machine learning, and data mining. It will also explore the implications of using such computer-aided techniques on classroom learning, such as the impact on student engagement, student achievement, and teacher-student communication. The study

will also discuss the potential challenges of utilizing such techniques in classrooms and possible strategies for overcoming these challenges. The research will examine the potential benefits of using computer analysis to optimize teachers' teaching methods and students' learning styles.

1.7.2 Research Method

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.

1.8 Conceptual Framework

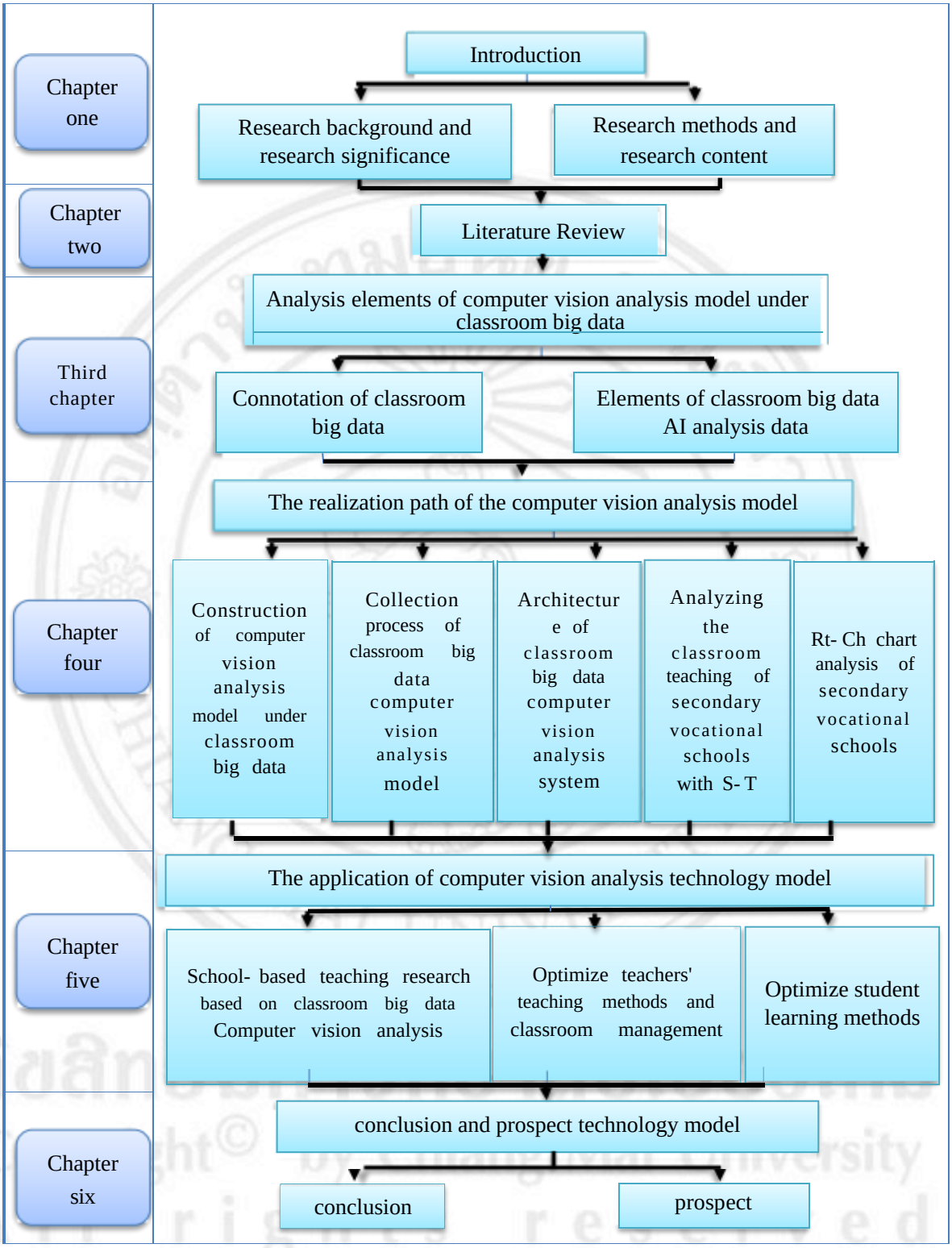

Figure 1.2 Conceptual framework

1.9 Thesis Outline

This research is mainly divided into six chapters. The first chapter is the introduction. This part describes the background, problems, significance, objectives, and scope of the study.

The second chapter is the literature review, which mainly introduces the relevant research background and significance at home and abroad.

The third chapter is the analysis elements of the computer vision analysis model under the classroom big data. This chapter mainly introduces that AI analysis overcomes the influence of technology, environment, and personality differences, to effectively and comprehensively collect procedural teaching data and learning emotion data. According to the classroom, teachers, and students in the teaching process, A1 analysis of classroom big data is divided into three elements: classroom behavior analysis, teaching type analysis, and listening state analysis.

Chapter 4 is the realization path of computer vision. This chapter mainly introduces the construction of a computer vision analysis model under the background of big data, and how to realize the key technologies applied to the construction model.

The fifth chapter is about the application of computer vision analysis technology. This chapter mainly introduces the application of the computer vision analysis model in daily teaching management.

The sixth chapter is the summary. This chapter mainly introduces the main results of the research, summarizes the shortcomings of the research, and looks forward to future computer vision analysis technology.

CHAPTER 2

LITERATURE REVIEW

With the progress of science and technology and the beginning of the Internet era, teachers are no longer just writing on the blackboard and telling relevant knowledge orally. With the development of big data, cloud computing, and other technologies, the advantages of artificial intelligence have become increasingly prominent, gradually affecting People's Daily life. Classroom teaching behavior is usually the main research content of classroom research, such as classroom teaching methods, improving classroom teaching efficiency, and improving the quality of classroom teaching. To carry out the research on classroom teaching behavior effectively and scientifically has extremely important significance and value for the research of the above topics. The research on teaching behavior in China has never stopped since ancient times. The earliest records can be traced back to the Chinese "Xueji", where there were records of "complements of hidden information" and "harmony of view and kindness"[1]. In modern educational technology and science, relevant foreign studies can be traced back to the late 1890s, when scholar Kratz first proposed the concept of characteristics of teaching behavior. Thus began a new era of teaching behavior research. By the 1960s and 1970s, research on classroom teaching behavior enjoyed a flourishing period and reached its heyday, with more and more researchers joining the wave of research on teaching behavior. One of the most popular research directions at that time was to explore the relationship between teaching behavior and teaching effect, teaching efficiency, and teaching quality, or to discuss and study from the perspective of how teaching behavior promotes and improves teaching methods [2]. At the early stage of the research, the teacher's main teaching behavior in class was regarded as the whole behavior of classroom teaching, so the research mainly focused on the teacher's teaching behavior in class, while the research on students and teacher- student interaction behavior was ignored and did not attract the attention of researchers. This situation did not start to improve until 1960 when more and more researchers began to pay attention to student

behavior, the interaction between teachers and students, and the significance of AI to education, and conducted in-depth research and discussion.

In 2017, the State Council of China issued the Development Plan for the New Generation of Artificial Intelligence, which mentioned: "As the core driving force of the new round of industrial transformation, AI will further release the huge energy accumulated in previous scientific and technological revolutions and industrial transformation, create new powerful engines, reconstruct all links of economic activities such as production, distribution, exchange and consumption, form new demands for intelligence in all fields from the macro to the micro, accelerate the birth ofnew technologies, new products, new industries, new forms of business and new models, trigger major changes in the economic structure and profound changes Change the way of human production and life and the mode of thinking, and realize the overall leap of social productivity ". Since then, AI technology has been widely applied and landed in various industries, and has also brought a lot of business opportuniti**e**s [1].

In 2017, Wu Yonghe, Liu Bowen and Ma Xiaoling studied "AI+education" and built an ecosystem of "AI+education", bringing new ideas to the education industry [10].

In 2018, many researchers such as Qiu Junling summarized the current situation of AI+education, constructed the application of AI+teaching, and briefly described the functions of AI+, so that it can understand how to obtain students' personalized teaching plans and learning quality through the analysis of the AI platform, and realize each student's needs for teachers' attention. Only by effectively utilizing advanced technologies such as artificial intelligence, big data and cloud computing, and strengthening the application research and practical feedback of intelligent education, can students gain more recognition in the teaching process and cultivate more talents who adapt to the development of society and the times [3] .

By 2019, according to the 2019 AI Investment Market Research Report released by Yiou Think Tank, as of May 2019, China's AI enterprises totaled 1093, distributed in 45 cities in 25 provinces, of which 77 Chinese enterprises engaged in AI technology development and application completed listing. At the same time, we can also see that AI technology applications are mainly distributed in industry solutions, robots, enterprise services and automobile industry. Although education is regarded as one of

the most suitable industries for the use of artificial intelligence, AI+education has not entered the explosive state on a large scale due to the slow nature and difficult to break out of the education industry itself.

In 2019, Ma Yunpeng (Smart City) outlined in "AI Brings a New Face to School Education" that AI enabling education is attracting high attention worldwide [4] .

In 2020, Song Su (campus network security in 2020) analyzed the significance of AI technology in education in his book Application of AI technology in the context of big data, and focused on specific application strategies. Let us know that the application of AI technology in the field of education is in line with the inevitable trend of the development of the times. On the basis of building a reasonable education platform and quality education model, it can create a good platform for students' personalized learning, maintain the high- quality education model of personalized education, and build a more reasonable and complete education and teaching system [5]. Students'classroom behavior recognition based on human skeleton and deep learning has been studied, and students' typical classroom behavior recognition methods based on human skeleton and deep learning have been used to identify students' typical classroom behavior, which can reflect students' learning status in a timely and effective manner, and help teachers accurately grasp students' classroom learning, thus helping intelligent classroom teaching [6] .

In 2021, Qi Xiaotong, Zhu Wenlong, Mi Yatian, Liu Qinle and Liu Ke (2021 experience exchange) analyzed the relationship between face recognition and AI+education technology in the Research on the Impact of the Combination of Face Recognition and AI+Education Technology on the Innovation and Reform of the Education Industry, and combined with the impact of classroom application on the reform of the education industry, closely around "AI+education", combined with the huge advantages of education innovation and the Internet, Bring new inspiration to the education industry and inject new vitality into the education industry [2].

Recent advances in technology have made it possible to analyze teaching methods and students' learning styles through computer analysis. This literature review examines the current state of research on this emerging field. It reviews the major theories of computer- supported teaching and learning, as well as the evidence to

support the use of computer-based approaches [5]. It further examines the challenges associated with applying computer-based analysis to teaching and learning, and the potential benefits to both teachers and students. The first major area of research focuses on the use of computer-based systems to support the teaching and learning process [6]. This includes the use of computer-based tools, such as learning management systems, to track student performance and provide feedback; the use of interactive simulations and digital games to enhance student engagement; and the use of artificial intelligence and machine learning to adapt instruction to the individual needs of students. The evidence suggests that these computer-based approaches have the potential to improve both the teaching and learning process [8].

The second major area of research focuses on the use of computer-based analysis to assess and understand students' learning styles. This includes the use of psychometrics to measure students' cognitive, affective, and social-emotional skills; the use of natural language processing and text analytics to assess reading comprehension; and the use of technology- enhanced assessments to measure student progress [9]. These tools can be used to identify student strengths and weaknesses, assess progress over time, and evaluate the effectiveness of teaching methods. The research in this area is largely concerned with the development and validation of computer-based assessment tools. For instance, a number of studies have evaluated the accuracy and reliability of computer-based assessments for reading comprehension and other language-based skills [10]. Other researchers have examined the effectiveness of computer-based assessment tools in predicting student performance on standardized tests. Additionally, a number of studies have explored the use of computer-based assessment tools to identify individual student learning styles and preferences. Finally, there is a growing body of research on the use of artificial intelligence (AI) to identify and optimize teaching methods. AI-based systems can be used to identify patterns in student behavior and learning and to develop personalized instructional strategies. Additionally, AI can be used to analyze student data and produce personalized recommendations for instructional changes [11].

The research in this area is still in its infancy. However, there is evidence that computer-based analysis can be used to identify student learning styles and optimize teaching strategies. There is also evidence that AI-based systems can be used to improve

the quality and effectiveness of teaching. In a recent study by Tsai and Lin (2020) [12], a computer-based system was used to analyze student learning styles in an online course. The study found that the system was able to identify students with different learning styles and recommend teaching methods that were more appropriate to their learning style. This could be used by teachers to tailor their teaching to the needs of the students. In a study by Jansen et al. (2020) [13], an AI-based system was used to analyze teacher-student interactions. The system was able to identify patterns of teacher-student interactions, as well as suggest strategies that could be used to improve the teaching quality and effectiveness. In a study by Zhou et al. (2020)[14], a computer-based system was used to analyze the effects of different teaching strategies on student performance. The study found that the system was able to identify teaching strategies that improved student performance. This could be used by teachers to optimize their teaching strategies for better student outcomes.

There is evidence that computer-based analysis can be used to identify student learning styles, optimize teaching strategies, and improve the quality of teaching. This could be used by teachers to tailor their teaching to the needs of their students, helping them to improve student performance [15]. One study used computer-based analysis to identify student learning styles and customize teaching methods based on the results. The study found that computer-based analysis was a useful tool for teachers in creating personalized learning environments. The study also found that these personalized learning environments led to better student performance [16]. Another study used computer-based analysis to identify the teaching strategies and methods used by teachers. The study found that the computer-based analysis was a reliable and effective tool for teachers to identify effective teaching strategies and methods. The study also found that the use of computer-based analysis allowed teachers to better assess and analyze the effectiveness of their teaching methods. Computer-based analysis can also be used to optimize teaching strategies. One study found that computer- based analysis could be used to identify the most effective teaching strategies for different types of students. The study also found that the use of computer-based analysis allowed teachers to customize the teaching methods for their students, leading to improved student performance [16].

Computer-based analysis can be used to improve the quality of teaching. One study used computer-based analysis to assess the quality of teaching and identify areas for improvement. The study found that using computer-based analysis allowed teachers to identify areas of improvement in their teaching methods, such as better use of classroom time and organization, and to adjust their teaching strategies to better match the learning styles of their students [17]. The study also found that computer-based analysis was a useful tool for providing feedback to teachers about their teaching methods and for helping to improve teaching and learning. In addition, computer-based analysis can be used to identify teaching methods that are most effective for different types of students. For example, one study used computer-based analysis to identify which teaching methods were most effective for students with different learning styles. The study found that students with visual-spatial learning styles responded better to instructional methods that incorporated visuals and diagrams, while students with auditory- verbal learning styles responded better to instructional methods that incorporated verbal explanations [18]. Computer-based analysis can also be used to identify student characteristics that can affect learning. One study used computer-based analysis to identify which students were more likely to succeed in college-level courses. The study found that students who had a higher level of cognitive ability, a positive attitude towards learning, and a good work ethic were more likely to succeed in college-level courses. Finally, computer-based analysis can be used to identify patterns of student behavior that can indicate learning difficulties [19].

The second area of research that will be discussed in this research is the use of computer analysis to optimize students' learning styles. Research has demonstrated that computer analysis can be used to identify students' preferred learning styles and develop strategies to make learning more effective. For example, a study conducted by Zhang et al. (2009) [20] aimed to develop a computer-based approach to analyzing and adapting student learning styles. The study used an artificial intelligence and machine learning approach to analyze student performance in a simulated environment and identify the learning styles of the students. Based on the analysis, the study offered a set of recommendations to improve student learning. Another study conducted by Morais et al. (2017) [21] used a computer-based system to analyze and adapt student learning styles. The study used a multi-agent system to study the learning styles of students and

develop a personalized learning approach. The study found that using a computer-based system to analyze and adapt student learning styles could improve student performance and increase student engagement. Furthermore, research has also shown that computer analysis can be used to optimize teachers' teaching methods. For example, a study conducted by Ngo et al. (2018) [22] used a machine learning approach to analyze student performance and optimize teachers' teaching methods. The study found that the machine learning approach could be used to improve the effectiveness of teachers' teaching methods and boost student performance.

The research shows that computer analysis can be used to optimize both students' learning styles and teachers' teaching methods. Computer analysis can be used to identify students' preferred learning styles, to analyze teachers' teaching methods, and to identify and address any areas of improvement. Computer analysis can also be used to facilitate collaboration between teachers and students, and to improve the overall effectiveness of the teaching-learning process. Computer analysis can be used to identify students' preferred learning styles by analyzing student data such as test scores and surveys. By analyzing this data, researchers can identify students' preferred learning styles, and identify any areas of improvement that can be addressed. For instance, researchers can identify students who are better suited to visual or auditory learning styles, or those who prefer hands-on or collaborative learning. By identifying these preferences, teachers can tailor their teaching methods to better accommodate their students' needs. Computer analysis can also be used to analyze teachers' teaching methods. By analyzing student data, such as test scores, surveys, and observations, researchers can identify areas of improvement in teachers' teaching methods. For instance, researchers can evaluate the effectiveness of teachers' instructional strategies, the use of technology in the classroom, the use of assessment tools, and the use of cooperative learning strategies. By identifying areas of improvement, teachers can use computer analysis to make modifications and improvements to their teaching methods.

Computer analysis can also be used to facilitate collaboration between teachers and students in order to optimize teaching methods and students' learning styles. The use of computer analysis in this regard has been seen to have a positive impact on student performance and attitude towards learning. Several studies have been

conducted to examine how computer analysis can help teachers and students better understand and optimize teaching methods and students' learning styles. One study conducted by Liu and Zhang (2015) [23] focused on the use of computer analysis as an effective tool for optimizing teaching methods and students' learning styles. The results of the study found that computer analysis helped teachers to understand the different learning styles of their students, which allowed them to adjust their teaching methods to better suit each student's needs. Additionally, the study found that computer analysis improved students' attitudes towards learning and increased their motivation to participate in the learning process.

Another study conducted by Vu et al. (2017) [24] analyzed the effect of computer analysis on improving teaching methods and students' learning styles. The results of the study found that computer analysis was effective in helping teachers to better understand and optimize their teaching methods and students' learning styles. Additionally, the study found that computer analysis improved students' attitudes towards learning and increased their motivation to learn. Furthermore, the study found that computer analysis allowed teachers to better evaluate student's progress and provide more individualized instruction. In a study conducted by Lim et al. (2018)[25], the use of computer analysis to improve teaching methods and students' learning styles was explored. The results of the study showed that computer analysis provided teachers with a better understanding of how to optimize their teaching strategies and better accommodate students' learning styles. Additionally, the study found that computer analysis improved the quality of both teaching and learning by providing teachers with timely feedback and helping them to understand the individual needs of each student. Furthermore, a study conducted by Kim et al. (2019)[26] examined the effects of computer analysis on teaching methods and students' learning styles. The results of the study revealed that computer analysis could help teachers to better understand their students' needs and modify their teaching methods accordingly. Additionally, the study found that computer analysis was beneficial in helping teachers to better evaluate student progress and provide more individualized instruction. In conclusion, the literature review revealed that computer analysis can be an effective tool for improving teaching methods and students' learning styles. The studies discussed in this review show that computer analysis can provide teachers with better insight into their students' needs

and help them to effectively optimize their teaching strategies. Additionally, computer analysis can help to identify the most effective learning styles for each student and help teachers to tailor their instruction to better serve their students' needs. Finally, computer analysis can help teachers to monitor their students' progress and provide them with timely feedback to better support their learning. Computer analysis can therefore provide teachers with valuable information to help them optimize their teaching methods and students' learning styles.

In recent years, the use of technology in the classroom has grown exponentially. While technology can help to enhance teaching methods and provide new ways to engage students, it can also be used to analyze the teaching methods and student learning styles of teachers. The purpose of this research is to assess the current literature on the use of computer analysis to optimize teachers' teaching methods and students' learning styles. The first area of research that will be examined in this research is the use of computer analysis to optimize teachers' teaching methods. Studies have shown that teachers can use computer analysis to better understand their teaching methods and gain insights into how their students are learning. These analyses can help teachers to understand the effectiveness of their strategies, identify areas of improvement and develop strategies for more effective teaching. For example, a study conducted by Lu et al. (2016) [27] found that teachers who used computer analysis to analyze their teaching methods and student feedback showed an increase in the effectiveness of their teaching. In February 2022, the Central Committee of the Communist Party of China and the State Council issued "China's Education Modernization 2035", which focused on the deployment of ten major tasks facing education modernization. Among them, the eighth point pointed out that we should speed up education reform in the information age. The New Generation AI Development Plan also pointed out that "we should build a new education system including intelligent learning and interactive learning, and promote the application of AI in the whole process of teaching, management, resource construction, etc." From the development stage of education itself, education is moving from a teacher-centered model to a student-centered model. The basis of this transformation is big data and artificial intelligence. According to the "Education+AI" Industry Research Report released by Taoli Capital, AI has penetrated into nine major fields of education, basically covering the entire industrial chain of "teaching, learning,

testing, evaluation and management". At the same time, through the application of AI technology in all aspects of education, we can collect students' comprehensive learning data, and then combine algorithm analysis to make the machine have cognitive ability, so as to plan the learning path for students based on their situation. It can be seen that AI is making education truly personalized, large-scale and efficient, and training talents with AI technology has become one of the future trends.

CHAPTER 3

ANALYSIS ELEMENTS OF COMPUTER VISION ANALYSIS MODEL UNDER CLASSROOM BIG DATA

With the rapid development of information technology, and computer and network technologies such as the Internet of Things, cloud computing, artificial intelligence, and 5G, we have entered a new digital era. The purpose of big data analysis is to extract effective and valuable information from big data, explore potential commercial value and objective law, and better guide people's production and life. For example, in the current epidemic prevention and control, mobile communication big data monitoring is used to timely discover high-risk groups and block the transmission chain of the epidemic. The application of mobile phones, the Internet, and the Internet of Things has led to the explosive growth of data volume. The data type has changed from traditional structured and static database data to mainly unstructured and semi-structured data. At the same time, streaming media data accounts for an increasing proportion, which makes big data analysis difficult. Therefore, the big data analysis technology should be able to run in distributed clusters, support the parallel processing of big data, and also support the analysis and processing of real-time streaming media data algorithmic-ally. In response to such social demands, a variety of big data processing tools have emerged, such as large-scale batch processing software MapReduce and Spark, and real-time streaming data processing software Storm and Flink.

In order to cultivate new talents to adapt to the era of big data, the Ministry of Education added a major in Data Science and Big Data Technology in 2016. In response, universities and colleges have successively opened major courses in big data and carried out research on training methods for big data talents. Our school has set up the course "Big Data Analysis" for the computer major in accordance with the requirements of The Times. This course is an important application course, which is committed to making students understand and master the big data analysis method, can

apply the big data processing software for case operation, and extract valuable professional knowledge and rules from the massive field data. Through the study of this course, students can understand the overall overview of data analysis, current application and research hotpot and future development direction, and master data prepossessing, data analysis and mining, data visualization, and other big data processing methods. As a compulsory course for undergraduate students majoring in big data and artificial intelligence, it is a core course in the whole big data and artificial intelligence talent training program, which lays an important theoretical foundation for students to learn artificial intelligence technology and further graduate professional study. The "Big Data Analysis" course is preceded by courses on data structure, database technology, etc., and requires students to be proficient in a programming language (Java, Python, R, or Scala). Learning this course can lay an important foundation for undergraduate students to learn artificial intelligence technology, participate in teacher projects, participate in competitions, and further graduate professional study.

3.1 Connotation of Classroom Big Data

Classroom big data is the data generated in the process of classroom teaching, which can also be called classroom teaching big data. Classroom teaching big data can realize real-time and dynamic diagnosis analysis and evaluation information feedback for students. Teachers can adjust teaching strategies dynamically and in real-time according to the feedback results to improve the classroom learning effect of students. According to different classroom teaching elements, classroom teaching big data can be divided into teacher and student behavior data, teaching evaluation data, teacher and student emotion data, and classroom management data. The normal application of classroom big data is the future development trend, which will promote the reform of the classroom teaching model and evaluation model.

3.2 Elements of Classroom Big Data AI Analysis

AI analysis overcomes the influence of differences in technology, environment, and personality, so as to effectively and comprehensively collect procedural teaching data and learning emotional data. According to the classroom, teachers, and students in the teaching process, the AI analysis of classroom big data is divided into three elements: classroom behavior analysis, teaching type analysis, and listening state analysis.

3.2.1 Classroom Behavior Analysis

Classroom behavior analysis is the analysis of teaching behavior, classroom atmosphere, and teaching style. Teaching behavior includes teacher behavior and student behavior. According to the characteristics of normal classroom teaching, the teacher' s behavior is divided into blackboard writing, lecturing, inspection, and teacher-student interaction, and the student's behavior is divided into response, reading, writing, listening to the lecture and raising hands. Through the analysis of teaching behavior, the behavior changes of teachers and students at different moments in class were recorded.

The active degree ofclass and the seat distribution ofstudents reflect the state of teachers and students in class, which is a direct reflection of the classroom atmosphere. The degree of classroom activity is reflected by the judgment of teachers' and students' emotions. Positive emotions represent a high degree of classroom activity, while negative emotions represent a low degree of classroom activity. The seat distribution of students reflects the interesting relationship among students, courses, and teachers, and reflects students' interest in courses and teachers' popularity from the side. The teaching style is determined according to the occupying rate of each area of the teacher on the platform. If the teacher changes frequently in the blackboard, projection screen, and table area, it indicates that the teacher's teaching style is humorous and vivid; if the teacher does not move in one area, it indicates that the teaching style is rigid.

3.2.2 Analysis of Teaching Types

Teaching type analysis includes class type, ST analysis, and teaching mode analysis.

Class type refers to the analysis of the class type according to the teaching behavior of teachers and stu?dents. Class types can be divided into regular classes and examination classes.

S-T analysis, that is, the Student Teacher analysis method, is used to analyze teacher- student interaction behavior in the teaching process, which is accompanied by teaching mode analysis, which is used for qualitative evaluation of teachers' teaching mode. These two analytical tools are mature and commonly used in teaching analytical methods at home and abroad. Teaching mode analysis is the specific application ofthe S-T teaching analysis method. By calculating Rt(teacher's teaching behavior share) and Ch(teaching behavior conversion rate), the new teaching mode is judged according to the RT-CH chart (Figure 3.1).

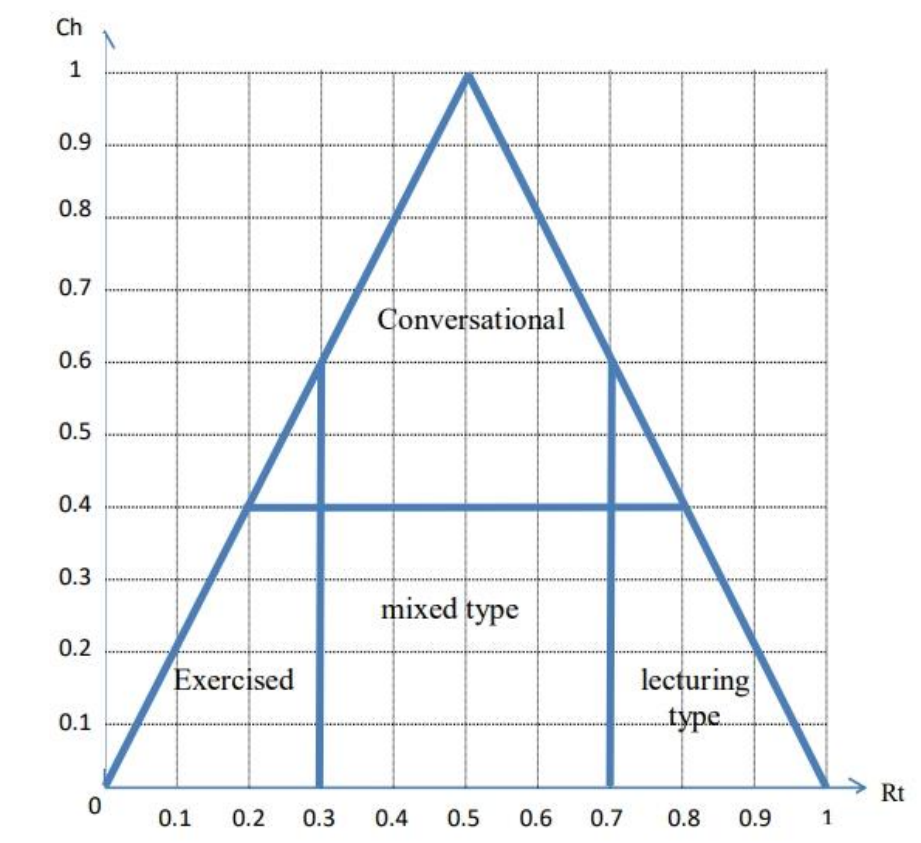

Figure 3.1 Rt-Ch diagram

According to the values of Rt and Ch, the teaching mode is determined. If $Rt \leq 0.3$, it is the practice teaching mode, $Rt \geq 0.7$ is the lecturing teaching mode, $Ch \geq 0.4$ is the conversation teaching mode, $0.3 < Rt < 0.7$ and $Ch < 0.4$ is the mixed teaching mode[6].

3.2.3 Analysis of Listening Status

Listening state analysis is an analysis of students' attendance, emotions, and class participation, mainly based on portrait recognition and facial expression recognition. Class attendance includes class attendance rate and head-up rate. Attendance rate can be automatically detected through image recognition, which is convenient to intuitively understand the changing trend of attendance rate in the whole semester. Head-up rate is the percentage of students who look up in the teacher's direction during class.

Classroom participation refers to the proportion of students actively participating in classroom teaching at a given time. The traditional classroom participation of students is subjectively evaluated by teaching and research staff, and the conclusion is highly subjective. Now the emotion is identified according to facial expression, and the specific emotion is divided into students' participating emotion and non-participating emotion, and the class participation is obtained by statistics on the proportion of students participating at a certain moment. Sample a class at regular intervals to graph class participation. Classroom fit is used to reflect the consistency of students' behaviors and states. The expression with the highest proportion at a certain moment is used as the classroom fit data at that time. For example, the lower the value at a certain moment, the more scattered the students' behaviors are; the higher the value at a certain moment, the more concentrated the students' behaviors are. Judging from the rhythm of the whole class, the degree of fit varies from high to low, indicating that the class is relaxed. If the fit level of a class is always high, it is not an ideal state, indicating that the class may be full and does not provide students with personalized digestion time.

The classroom doubt degree refers to the doubt degree of students on the teaching content, and the proportion of students who do not participate in the facial expression is used as the classroom doubt degree data at a certain moment. No matter whether it is lecture-based or conversational teaching mode, it has no absolute advantages or

disadvantages. The most important thing is to find a suitable teaching mode for students. By using the doubt degree data of different points in a class at different moments, the doubt degree data curve can be drawn, through which students' mastery of knowledge can be judged. The data curve of the degree of doubt in a good class should gradually decrease as the teaching process progresses, but if the degree of doubt is still above 50% by the end of the class, then the teaching and research staff should be concerned enough to evaluate whether there is a problem in the teaching method.

Classroom activity is the proportion of students who look up and listen carefully at a given moment. In school, there are always some teachers' courses that can be regarded as star courses for students to attend and listen to. This is not only related to the exquisite teaching design of teachers, but also depends on the personal charm of teachers to a large extent, such as sharp opinions, humorous examples, the cadence of teaching methods, and emotional movements with ups and downs. The classroom activity curve can help explain why the star teacher's classes are so popular. It's not that the more active the class, the better, but that there should be ups and downs. For example, teaching and research staff can focus on what the teacher has done to arouse students' deep thinking when the activity level is below 40%, and how the teacher has aroused students' emotions when the activity level is over 80%.

To sum up, classroom big data AI analysis comprehensively counts the status data of participants and the process data of education and teaching and analyzes and mines the acquired big data according to various methods such as time trend, comparative analysis, and quantitative statistics to obtain the overall situation and potential information of teachers, students, and teaching content. Generate understandable and interactive reports, graphics and analysis reports, etc., and push them intelligently according to multiple roles such as teachers, administrators, school leaders, supervisors, and inspectors. At the same time, the continuous analysis of large-scale classroom data can dig out the existing rules in education and teaching, and improve the overall teaching quality of the school.

CHAPTER 4

THE REALIZATION PATH OF THE COMPUTER VISION ANALYSIS MODEL

4.1 Construction of Computer Vision Analysis Model Under Classroom Big Data

One of the core contents of data analysis is data modeling. By analyzing the statistical and semantic features of the existing data, we can find out the rules, and then summarize it into an abstract data analysis model, so as to provide a basis for data analysis. According to the normal teaching video data, the computer vision analysis of classroom big data combines AI technology, recording, and broadcasting system with the course platform to establish the intelligent data model. Through the data analysis, the classroom portrait is built (as shown in Figure 4. 1), which specifically shows the classroom teaching situation of each college and provides the auxiliary basis for classroom management, teachers, and colleges to understand the classroom teaching situation comprehensively.

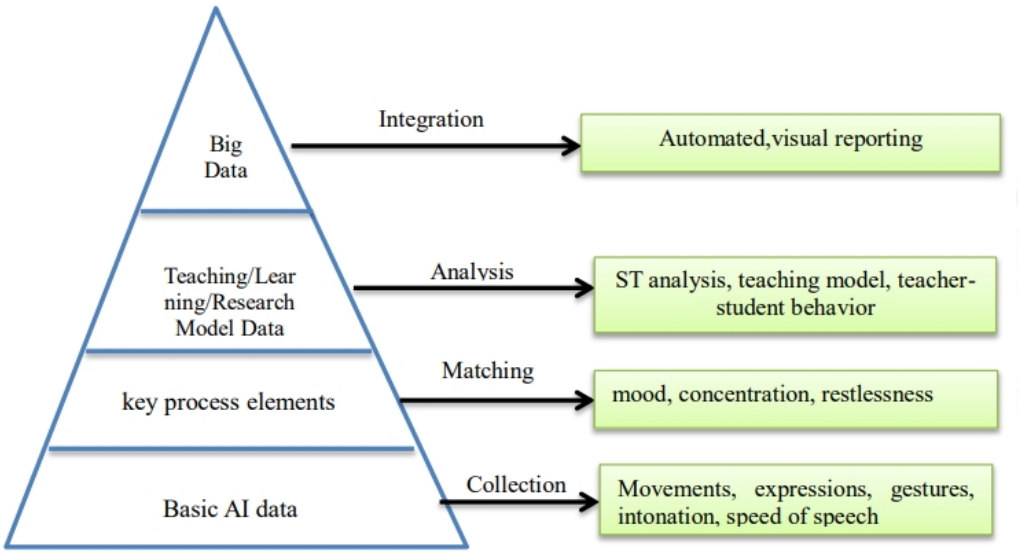

Figure 4.1 Classroom big data AI analysis model

It can be seen from the big data analysis model of computer vision classrooms that the four stages of collection, matching, analysis, and integration are ascending from low to high. In the whole analysis process, basic AI data such as movement, expression, gesture, intonation, and speech speed are first collected to match key process elements such as emotion, attention, and agitation. Then, on the basis of analyzing ST, teaching mode, teachers' and students' behavior, and other teaching, learning, and research model data, big data is integrated to form automatic and visual reports.

4.2 Collection Process of Classroom Big Data Computer Vision Analysis Model

The collection and matching process of the classroom big data computer vision analysis model is mainly to collect movements, expressions, gestures, intonation, and speech speed of teachers and students, and match key process elements such as emotions, attention, and agitation through technology. This process mainly applies the technology of face recognition, expression detection, speech recognition, and so on.

4.2.1 Face Recognition Technology

(1) Basic Theory

Face Recognition technology refers to the use of analysis and comparison of computer technology to recognize faces. Face recognition technology generally includes the following parts: face detection, face alignment, face verification, and face recognition. Among them, face detection is the basis of subsequent face recognition technology. This research mainly uses face detection technology in face recognition technology, and the subsequent facial expression recognition technology.

Face Detection is a key step and premise of an automatic face recognition system. From the field classification of this technology, face detection technology belongs to the special target detection of computer target detection technology. Different from the general target detection, face detection has its particularity, such as the face has quite complex detail changes, such as different skin color, face shape, different local expressions such as eyes, mouth opening and closing, and so on; the face is often covered, such as eyes, masks, head accessories and so on.

(2) The Overall Introduction of Face Detection Technology

Face detection is the premise and foundation of all the follow-up research in this research. At the early stage of the study, the face detection module of open-source software such as Open CV was used for the test. However, the face detection effect in the classroom scene was poor and could not meet the requirements of this study. Therefore, by referring to and improving some mature target detection and face recognition models, such as MTCNN and RCNN, this research builds a face detection model based on a convolutional neural network.

The object detection model can be divided into two types according to the way of implementation: 1-stage and 2-stage. The former refers to the use of a network model to obtain the location of the target in one step, a typical representative of the YOLO algorithm; The latter refers to the first determination of the general position, and then the obtained results are screened again, and finally, the final results are output, represented by algorithms such as RCNN. Each of these two methods has its own advantages and disadvantages. The 1-stage algorithm is fast, but its accuracy is relatively low, and it is difficult to detect small targets. 2- stage is relatively accurate, but the process is complicated, so the speed is relatively slow. The objective of this research is multi-object face detection in the classroom scene, which has certain requirements for the accuracy and speed of the model. Therefore, this research refers to Li et al. 's face detection method using the cascade CNN, proposes a new framework, and constructs the face detection model by using the cascade method of three convolutional neural network models with network complexity ranging from simple to complex.

The three convolutional neural network models were named CNN1, CNN2, and CNN3 respectively, and the hidden layer of the three network models.

The number of convolution layers and the number of the kernel are increasing successively. Therefore, the work of the face detection model in this research is mainly divided into three stages:

In the first stage: Using the CNN1 network, get the initial candidate Windows and their bounding box regression vectors relatively quickly and roughly. Then, the estimated boundary box regression vector is used to calibrate the candidate border

vector. Finally, non-maximum suppression (NMS) is used to merge highly overlapping candidate boxes to produce relatively few and precise candidate boxes.

In the second stage, all candidate boxes were sent to more complex CNN2, and a smaller number of candidate boxes were further screened out. Border regression was used to perform boundary calibration, and NMS was used to merge candidate boxes.

The third stage: This stage is very similar to the second stage, but in this stage, a deeper convolutional network structure is used to extract facial features in more detail, and the border regression and NMS threshold are adjusted to refine the selection of candidate boxes, and the final face detection results are output.

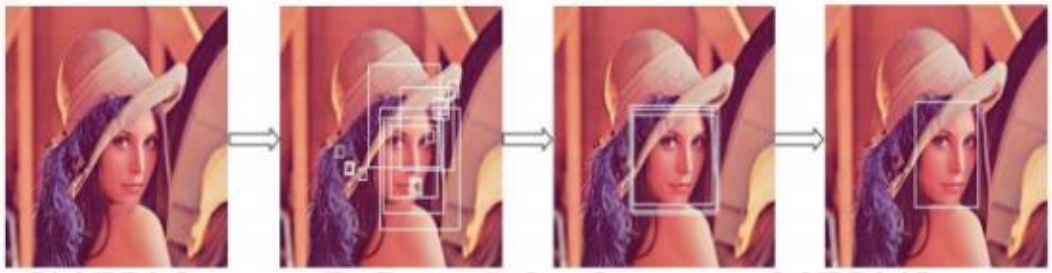

Figure 4.2 Face Dection for Lana Model [7].

4.2.2 Expression Recognition Module [2]

(1) Expression recognition

Expression recognition refers to the separation of specific expression states from a given static image or dynamic video sequence, so as to determine the psychological emotion of the recognized object. The work of expression recognition in this research can be divided into three steps: face image acquisition and prepossessing, expression feature extraction, expression classification, and emotion rating. Facial Expression images used in this research are derived from Facial Expression Recognition 2013 (FER2013), gaggle's open facial data set. All data have six expression labels: happy, angry, surprised, afraid, disgusted, and sad. In this article, tags are redefined and grouped according to requirements. Facial features were extracted by hand to extract the features of the key facial areas affecting the expression, avoiding the influence of other facial areas on the results.

(2) Face detection and expression recognition module implementation

After the face detection is completed, it is necessary to recognize and score the detected faces for the next step. In this part of work, this research redefines several common expressions in class according to the application scenarios in class, and extracts 42 feature points and face features related to expressions.

Expression redefinition: expression is the objective explicit behavior of emotion, but also the objective index to study human emotions. Facial expressions can be measured by the facial muscle movement itself. Paul, a famous American psychologist. Merman's facial emotion recording technology can measure six emotions: happiness, surprise, disgust, anger, fear, and sadness. Microsoft's expression recognition API defines eight emojis: anger, contempt, disgust, fear, happiness, neutrality, sadness, and surprise. At the same time, other representative facial expression recognition pis and some facial expression recognition data sets published on the network are analyzed, which generally define the above 8 kinds of universal facial expression. However, it is clear that these emojis do not apply to classroom teaching, such as "anger" and "fear" emojis cannot be used in a normal classroom. Therefore, this research investigates the actual psychological state of students in college classes, summarizes and summarizes by referring to relevant literature, and redefines five expressions: "listening", "doubt", "understanding", "resisting" and "disdain", as shown in Figure 4.2

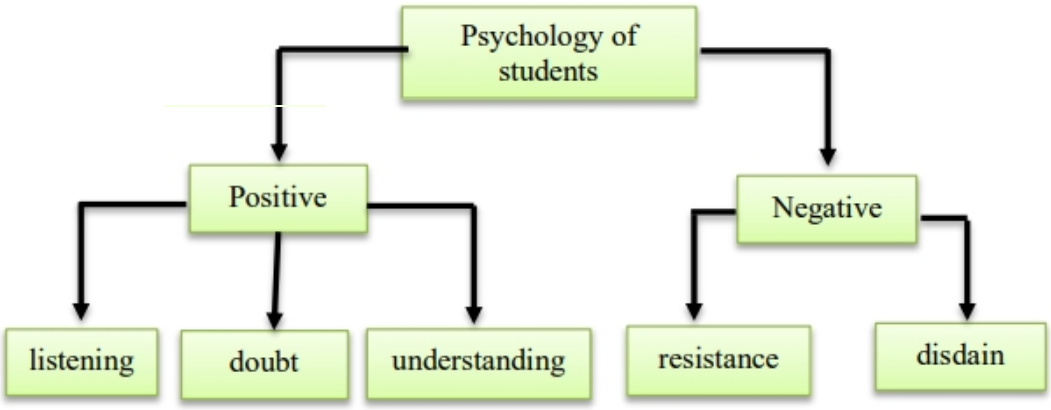

Figure 4.3 Five expressions redefined according to students' mental state

Among them, "listening" means that students are listening carefully, "doubt" means that students are following the teacher's ideas to actively think about the problem, "understanding" means that students accept the class content, "resistance" means that students are disgusted with the class content, "disdain" means that students feel boring class content and are not willing to learn. The first three expressions above all reflect the positive state of students in class, while the last two expressions are exactly the opposite, reflecting the negative state of students in class. By referring to the practice of Han Li et al., this research has made a long- term observation of the expressions and facial features of students in class while listening to the lecture. Through analyzing and studying the features of human eyes, head posture, lip posture, and other features of the five expressions, the corresponding facial features of the above five expressions are summarized, as shown in Table 4.1 below:

Table 4.1 Facial features corresponding to the five expressions

Mental state	Head feaures	Eye features	Lips features
listening	Upward or direct (head Angle | α | change between 0 ~ 60 degrees)	Eyebrows naturally stretch (Angle ß between both ends of eyebrows and the midpoint of eyes <=120 degrees)	The feature is not obvious
doubt	Bow slightly tilted or action (head Angle | α | change between 0 ~ 60 degrees)	Eyebrows naturally stretch (Angle ß>120 degrees between both ends of eyebrows and midpoint of eyes)	The corners of the mouth are raised (the characteristic line of the mouth and its bisector show a positive deviation of d<0)
understanding	Looked up or down (head Angle | α | change between 0 ~ 60 degrees)	Eyebrows stretch naturally	The corners of the mouth are raised (the characteristic line of the mouth and its bisector show a positive Deviation d>0)
resistance	Bend or twist (head Angle | α | change greater than 60 degrees, or face detection failure)	The feature is not obvious	The feature is not obvious
disdain	Bend or twist (head Angle | α | change greater than 60 degrees, or face detection failure)	The feature is not obvious	Move one corner of the mouth upward (large deviation or Angle of inclination >0 degrees)

According to the correspondence between the five expressions and facial features in Table 4. 1, the data set used to train the expression recognition model is re-labeled manually so that the face data ofvarious expressions in the data set are matched with the new expression labels respectively.

4.2.3 Voice

(1) S-T behavior coding was carried out with the precise speaking time of teachers obtained by ASR, and automatic variable length S-T double coding was realized by constructing S-T interactive coding;

(2) The time-change curves Rt(t) and Ch(t) of the ratio of teacher-dominant behavior and the teacher-student interaction rate Ch are automatically generated based on the time-length S-T analysis method.

(3) Using Rt(t) and Ch(t) to model teaching activities, deconstruct the continuous teaching process into a sequence of teaching activities;

(3) Through algorithm integration, a lightweight automatic visual classroom teaching process analysis software is developed

4.3 Architecture of Classroom Big Data Computer Vision Analysis System

4.3.1 System Architecture

The computer vision analysis of classroom big data not only involves the concurrent analysis and processing of a large number of data, but also involves the collection of data, the mining of rules, and the arrangement of knowledge. In the computer vision analysis system architecture (FIG 4.3), the recording and broadcasting system is used as the information entry. Through the application of artificial intelligence technology, behavioral data of teachers and students in the classroom can be intelligently obtained

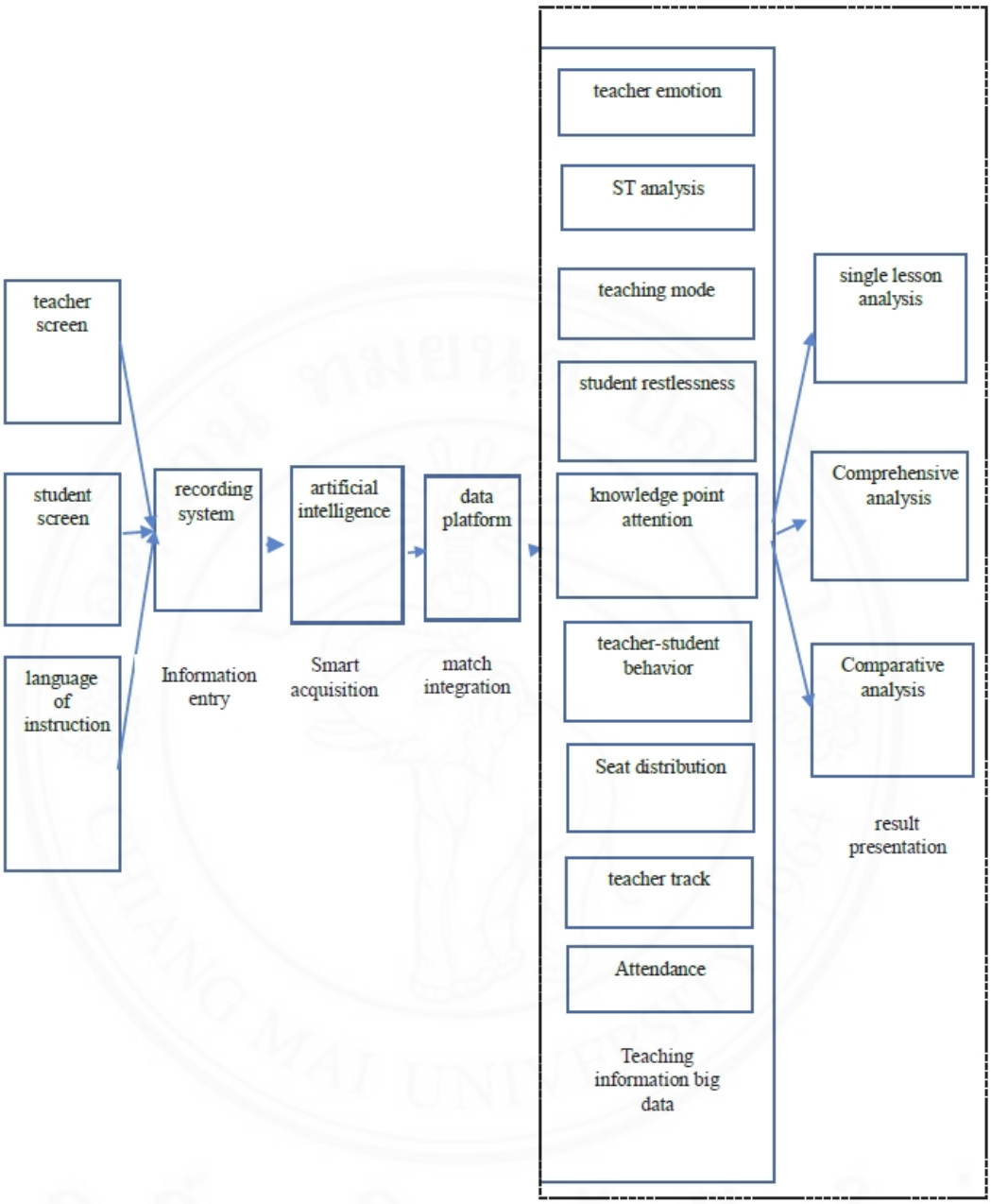

Figure 4.4 Architecture diagram of computer vision analysis

The recording and broadcasting system, as the information entrance, is an education and teaching application system with multimedia teaching and classroom as the center, the application of cloud computing technology, and the integration of course recording, live class, and course resource management. The recording and broadcasting system automatically records the course according to the course schedule and completely records the classroom teaching process, so that the whole process from

recording to the release of the course does not need manual intervention, achieving a high degree of aggregation of information management. On the basis of recording and broadcasting system architecture, artificial intelligence technology carries out normal, accompanying collection and real-time analysis of teaching information big data. The data platform further integrates the big data of the analyzed teaching information and presents the analysis results in the visual ways of comprehensive analysis, single lesson analysis, and comparative analysis. The result presentation of the computer vision analysis system includes comprehensive analysis, single lesson analysis, and comparative analysis. Comprehensive analysis is to calculate the comprehensive score of the course based on the behavior of teachers and students and conduct multidimensional statistics. At the level of the whole school, the score and ranking are calculated according to the college, teachers, and courses. At the college level, score, and rank according to teachers and courses; At the course level, the score ranking of the same course is counted. The single-class analysis is to analyze the behavior of teachers and students in a single class, including class attendance rate, head rate, seating distribution, teacher emotional radar, teacher activity track, classroom fit, ST analysis, and teaching mode analysis. The three modules of classroom behavior analysis, teaching type analysis, and listening state analysis mentioned above constitute the visual presentation interface of single-class analysis. Comparative analysis is the comparison of various indicators of selected courses. Through comparative analysis, the differences between two or more courses can be clearly understood, so as to improve the course and improve the teaching quality.

4.3.2 Analyze key technologies in the process

1. S-T Analysis Method

Automatic Speech Recognition (ASR) with teachers' near-field speech can obtain relatively accurate teacher speech, including teacher speaking text, speaking time, etc. Therefore, teaching audio can generate teaching text, speaking time, and audio mode information [6]. Analysis and evaluation of effective teacher-student interaction [7] [8], teaching activities [9], teachers' verbal intention [6] [10], etc. In this study, the precise teacher speaking period obtained by ASR was used for S-T behavior coding, and the automatic variable length S-T double coding was realized by

constructing S-T interactive coding. Based on the time-length S-T analysis method, the time-change curves Rt(t) and Ch(t) of the ratio of teacher dominant behavior Rt and the teacher-student interaction rate Ch are automatically generated. Rt(t) and Ch(t) are used to model teaching activities, deconstructing the continuous teaching process into a sequence of teaching activities. Through algorithm integration, a lightweight automatic visual classroom teaching process analysis software is developed.

S is the abbreviation of Student, T is the abbreviation of Teacher, S-T analysis is the analysis of teachers and students, through the analysis of classroom teaching videos, sampling the teaching process at a certain sampling frequency, then the obtained teaching sample behavior is coded and recorded into S-T behavior, and further drawn into S-T curve. A series of indicators, such as classroom teacher's behavior share (Rt) and conversion rate (Ch) of teacher-student behavior, were analyzed on this basis, and the RT-CH change curve was drawn to determine whether the class type was teacher-initiated or student-initiated, 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 the teaching process; NT: the total number of T behaviors; NS: the 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:

$$Ch = \frac{(g\#1)}{N} \quad (1)$$

$$Rt = \frac{NT}{N} \quad (2)$$

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.

4.3.3 Recurrent Neural Network

1. Artificial neural network

An artificial neural network (Ann) is a nonlinear and adaptive information processing system composed of a large number of interconnected processing units. It is proposed on the basis of modern neuroscience research results. It uses a perceptron to simulate neuron nodes and attempts to process information by simulating the way the brain's neural network processes and remembers information.

2. Convolutional neural network

For the input with a large number of eigenvalues, such as images, if the ordinary fully connected neural network is used, it will produce a very large order of magnitude of parameters, which cannot be trained. Therefore, a convolution neural network can be used to solve this kind of problem. A convolutional neural network is the main model used in face detection in this research. A convolutional neural network is a kind of feed-forward neural network that includes convolutional computation and has a depth structure. Currently, it is widely used in deep learning research of image, speech, and other fields and has huge energy. Breakthrough progress has been made in these fields. Different from the Fully Connection structure of the traditional neural network, in addition to the input and output layers, The hidden layers of Convolutional neural networks generally include the Convolutional Layer, the Pooling Layer, and the Fully Connected Layer.

This research proposes an RNN structure that deepens the depth of the network by means of a jump connection. Through the longitudinal deepening of the network, it can ensure the modeling of long time series while the network still performs well, so as to solve the problem of low recognition accuracy caused by long classroom teaching behavior videos.

A recurrent neural network (RNN) can realize the sequence of modeling layers in the field of natural language processing, and successfully extend to a number of fields. RNNs networks are primarily used to process sequence data, so they are particularly useful in NLP, but researchers have also migrated them to images, and found that they work well in video. As is known to all, the time sequence information of its context is particularly important in the video, and it is naturally thought of as a sharp tool to capture the sequence information. However, it generally has the problem of disappearing gradient, and with the deepening of the network, this phenomenon becomes more and more obvious, and the training becomes more and more difficult. The main structure of RNNs is shown in Figure 4.4 below.

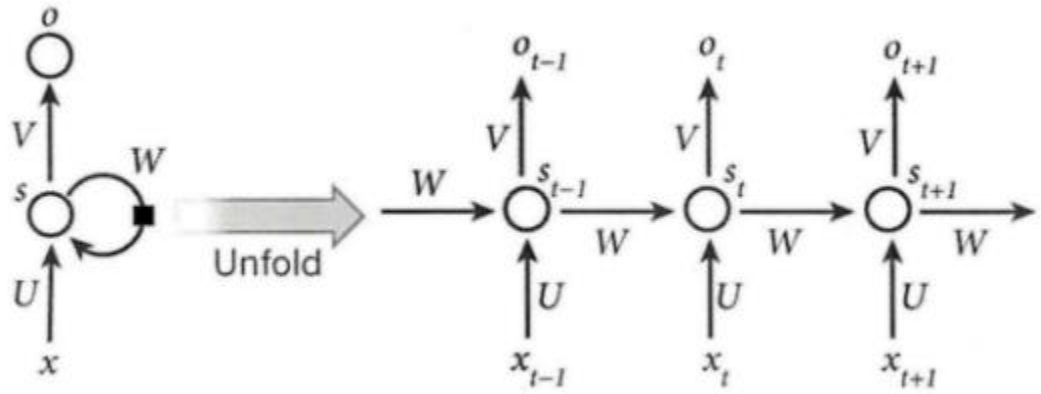

Figure 4.5 Schematic diagram of cyclic neural network structure[32]

RNNs can theoretically model time series of any length. Since it takes the current point in time and historical information as input, it can save the time sequence information and output it to the next layer as historical information input the next layer, and then pass it on layer by layer. However, in practice, due to the problem of computational complexity, only the influence on the adjacent time unit is usually considered, that is, the current state is related to the previous states rather than all the historical states.

The gains from the deepening of neural network depth are good, but the problems that come with it are also many. In this study, the RNN network was improved and deepened to capture the long-time context information, and the sequence context information of video frames and the representation information of each individual structure were captured by designing the sequence layer and the representation layer respectively. For the RNN network, it can be deepened directly through stacking, but it is difficult to train the above two information flows together. The time experiment results also show that it is difficult to train. Therefore, a shallow RNN network is generally used to extract CNN network features and then train them as the input of the RNN network, but the such network is not an end-to-end network.

The challenge is how to train the two information flows independently and collaboratively as much as possible. For the characterization layer, input frames are extracted independently based on the CNN network structure, while the timing information is captured through the RNN network. As shown in Figure 4.5, R represents the representation unit, T represents the timing unit, information is extracted by the representation unit R, and the timing unit T encodes the timing information. $O'_{i,t}$ Is the input of layer i at the time stamp t, designed as a regular CNN network to extract features, expressed by the following formula 3, φ_i Represents the parameter of R at layer i, R is Rel U(Conv(.)) function.

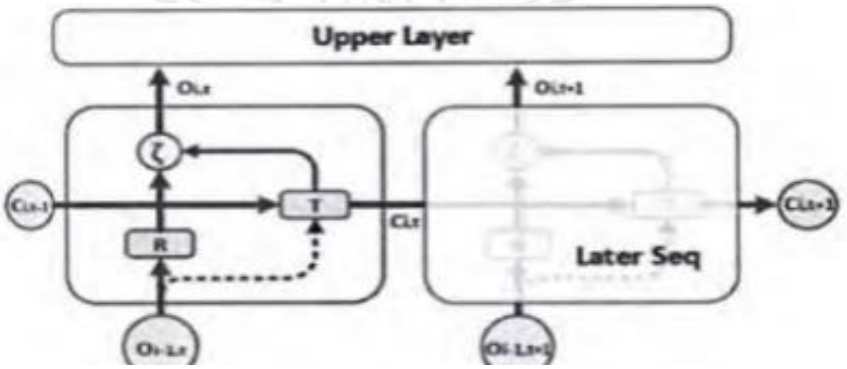

Figure 4.6 Structure of two layers of information flow [32]

$$O'_{i,t} = R(O_{i-1,t} : \varphi_i) \quad (3)$$

A time sequence flow is represented by formula 4, which represents the memory state of layer i at the time stamp t， φ_i Represents the I-th layer parameter of T, and T is the Sigmoid (Conv(.)) function.

$$C_{i,t} = T\%C_{i,t\#\$,} O_{i\#\$,} t : \phi_i * \quad (4)$$

$$O_{i,t} = \zeta, O'_{i,t}, C_{i,t} - \quad (5)$$

According to Formula 5, the fusion of two information flows is carried out.

In addition, for difficult training problems, the network is expected to learn as much as possible the representation flow information and less time sequence information at the beginning, and then learn the time sequence information when the network deepens. At the same time, a method similar to Dropout is adopted to reduce the training complexity.

The structure diagram of the behavior and speech recognition network is shown in Figure 4.6. 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.

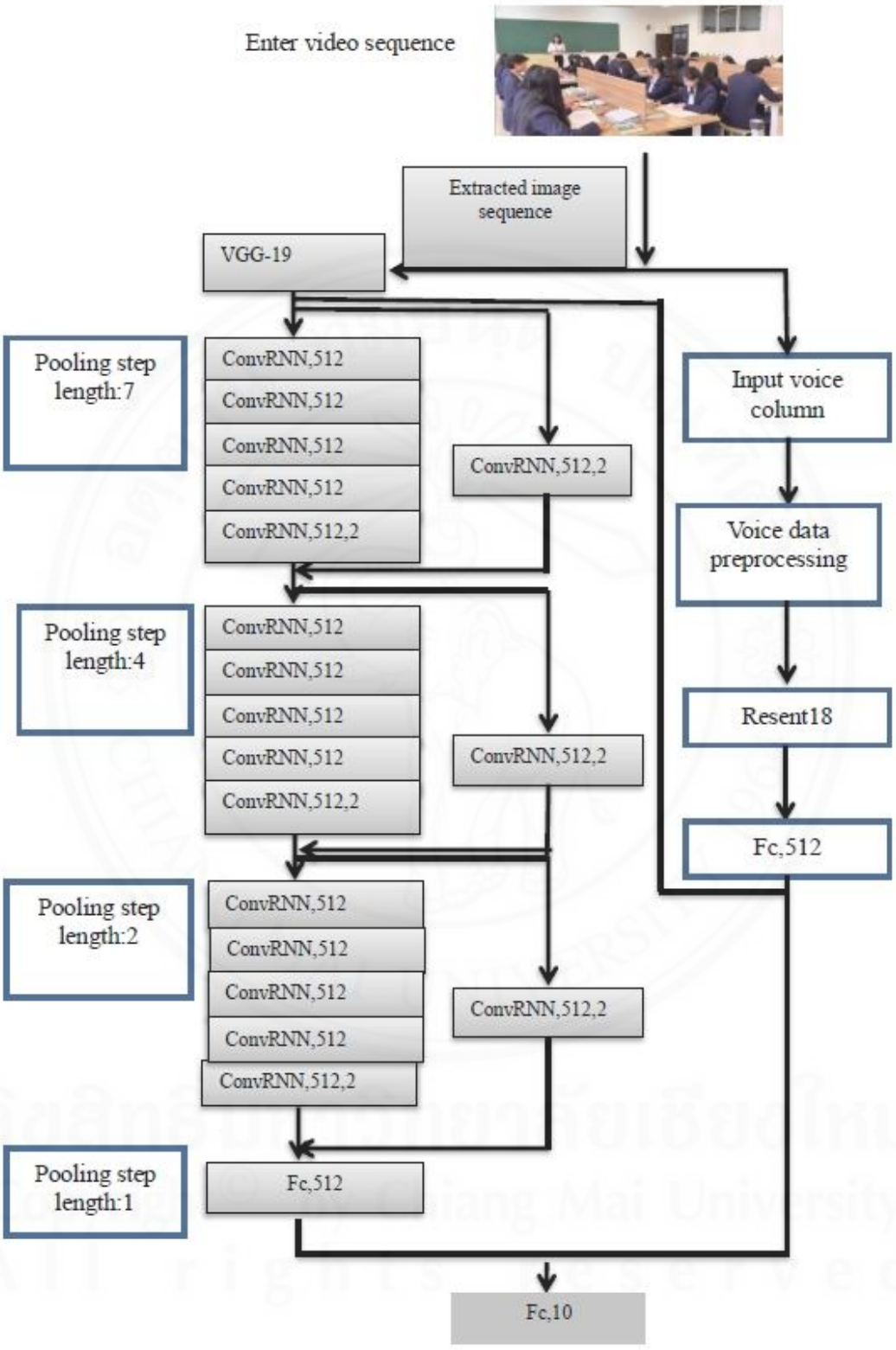

Figure 4.7 Structure diagram of behavior and speech recognition network

The network structure of the model adopts the basic network for feature extraction and then adopts the RNN network for time series modeling. Meanwhile, in order to deepen the network, the jump connection structure is adopted to deepen the depth. Finally, the full connection layer is added for classification. To put it simply, the spatial appearance information of the single frame image in the video sequence is extracted through CNN, and then the time information is obtained through the RNN network. However, there are problems such as gradient disappearance when the RNN network is modeling long-time series extraction. In order to improve this problem, a shorteut structure in the Resnet network is introduced to deepen the network. The RNN model can conduct long series of time modeling, that is, it can capture space-time information.

4.4 Analyzing The Classroom Teaching of Secondary Vocational Schools With S-T

4.4.1 Overview of The Basic Information of The Research Object

The teaching case of this study comes from the computerized accounting class of secondary vocational schools. The first section of the third chapter of this book, "System management", is taken as the research object. Learning this course is carried out based on preliminarily mastering the meaning of accounting computerization, the provisions of electronic accounting archives management, the way of accounting software and function modules, and other basic content, which lays the foundation for the teaching of this lesson "T3 software system management". Three classroom video samples were recorded, and the sample data are shown as follows, including two different grades of 17 and 18. Teacher A, Teacher B, and teacher C all taught "system management", and the whole teaching process of the three teachers was conducted in the computerized accounting training room. Among them, teacher A, the male teacher, taught in class 2 for about 20 years. B, a female teacher, has taught class 1 for about 10 years. Female teacher C, teaching class 2, teaching for about 3 years. Two teachers A and B in this survey are from the same school and teach different grades respectively. Miss C is from another school. Both secondary vocational schools use the book, published by Hebei Science and Technology Press.

By repeatedly watching the teaching videos of three teachers, this study recorded and sorted out relevant data, which is conducive to teachers' analysis of the basic structure of the classroom, timely adjustment of teaching ideas, and optimization of the teaching process.

Debug the video equipment before class, adjust the shooting Angle, so that the whole class can be displayed in the equipment screen, press the end button at the end of class, and do a good job of video backup. In this recording, three classes of three teachers were selected for observation and analysis. The class time of the three teachers was 41 minutes, and the behaviors of teachers and students were recorded at an interval of 10 seconds. Then, the S-T data record form was manually filled in, there were 246 data for each teacher.

Table 4.2 S-T record at an interval of 10 seconds

	1	2	3
Teaching contents	System management	System management	System management
class	Accounting 18-2	Accounting 17- 1	Accounting 18-3
teacher	A(Lecturing type)	B (Conversational)	C (mixed type)

4.4.2 Description of The Teaching Process of Different Teachers In The Same Course

The research on the classroom teaching behavior of three secondary vocational teachers will be conducted by means of process description, using the S-T analysis method to conduct data analysis on the teaching videos of the three teachers, and drawing corresponding conclusions based on the situation reflected in the questionnaire survey and interview. By repeatedly watching the teaching video, we can summarize the classroom teaching process of 3 accounting computerization courses.

In the previous learning process, students have understood the development of computerized accounting, know the similarities and differences between computerized accounting and manual accounting, the way to obtain accounting software, and the structure of a computerized information system. The course of

"system management" includes three modules, which are the users of system management, the functions of system management, and the operation process of system management. Through the study of this lesson, students are required to master the basic knowledge and operation methods of "system management". The content of this lesson is mainly to prepare for the next section on basic file settings. It is a subject that students begin to learn after learning Financial Accounting, Computer Basis, Basic Knowledge of Accounting, Cost Accounting, and Auditing. During the study, students already possessed a large amount of theoretical knowledge of accounting and mastered the process and methods of manual accounting and accounting. At the same time, they can skillfully operate computers. Basic computer skills are available. On the basis of students' original knowledge, students can master the operation steps and use methods of each module of accounting computerization software, improving students' comprehensive quality and practical ability.

Knowledge objective: To enable students to understand the method of starting the system and establishing the account set, to understand the difference between the account set supervisor and the system administrator authority, to enable students to master the method of setting the operator, familiar with the account set backup and recovery process. Ability goal: Be proficient in the initial accounting work, and realize the leap from skillful operation to skillful operation and even flexible operation. Objective: To let students understand the significance of learning this course, to attract students' interest through demonstration, to strengthen students' practical ability in the actual operation process, and to cultivate students' ability of independent cooperation and exploration. Operator setup method, account set up and modification.

The relationship between system management and account set management as well as the setting of authority, T3 is introduced by the teacher to be composed ofmultiple subsystems, subsystems serve different levels of the enterprise, and their functions are relatively independent, but they have a close relationship. They have a common database, common use of the same enterprise account set information, and the system management is the accounting computerization software for each subsystem to provide a common management platform, in order to facilitate the system management can unified management of the whole system of public tasks, such as the system and establish the account settings, set the operator authority, account set backup and recovery, etc.

The independent operation of any accounting computerization software must be based on system management. This part enables students to have a preliminary understanding of the function of system management, stimulates students' thirst for knowledge and exploration consciousness, and then derives the specific content to be explained in this lesson. The teacher did a good job in PPT courseware before class and showed on the big screen the modules of system management, which required students to master the management ofaccount sets, the use of the system and the management of operators and permissions, and directly told students the learning objectives and requirements of this class. Then lead the students to study each module. When learning the management module of operator and authority, the teacher guides the students to use the T3 management software to deal with the business, should first set the operator of each subsystem, and then the operator logs in the software system for business processing, and introduces the function and authority of the system supervisor and the account set supervisor. When learning the module of the account set supervisor, the teacher guides the students to use the software for financial and business processing. First of all, the teacher needs to set up some basic information in the software system, such as filling in the basic situation of the enterprise, setting up specific accounting methods and coding rules, and further explaining and explaining the accounting process. When learning the modules enabled by the system, the teacher explained that UFIDA T3 management software includes several subsystems, which are composed of the salary subsystem, the fixed assets subsystem, the general ledger system, and the purchase, sale, and inventory accounting subsystem. Only when these subsystems are enabled can they be used to process economic business. Students should be guided to start the system after the completion of the accounting set. Students practice in class and teachers give individual explanations. The teacher made a summary of the class, and made a brief review of the methods of the system starting and setting up account sets, the methods of setting up operators, and the process of an account set backup and recovery. Assign preview tasks.

The teacher first reviews the knowledge related to the new lesson by asking questions. What is the source of the accounting software? Manual accounting procedures? The characteristics of commodity accounting software? Let the students think about these four questions and discuss them in groups. The teacher explains the function of system management, detects the effect of students' pre-class preview,

and asks which aspects of operator management are included. It is concluded that operator management includes adding the operator, modifying the operator, deregistering the operator, and deleting the operator. The teacher stressed the points for attention: students take notes. In system management, each operator number is unique, and the operator number should not be repeated even in different accounts. Group discussion to explore the differences between the authority of the set of accounts supervisor and the general authorization. After the teacher commented on the results of the group discussion, the teacher stressed the following points for attention: students take notes, only the book set supervisor has the authority to modify the book set, and the system administrator is only responsible for the establishment, backup and recovery of the book set and other tasks. Does the teacher ask which aspects of account management include? Account management includes the establishment, modification, backup, deletion, and recovery of account sets, etc. Teacher question system enabled method. Students answer, and there are two ways to enable the system. The first method is to enable the system immediately after the completion of the accounting work, and the other method is to log in to the system management page after the accounting supervisor enables the system Settings. The teacher emphasizes this note: students take notes, and the ledger supervisor and the system administrator have the authority to enable the system Settings. Students conduct computer operation practice. In the process of practice, the teacher will take the initiative to ask the students about the operation's progress. For the operation that the students do not know, the teacher will give an individual explanation. The teacher asked the students what they learned from this lesson. First let the table talk to each other, and then ask individual students to speak, the teacher to supplement the shortcomings. By asking students to make a summary by themselves, they will lead the class to review, summarize, consolidate, and improve the content of this lesson, and write on the board to strengthen students' impression of theoretical knowledge.

The teacher uses problem leading, first of all, puts forward a question related to a life situation, and triggers students to think. Then ask the students to preview and think about the content to be learned in this class with the questions, and then the teacher and the students will explore the interactive questions. The teacher opened the broadcast demonstration function and demonstrated the operation steps on the computer while explaining the theory. In this process, the students were asked to repeat the operation

behavior just said by the teacher. Teachers demonstrate the process of adding, modifying, deleting, and deregistering operators, emphasize cautions, and let students hands-on practice. The instructor stressed the importance of this area: the operator can only deregister its identity through the logout function, if enabled, it cannot be deleted. While the system administrator is responsible for the daily management of the operator, the accoun The teacher opened the radio demonstration function, which fully promoted the enthusiasm of the students. The teacher uses the broadcast function to lead the students to learn a module and will let the students immediately hands-on practice. The teacher inspects the task operation of each student while walking around. In view of the problems existing in a small number of students, the teacher takes individual guidance. For the common problems of most students, the teacher will use the console to suspend the computer operation of all students, and the teacher will give a unified centralized explanation. In the operation process, the group as a unit cooperates and help each other, the fast students in the group to help the slow students, and mobilize all students to participate in class activities. Students work in small groups to discuss the functions of the system administrator and the set of accounts supervisors and the differences between them. Draw a conclusion after discussion by students; Although both the ledger supervisor and the system administrator can set the operator permissions, they set the size of the operator permissions are not the same. The system administrator can set an operator as a ledger supervisor, but the ledger supervisor does not have the authority to make another operator a ledger supervisor. At the same time, all the permissions of the operator can be set by the system administrator, but the book set supervisor can only set the permissions of an operator within the scope of the book set. The teacher demonstrated the process of adding the accounting information, unit information, accounting type, and basic information of the enterprise in the software system and let the students do the hands-on practice. After most of the students finished, several students were randomly selected to demonstrate the specific operation process on stage. Let them use the demonstration function of the console step-by-step operation, and ask the rest of the students to find the student in the process of operation error. When learning the knowledge of "system enables", the teacher stressed that both the ledger supervisor and the system administrator have the authority to enable the system. The teacher asks the students to talk about what they have learned in this class, in order to consolidate the

theoretical knowledge they have learned in this class and enhance their ability to summarize problems.t set supervisor has no authority to manage the operator.

4.4.3 S-T Data Record Form For Secondary Vocational Schools

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 reviewresearchs 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 delete 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.

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 ofstudents. 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 4.3).

Table 4.3 S-T table (Teacher A)

Time	10s	20s	30s	40s	50s	60s	g	Time	10s	20s	30s	40s	50s	60s	g
1 min	S	S	T	S	T	T	4	2 2 min	T	S	S	T	T	60s	4
2 min	T	T	T	T	T	T	0	2 3 min	T	T	S	S	S	T	3
3 min	T	S	S	S	T	T	2	2 4 min	T	T	T	T	T	T	0
4 min	T	T	T	T	T	T	0	2 5 min	T	T	T	T	T	T	0
5 min	T	T	T	T	T	T	0	2 6 min	S	S	S	S	S	S	0
6 min	T	T	T	T	T	T	0	2 7 min	S	T	T	T	S	S	2
7 min	T	T	T	T	T	T	0	2 8 min	S	S	T	T	T	S	2
8 min	T	T	T	T	T	T	0	2 9 min	S	S	T	T	T	T	1
9 min	T	T	T	T	T	T	0	3 0 min	S	S	T	T	T	T	2
1 0 min	T	T	T	T	r	T	0	3 1 min	S	T	T	T	s	S	3
1 1 min	T	T	T	T	T	T	0	3 2 min	S	T	T	T	T	S	2

Table 4.3 S-T table (Teacher A) (Cont.)

Time	10s	20s	30s	40s	50s	60s	g	Time	10s	20s	30s	40s	50s	60s	g
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								

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 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 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 ofnew 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 4.4).

Table 4.4 S-T table (Teacher B)

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

Table 4.4 S-T table (Teacher B) (Cont.)

Time	10s	20s	30s	40s	50s	60s	g	Time	10s	20s	30s	40s	50s	60s	g
18 min	T	T	S	S	S	T	3	39 min	S	T	T	S	S	S	3
19 min	S	T	T	S	S	S	3	40 min	T	T	S	S	S	T	3
20 min	T	S	S	S	T	T	3	41 min	T	T	T	S	S	S	2
21 min	S	T	S	T	T	S	5								

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 S-T table(as shown in Table 4.5).

Table 4.5 S-T table (Teacher C)

Time	10s	20s	30s	40s	50s	60s	g	Time	10s	20s	30s	40s	50s	60s	g
1 min	T	T	S	S	S	S	2	22 min	S	T	S	S	S	S	2
2 min	T	S	S	S	S	S	2	23 min	S	S	S	S	S	T	1
3 min	S	S	S	S	S	S	0	24 min	S	S	T	T	S	S	3
4 min	T	S	S	S	S	T	3	25 min	T	T	S	T	T	T	3
5 min	S	T	T	T	T	T	2	26 min	S	T	T	T	T	S	3
6 min	T	T	S	S	T	T	2	27 min	T	T	T	T	T	T	o
7 min	T	T	S	S	S	T	2	28 min	T	T	S	T	T	T	3
8 min	T	S	T	S	T	S	6	29 min	T	S	S	T	T	T	2
9 min	T	S	S	T	S	S	4	30 min	T	T	T	T	T	T	o

Table 4.5 S-T table (Teacher C) (Cont.)

Time	10s	20s	30s	40s	50s	60s	g	Time	10s	20s	30s	40s	50s	60s	g
10 min	T	S	T	T	S	S	4	31 min	T	T	T	S	S	T	2
11 min	T	S	T	S	T	S	6	32 min	S	T	S	S	S	T	4
12 min	T	T	S	S	T	S	4	33 min	S	S	S	S	S	S	0
13 min	T	S	S	T	S	T	5	34 min	S	S	S	T	T	S	2
14 min	T	T	S	T	T	S	3	35 min	T	T	T	S	S	T	3
15 min	T	S	T	S	T	S	6	36 min	T	T	S	S	T	T	2
16 min	T	T	S	T	T	S	4	37 min	T	S	T	T	T	S	3
17 min	T	T	T	T	T	S	2	38 min	T	T	T	S	T	T	3
18 min	T	T	S	T	T	T	3	39 min	S	T	T	T	S	S	3
19 min	S	T	T	S	T	T	4	40 min	T	T	S	T	T	S	4
20 min	T	T	T	S	T	T	2	41 min	T	T	T	T	T	T	4
21 min	S	S	S	T	T	S	3								

4.4.4 S-T Diagram Analysis of Secondary Vocational Schools

In Teacher A's class, there are 175 teachers' behavior T and 71 students' behavior S, g is 52. The proportion of teachers' behavior Rt=175/246=0.711, and the proportion of students' behavior Ch=(52- 1)/246=0.207. Calculate teacher A's teaching video and get the relevant S- T diagram.

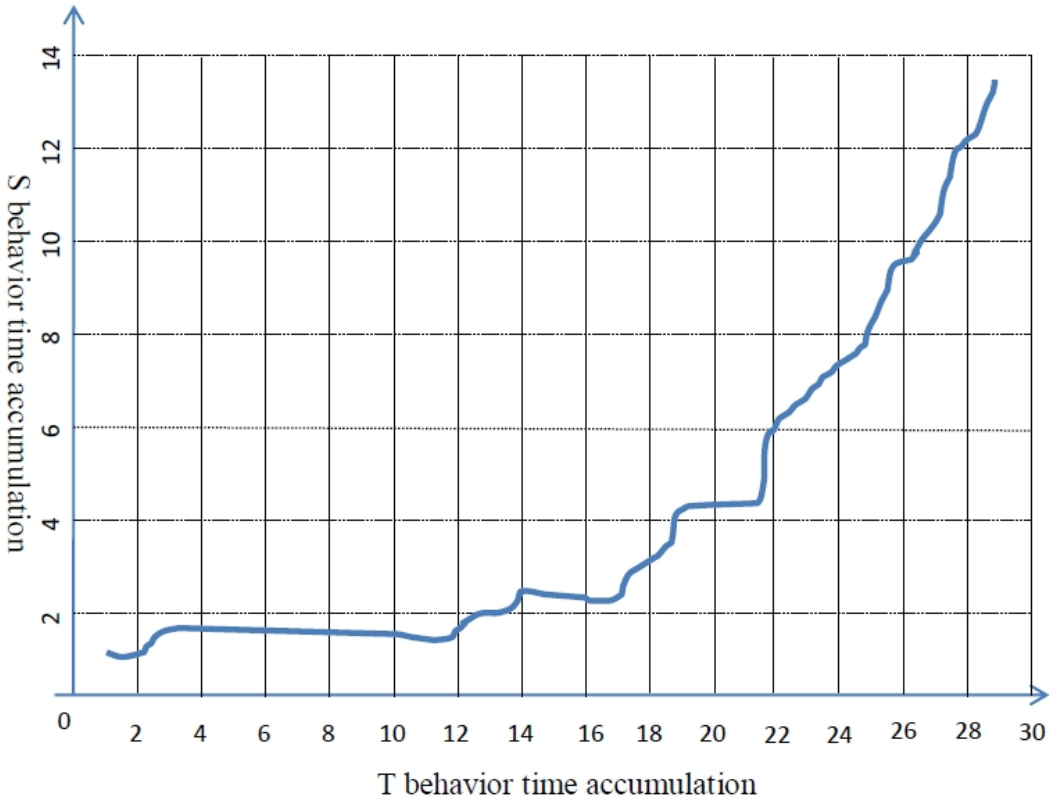

Figure 4.8 Teacher A --->Statistical chart of S-T behavior data of teacher A

In Teacher B's class, there are 139 teachers' behavior T and 107 students' behavior S, with a score of 105. Teacher behavior Rt=139/246=0.565, student behavior Ch=(105- 1)/246=0.422. Calculate teacher B's teaching video and get the relevant S-T diagram.

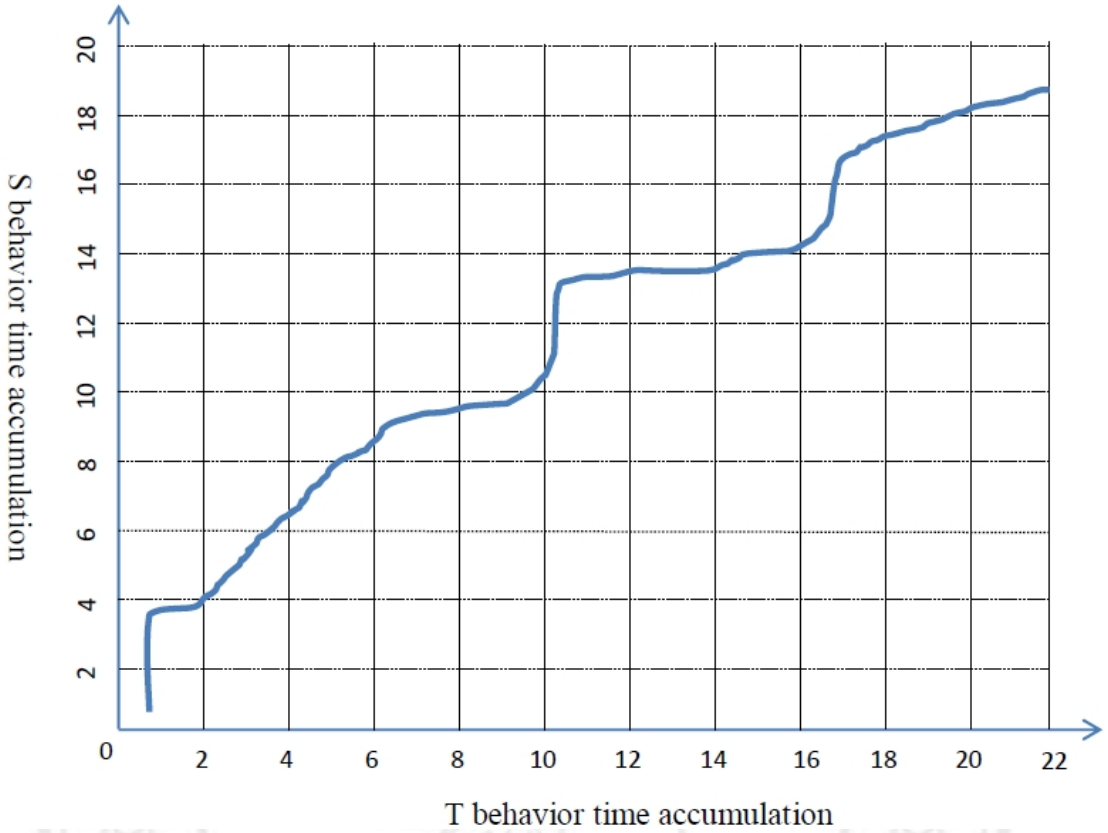

Figure 4.9 Teacher B --->Statistical chart of S-T behavior data of teacher B

In Teacher C's class, there are 136 teacher behavior T, 110 student behavior S and 95g; Teacher behavior Rt=136/246=0.552, student behavior C=(95- 1)/246=0.382. Calculate teacher C's teaching video and get the relevant S-T diagram.

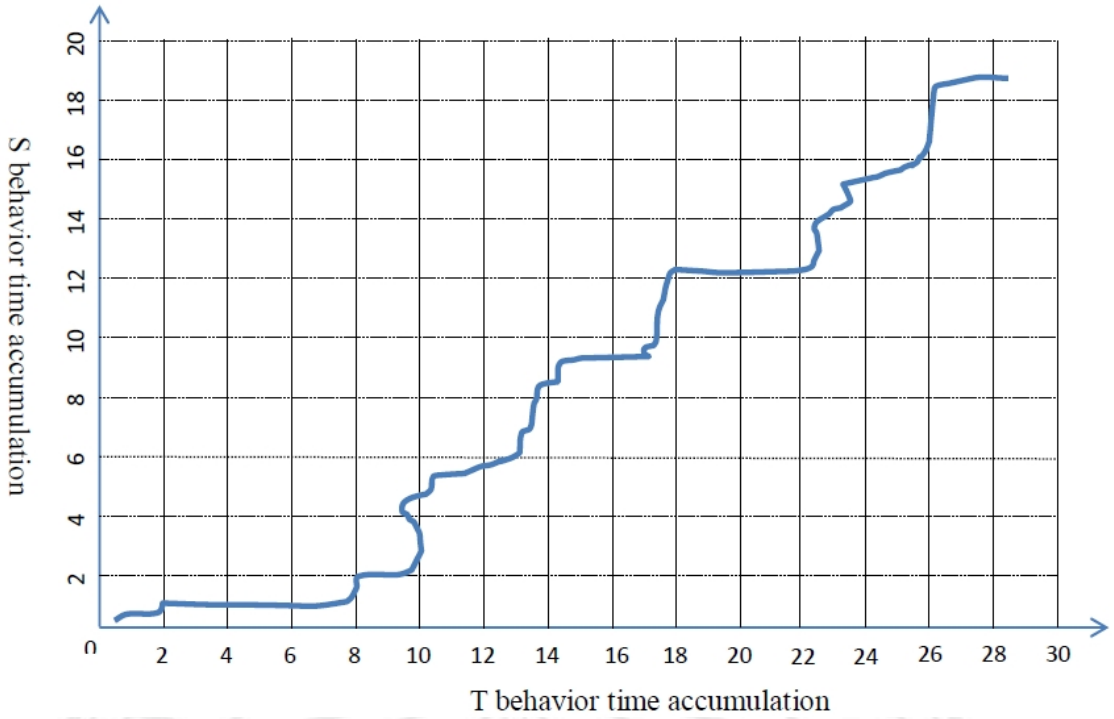

Figure 4.10 Teacher C --->Statistical chart of S-T behavior data of teacher C

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 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 ofnew 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".

4.5 Rt-Ch Chart Analysis of Secondary Vocational Schools

S-T analysis divides the teaching mode into four categories according to Rt and Ch parameters: if the teaching mode is based on student behavior and the interaction degree of teacher-student activities is low, it is practice teaching mode; If it's teacher behavior Main, teacher-student activity interaction degree is low, it is teacher-based teaching mode; If the proportion of student behavior and teacher behavior is the same, and the interaction degree of teacher-student activities is high, it is the conversational teaching model. If the proportion of students' behavior is the same as that of teachers, and the interaction degree of teacher-student activities is low, it is a mixed teaching model.

The Rt and Ch values can be calculated according to the data, and the RT-CH chart can be obtained. The teaching mode corresponding to this class can be found in the RT-CH chart for each class. The data for Teacher A is Rt=0.711, Ch=0.207, the number for

teacher B is Rt=0.565, Ch=0.422, and the data for teacher C is Rt=0.552, Ch=0.382. According to the data of Rt and Ch of the three classes, the value ofRt and Ch are taken as the horizontal and vertical coordinates respectively. Teacher A, Teacher B and Teacher C will fall into the corresponding teaching mode.

In Figure 4.11, we find the coordinate (0.711, 0.207), and it can be seen that the teaching mode of the teacher is lecture-oriented, indicating that the class is dominated by teacher A, and the interaction between teachers and students is low. Through the Rt and Ch data of teacher A, we can find that teachers have A lot of behaviors, while students have relatively few behaviors, indicating that the initiative of the class is mainly in the hands of teachers, and it can be seen that students' behaviors only account for 0.207, indicating that only a few people think about the questions raised by teacher A, while most people speak almost nothing. Only passive acceptance of knowledge and mechanical practice, lack of classroom discussion, and collaborative learning. The new classroom teaching advocated by the constructivism theory emphasizes that "students should cooperate to explore, and teachers and students should fully exchange and discuss". Although there are also exchanges and interactions between teachers and students in the teaching process of Teacher A, it is limited to the teaching mode of "students raise questions in the process of computer operation, and teachers can answer them". It does not fully stimulate students' interest in learning and creates an interactive learning atmosphere, and the whole classroom atmosphere is rather dull. The modern classroom should embody the concept of "student-centered, teacher as the main body", strengthen the communication and interaction between teachers and students, guide students to think actively, make every student really participate in the class, give the class back to the students, make the students become the master of the class.

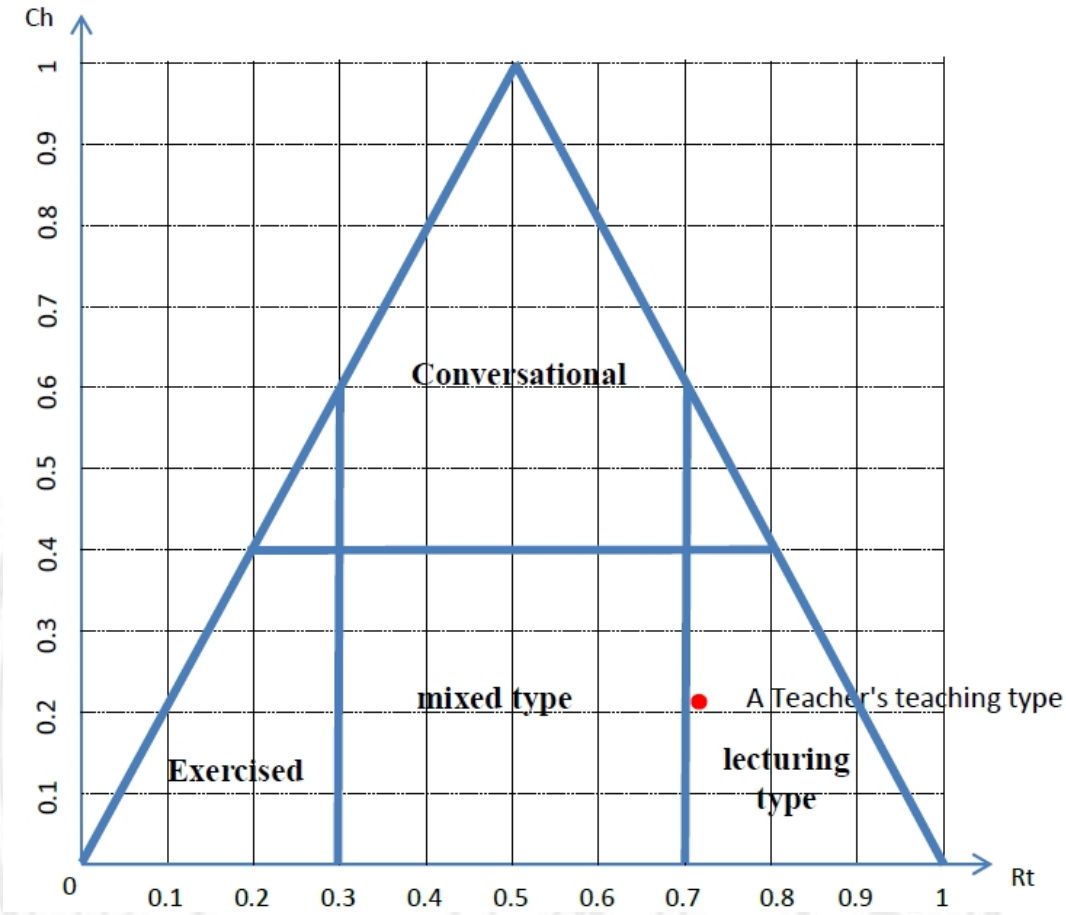

Figure 4.11 A Teacher's teaching typ

In Figure 4. 12, we find the coordinates (0.565, 0.422). It can be seen that Teacher B's teaching mode is conversational, which indicates that the ratio of student behavior to teacher behavior is similar, and the interaction between teachers and students is relatively frequent. Dialogue teaching refers to the process in which the subjects in the classroom communicate with each other to constantly solve the problems in the classroom, so as to establish a harmonious relationship between the subjects and improve the teaching quality 2]. Most of the classroom teaching behaviors of this class are questioning behaviors, and the conversational teaching mode is conducive to the establishment of a harmonious teacher-student relationship. Moreover, through the Rt and Ch data of teacher B, we can find that the student behavior accounts for 0.422, indicating that the classroom also fully reflects the subject status of students. However,

the frequent change of behavior between teachers and students will make students feel that the pace of the class is too tight to adapt to, and will also produce a sense of "question-and-answer" fatigue. Some types of courses may be more suitable for teachers to teach the key points of the operation process, and let students practice and operate themselves to find problems. Students also said in the interview that the course on computerized accounting is more suitable for students to practice on the computer. Too much interaction between teachers and students in the class will affect the progress of operation and the effect of learning. In view of this situation, teachers should choose the most appropriate way of interaction according to the characteristics and actual situation of the subject, so as to promote the classroom to achieve the ideal teaching effect.

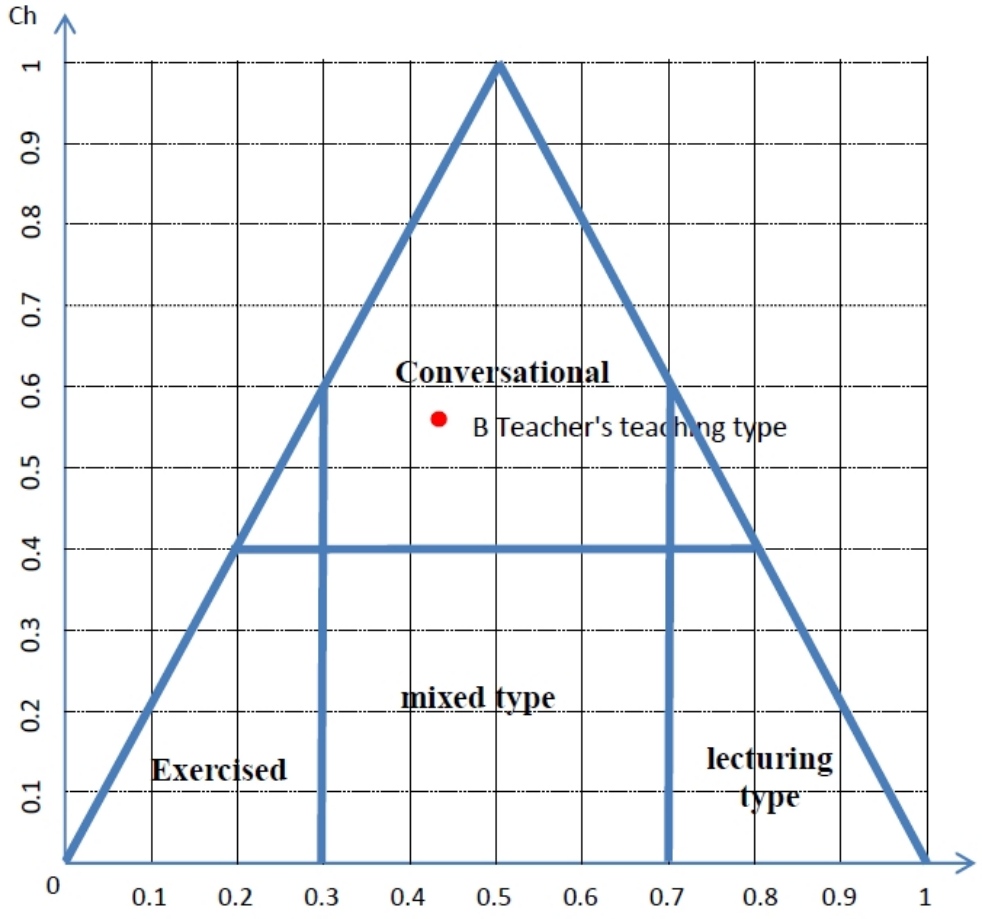

Figure 4.12 B Teacher's teaching type

In Figure 4.13, we find the coordinate (0.552, 0.382), and it can be seen that the teaching mode of teacher C is mixed, indicating that the students have the same behavior proportion with the teacher, and the interaction degree is low. Through the Rt and Ch data of teacher C, we can see that this point is very close to the conversational mode, so we can judge that the teacher-student interaction of this class is relatively good. The blended teaching mode can better highlight the dominant position of students. Teacher C can better grasp the rhythm of classroom teaching, practice the student-oriented and teacher-led classroom teaching mode, and flexibly adjust the teaching schedule and teaching plan in the implementation process, which greatly mobilize the enthusiasm and initiative of students and promote students to better grasp knowledge and skills.

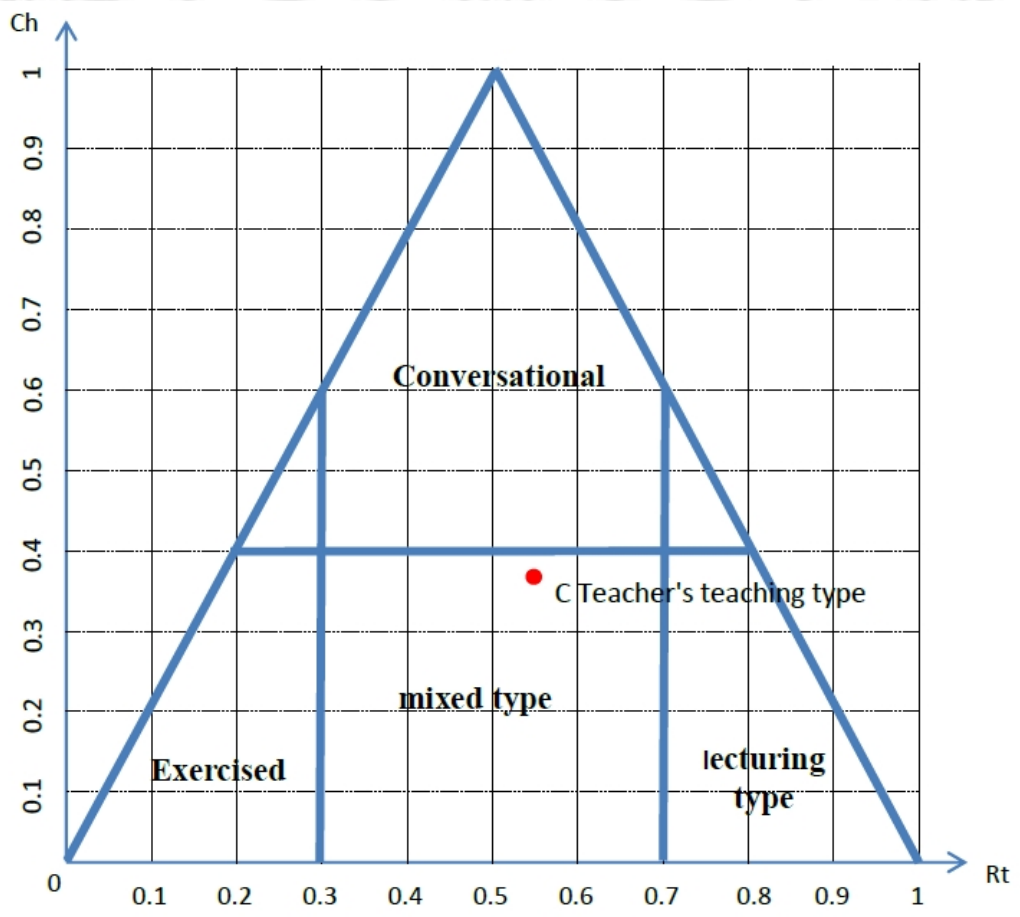

Figure 4.13 C Teacher's teaching type

CHAPTER 5

THE APPLICATION OF COMPUTER VISION ANALYSIS TECHNOLOGY

5.1 School-Based Teaching Research Based On Classroom Big Data Computer Vision Analysis

Computer vision analysis provides powerful data support for school teaching, teacher development, management, and scientific research. Computer vision analysis can promote the development of teachers, provide a lot of conveniences for teaching and research staff to listen to and evaluate the course, and achieve efficient evaluation. Teaching and research staff can complete the supervision online. They can not only watch the class live synchronously or asynchronously, but also submit the course evaluation online, saving the trouble of manual summary. In addition, the teaching and research staff's teaching evaluation time is also more flexible, can check and evaluate the course during and after class, lifting the time limit. Relying on the computer vision analysis system of classroom big data, schools can build a hybrid school-based teaching and research model to realize the teaching and research process of experience initial evaluation, report reading, data re-evaluation, and conclusion determination (see Figure 5.1).

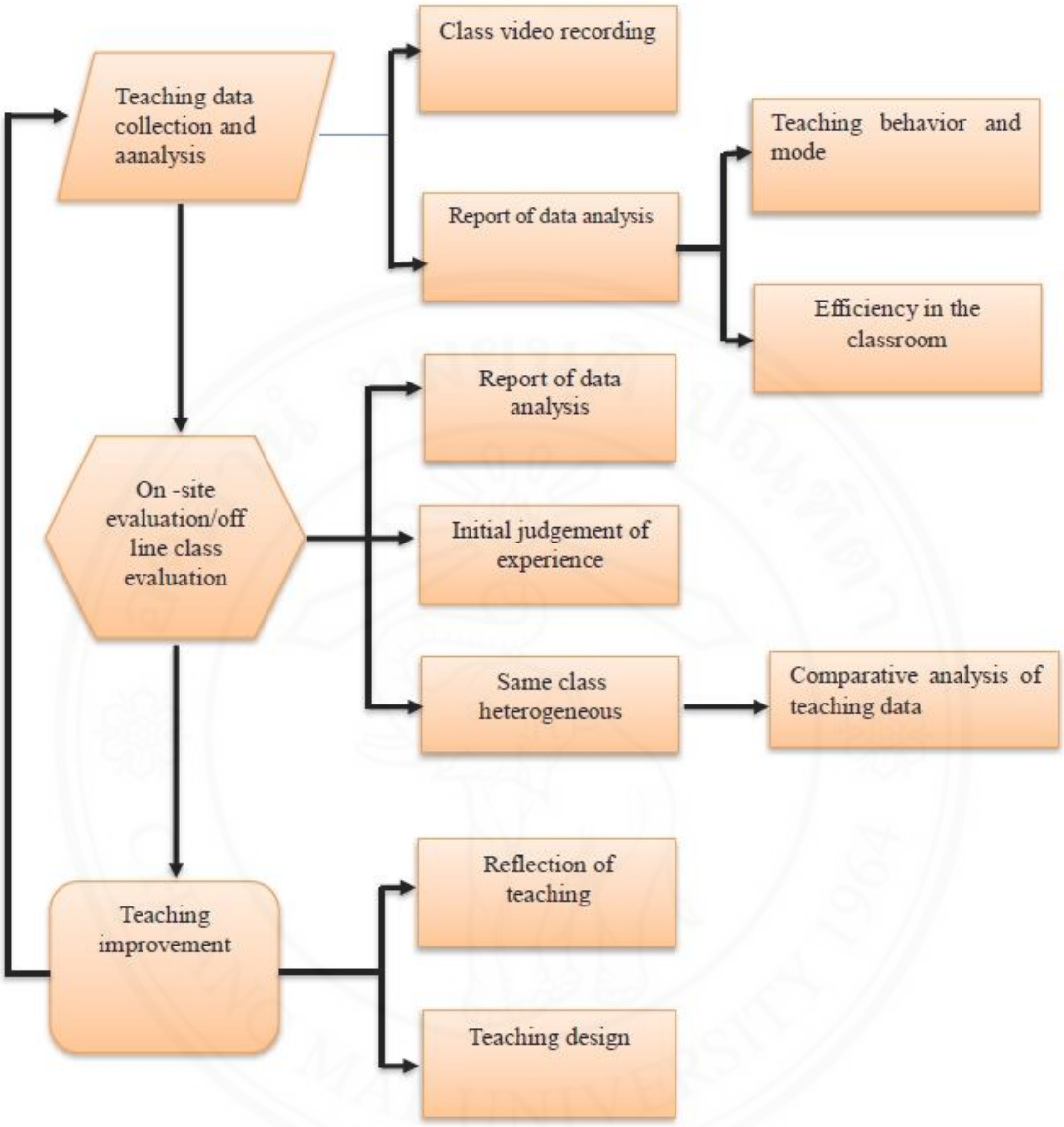

Figure 5.1 Flow chart of teaching and research

5.2 Optimize Teachers' Teaching Methods And Classroom Management

Computer vision analysis can improve the efficiency of the class tour, and improve the teaching style, and the style of learning. Attendance rate is a common index of study style investigation. The traditional manual patrol statistics method is not only time-consuming and laborious but also often uses the way of random inspection, which will inevitably have some omissions. The computer vision analysis can automatically detect attendance through image recognition, and the recognition accuracy can reach more than 90%(Data from China Academy of Computer Technology Innovation). Two statistical methods, curve and report, are provided. The curve can vividly and intuitively reflect the law and relationship between variables, so that teachers can intuitively understand the change trend of attendance throughout the semester. Through report statistics, it is convenient for data collection, review, data comparison and analysis, as well as for calculation and analysis. Computer vision analysis can also improve the level of classroom management and promote the deep integration of management information and education and teaching innovation. Teachers can obtain the most accurate and effective classroom information through computer vision analysis data, and find problems in time; Through the comprehensive analysis of the overall data of the students, the objectives and policies in line with the actual management of the students are formulated to improve the teaching quality and promote the development of the school.

The use of a computer vision analysis model can better focus on what teachers have done, said, thought, learned, and felt in the classroom, and then through AI intelligence analysis, let teachers find out the teaching problems, find suitable for students and their own teaching mode, and constantly improve their own ability. We can also recommend suitable teaching methods according to the needs.

5.3 Optimize Student Learning Methods

Collect and analyze every student's classroom and learning data through computer vision, monitor learning effect and timely evaluation through computer vision intelligent analysis system, diagnose problems in learning, accurately analyze every student's learning style and characteristics, improve daily learning style and behavior, and cultivate students' intelligent learning style. And by automatically identifying the student's

learning status data, the model can recommend approaches that are appropriate for their interests and personalities.

CHAPTER 6

CONCLUSION

In recent years, computer vision analysis and education-related research is gradually becoming hot, and the classroom as the main teaching venue for daily teaching, the basic research of classroom teaching emerge in an endless stream, but the relevant research based on artificial intelligence is still relatively few, on this basis, this research conducts relevant research on the automatic identification of classroom teaching of teachers and students. It is expected to achieve a high-precision automatic identification model, make a step forward for the automatic analysis of education and teaching so as to truly improve or even liberate the traditional human analysis, and make corresponding contributions to the automatic, scientific, intelligent, data-driven new teaching methods for teachers and students.

6.1 Conclusion

This research carries out research and discussion around the hot topic of "computer vision analysis". Aiming at the optimization of classroom teachers' teaching methods and students' learning methods, it constructs the idea of classroom big data computer vision analysis system architecture. This research carries out a detailed study on the AI intelligence analysis of classroom data and tries to apply it to the reflection of classroom teaching, 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.

The main work of this research is as follows:

(1) The background and research significance of this topic are introduced in detail, and the deficiencies of current teaching methods and students' learning methods are analyzed. Reviewed the development of computer vision and AI and education, analyzed and learned advanced computer video analysis methods.

(2) Combined with the classroom teaching scene of the school, an efficient and accurate computer vision analysis model based on deep learning is proposed. This method uses a convolutional neural network (RNN) as the main network and combines advanced methods such as face recognition technology commonly used in target detection, so as to obtain more efficient and accurate results than traditional methods.

(3) Introduce AI-related technologies into the classroom to solve the difficult problem of classroom scene identification, so as to automatically identify the classroom behaviors of teachers and students. Help teachers and students optimize teaching methods and student learning methods.

6.2 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 to help classroom analysis, this research builds an AI-based classroom model analysis framework from the aspects of classroom teachers' class and students' class feedback, and applies artificial intelligence technology to practical applications. However, it must be recognized that the application of artificial intelligence technology to the analysis of classroom teaching still faces the following difficulties: first, the academic community has not formed a unified evaluation standard for the analysis index and reference threshold of classroom teaching characteristics; Second, classroom teaching analysis mainly focuses on "teaching", and most of them are targeted at a single discipline. The analytical techniques that focus on "learning" and apply to multi-disciplines and multi-classes are still to be explored. Third, the lack of open and annotated teaching data sets leads to the exploration of classroom teaching automation analysis confined to a large number of data classifications and statistics. The follow-up research needs to further combine the latest research results ofnatural language understanding, computer vision, and big data of education to improve the comprehensiveness and accuracy of teaching data collection and is expected to provide new ideas and new methods for AI-supported teaching analysis.

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APPENDICE

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