Face Recognition Attendance System Based on Real-Time Video Processing

Submitted by

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

VISWAJYOTHI COLLEGE OF ENGINEERING AND TECHNOLOGY VAZHAKULAM

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VISWAJYOTHI COLLEGE OF ENGINEERING AND TECHNOLOGY, VAZHAKULAM.

Department of Electronics and Communication Engineering

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2. Build up excellent infrastructure and lab facilities to train the students in the current & emerging technology.
3. Maintain well qualified faculty who are willing to upgrade their knowledge continuously.
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5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

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7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

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Program Specific Outcomes

Our Students shall be able to,

1. Design and modify embedded system-based products which will find applications in the fields of Communication and automation.

2. Develop algorithms for real life applications in signal & image processing.

3. Design efficient low power electronic circuits.

DECLARATION

I undersigned hereby declare that the seminar report "**Face Recognition Attendance System Based on Real-Time Video Processing**", submitted for partial fulfillment of the requirements for the award of degree of Bachelor of Technology of the APJ Abdul Kalam Technological University, Kerala is a bonafide work done by me under supervision of **Dr.Cyriac M Odackal,** Associate Professor. This submission represents my ideas presented in my own words and where ideas or words of others have been included, I adequately and accurately cited and referenced the original sources. I also declare that I have adhered to ethics of economic honesty and integrity and have not misrepresented or fabricated any data or idea or fact or source in my submission. I understand that any violation of the above will be a cause for disciplinary action by the institute and/or the University and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been obtained. This report has not been previously formed the basis for the award of any degree, diploma or similar title of any other University.

Place: Vazhakulam
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NELSON JOSEPH

BONAFIDE CERTIFICATE

This is to certify that the seminar report entitled **"Face Recognition Attendance System Based on Real-Time Video Processing"** is a bonafide record of the work done by **NELSON JOSEPH (VJC17EC054)** in partial fulfillment of the requirements for the award of the Degree of Bachelor of Technology in Electronics and Communication Engineering of APJ Abdul Kalam Technological University, Thiruvananthapuram.

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CONTENT

ACKNOWLEDGEMENT

ABSTRACT

With the advent of the era of big data in the world and the commercial value of face recognition technology, the prospects for face recognition technology are very bright and have great market demand. This article aims to design a face recognition attendance system based on real-time video processing. The system prevents the drawbacks of the traditional Face recognition systems. This article mainly sets four directions to consider the problems: the accuracy rate, the stability, the truancy rate and the interface settings of the face recognition attendance system using real-time video processing. By analysing the situation of these problems, the concept of attendance system based on face recognition technology is proposed, and the research on face recognition attendance system based on real-time video processing is carried out. Experimental data shows that the accuracy rate of the video face recognition system is up to 82%. Compared with the traditional check-in method, the face recognition attendance system can be reduced by about 60%. The rate of skipping classes has greatly reduced the phenomenon of students leaving early and skipping classes. The face recognition time and attendance system with real-time video processing through the above experimental certification can quickly complete the tasks of students in the time and attendance check-in system, get rid of the complex naming phenomenon, greatly improve the efficiency of class, and play an important role in guiding the development of the time and attendance system.

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LIST OF ABBREVIATIONS

SVR	Support vector Machines
CNN	Convolutional neural networks
LDA	Linear Discriminant Analysis
ODBC	Open Database connection
SQL	Structured query language

CHAPTER 1

INTRODUCTION

In recent years, the face recognition application system has developed rapidly as a computer security technology in the world, especially today, when terrorist activities are rampant, this technology has received more and more attention. Face recognition technology has many typical applications in the field of public safety, civil economy, and home entertainment [1], [2]. The pipeline of general enterprises needs to record the attendance of personnel, which has become a basic requirement of the company. However, when these attendance systems are formulated, unnecessary errors often occur. Taking the current fingerprint attendance system as an example, the study has found that the fingerprint attendance system has an error rate of about 5%, and there will be a phenomenon that fingerprints cannot be hit, which seriously affects the efficiency of attendance, especially in large attendance sites, which is more likely to cause congestion. However, the card attendance system has the phenomenon of employees swiping cards for someone else, and it is difficult to achieve the purpose of real time attendance. Compared with the two attendance systems, the face recognition system has higher accuracy and stability, because there are more points for face recognition, which is more accurate than other systems. Greatly improved, it is difficult to congestion [3], [4]. Although China's research on face recognition technology started late, our scientific researchers have caught up and some leading figures have established their own industry positions in the field of face recognition. With the advent of the era of big data in today's world and the commercial value of face recognition technology, the prospect of this technology research is very bright and has great market demand.

The design of face recognition attendance system with real-time video processing is conducive to the development of enterprises and has a positive effect on the development of enterprises in the future. This article aims to design a face recognition time and attendance system based on real-time video processing. In this experiment, four investigation experiments were carried out: the accuracy rate of the face recognition system in actual check-in; the stability of the face recognition time and attendance system with real-time video processing; analysis of the skip rate of face recognition attendance system using real-time video processing; interface settings of face recognition attendance system using real-time video processing.

The experimental results prove that the time and attendance system achieve the expected time and attendance results through face recognition technology and with the help of a computer, which fully reflects the feasibility design of the overall algorithm. The students who completed the attendance sign-in system quickly completed the tasks, got rid of the complicated sign of roll call, and soon realized the sign of operation and function. The future system time and the form of attendance system conversion have made tremendous innovations, greatly improving the attendance rate and the reliability of face recognition technology. It is worthy of further exploration and realization by our scientists.

CHAPTER 2

PROPOSED METHOD

2.1 REAL-TIME VIDEO FACE IMAGE RECOGNITION
2.1.1 FACE RECOGNITION

Face recognition is the core of the entire recognition process. Face recognition is a computer vision technology that analyzes facial feature information for identity identification. In a broad sense, face recognition is divided into two parts: face detection and face recognition matching. Face recognition technology is based on the facial features of the person, and the input face image or video stream. First determine whether there is a human face, if there is a human face, then further give the position, size of each face and the position information of each major facial organ. Based on this information, the identity features contained in each face are further extracted and compared with known faces to identify the identity of each face [8], [9]. Face recognition technology belongs to biometric recognition technology, which mainly includes four parts: face image collection, face image preprocessing, face image feature extraction, matching and combining hard recognition, combined with hardware cameras, network lines and computing device.

2.1.2 FACE FEATURE EXTRACTION BY LDA METHOD

The meaning of LDA is linear discriminant analysis. This algorithm is to find a set of linear transformations that minimize the intra-class dispersion between each category and maximize the inter-class dispersion. Fisher is a linear judgment method in LDA. The name is called because Fisher function is often used for calculation. LDA can also be used very well in face recognition, but when using this method to extract face features, some small sample problems often occur. As long as a training sample of the face can be given, and the sample belongs to the other four categories, the total number of faces in the sample is:

$$N=\sum t=1MM1(2)$$

2.2 MAIN FACE RECOGNITION METHODS

2.2.1 GEOMETRIC FEATURE METHOD

Since the facial features such as eyes, nose, ears, mouth, etc. are different in structure, different human faces are represented according to different characteristics of the characteristic shapes of these organs. Geometric features were first used in the description and recognition of the side profile of a human face. It determines a number of feature points based on the profile line of the person's side, and then derives a set of feature quantities for recognition such as angle and distance based on these feature points. Its advantage is the use of simple geometric information, so the time cost of storage space and classification is small, and it can still be used when the image recognition rate is low; it is not sensitive to changes in lighting. Its disadvantage is that it is difficult to extract stable features from the image, it is greatly affected by changes in posture and expression, and the stability is not high

2.2.2 SUBSPACE ANALYSIS METHOD

The analysis method of subspace is to use spatial transformation to map face image data into a certain subspace to achieve dimensionality reduction of face data. It is a huge face data that becomes simple to calculate, and then to the dimensionality reduction data classification. Different subspace analysis methods use different criteria, and different subspaces can be obtained. Common subspace analysis methods for face recognition include: principal component analysis, linear discriminant analysis, independent element analysis, etc.

2.2.3 NEURAL NETWORK METHOD

Neural network is a commonly used method in membrane recognition. Its principle is to use a large number of simple calculation units to form a certain hierarchical structure. Each simple unit can only solve simple calculations, but the system composed of units in complex structures can be a complicated question. The neural network algorithm has also achieved good results in face recognition. For example, commonly used BP networks, self-organizing networks, convolutional networks, etc. As long as the network is large enough, there are enough training samples to theoretically recognize all faces. Although neural networks have some advantages in face recognition, they also have considerable defects. The structure of neural networks is huge and complex, and their training requires a huge sample library. The training time often takes days or even months. The speed is not fast enough. Therefore, neural networks are not commonly used in the actual application of face recognition.

2.2.4 SUPPORT VECTOR MACHINE METHOD

Support vector machine is a research hotspot of pattern recognition. The basic principle of the algorithm is to use samples to form a lattice in the high-level feature space, select sample points as the support vector near the boundary between the two types of sample points, and use the support vector to make the decision. And finally achieve the purpose of classification and identification. The method of projecting into a high-dimensional space makes it possible to solve many problems that are difficult to linearly classify in the status space. But support vector machines also have their shortcomings. First, support vector machines are a two-class classification algorithm. Although some methods can be used to solve multi-classification problems, their efficiency is often greatly reduced. Secondly, support vector machines want high-dimensional space projection, which requires the support of kernel functions, but choosing kernel functions is indeed a lot of trouble. Finally, although support vector machines can classify independently, the effect of directly classifying faces is not good, and often feature extraction is required for faces.
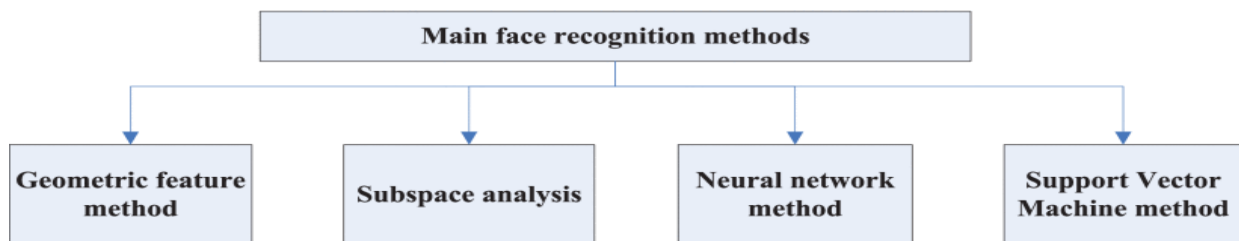
FIGURE 1. Main face recognition methods.

2.3 VIDEO IMAGE RECOGNITION SYSTEM

The face detection technology is used to locate and segment a partial face image from the image; the feature extraction technology extracts the amount of data that can characterize the face image, and forms the features to be stored in the feature database. Face recognition process: face positioning and image processing in the image; feature extraction and selection; detecting and recognizing the image, and returning the recognition result. First create a facial image file of the face. That is, use the camera to collect facial image files of the person's face or take their photos to form a facial image file, and store these facial image files to generate faceprint codes. Get the current human face. That is, use the current facial image captured by the camera, or take a photo input, and generate a facial texture code from the current facial image file. Compare with the current facial texture encoding and file inventory. That is, to

retrieve and compare the current facial texture code with the facial texture code in the file inventory. The above-mentioned "face coding" method works according to the essential characteristics of the human face and the beginning. This facial coding can resist changes in light, skin tone, facial hair, hairstyle, glasses, expression and posture, and has strong reliability, so that it can accurately identify a person from millions of people. The face recognition process can be completed automatically, continuously, and in real time using ordinary image

2.4 BASIC FACE RECOGNITION ALGORITHM

When designing a system to select a face recognition algorithm, we have to consider the following factors: recognition rate, algorithm robustness, and matching time. To sum up, the system selects Gabor features plus Fisher based discriminant analysis method based on orthogonal basis to become a linear discrimination method. Face image feature representation is a key part in face recognition, and good feature representation can improve the robustness of image matching. Gabor wavelet feature description method is a comprehensive method that combines gray and local descriptions. It has the advantages of gray-based and feature-based methods [19].

CHAPTER 3

EXPERIMENTS

3.1 EXPERIMENTAL SETUP

Choose two universities from a province, choose the same number of students for the experiment, collect, count and analyze the experiment, analyze the application space, development prospects of the face recognition system in the actual check-in, and the face recognition system in some problems with the actual check-in. Control group uses traditional fingerprint check-in and Experimental group uses a real-time video processing face recognition attendance system.

3.2 EXPERIMENTAL PROCEDURE

1. Accuracy rate of face recognition system in actual check-in

The face recognition attendance system using real-time video processing is used to count the sign-in rates of students from two colleges and universities, and to compare and analyze the sign-on accuracy rate of the face recognition attendance system using real-time video processing.

2. The stability of face recognition attendance system with real-time video processing

Taking the manual punch card as the control group, the face recognition attendance system using real-time video processing is used for the check-in statistics, and the number of check-in punch cards is used as the main observation parameter to detect the stability of the face recognition attendance system.

3. Analysis of the truancy rate of face recognition attendance system using real-time video processing

Taking the manual punch card as the control group, and using the real-time video processing face recognition attendance system to perform real-time check-in statistics, observe the students' skip-rate rate of the two methods.

4. Interface settings of face recognition attendance system using real-time video processing

By identifying the student's face as the attendance interface, the successful student attendance and time information will be displayed on the screen. By selecting face detection and recognition, the video images of the attendance students can be described by the face recognition attendance system multi-person video.

3.3 DATABASE DESIGN

This system uses MySQL database for data storage. MySQL has the advantages of fast speed, low cost, small size, open source, support for multi-threading and multi-processor, good portability, and at the same time can use ODBC (open database connection) and SQL (structured query language) to increase the data (create), delete (delete), query (select), modify (update) operations.

3.4 FACE RECOGNITION MODULE DESIGN

This system uses a variety of popular programming languages-Python (Interpretive Language), Java, C++ and other languages to develop. Python is used for real-time video data collection and face recognition processing. C++ is used to complete the related system running components such as file operations and client running interface design. Java is used to build a face recognition WEB platform service. Combined with the third-party library Open CV to realize the writing of face recognition module, OpenCV provides rich visual processing and image processing algorithms to analyze and process the facial features captured by the classroom camera. The system is divided into three modules: front-end operation, real-time video face recognition module, and background data management.

CHAPTER 4

DISCUSSION

4.1 SYSTEM IN ACTUAL SIGN-IN ACCURACY RATE

By investigating two colleges A and B in a province, we conducted experiments in colleges based on the application of face recognition attendance system accuracy, and selected 200 college students who need to punch cards. The statistical results of the survey are shown in Table 1 and Figure 3. According to the experimental results, the accuracy rate of face recognition in the classroom video of the two colleges is currently high, and the accuracy rate of face recognition in the college video is about 82%. About 15% of the failed card punches due to video blur and other reasons, About 3% of the staff failed to punch in, it can be seen from these data that the accuracy rate of the video face recognition system is relatively high.

| Video face recognition accuracy	High school A		High school B	
	Test group	Control group	Test group	Control group
Accurate identification (%)	82	94	83	96
Video is blurry (%)	15	0	12	0
Punch failed (%)	3	6	5	4

TABLE 1 Video Face Recognition Accuracy
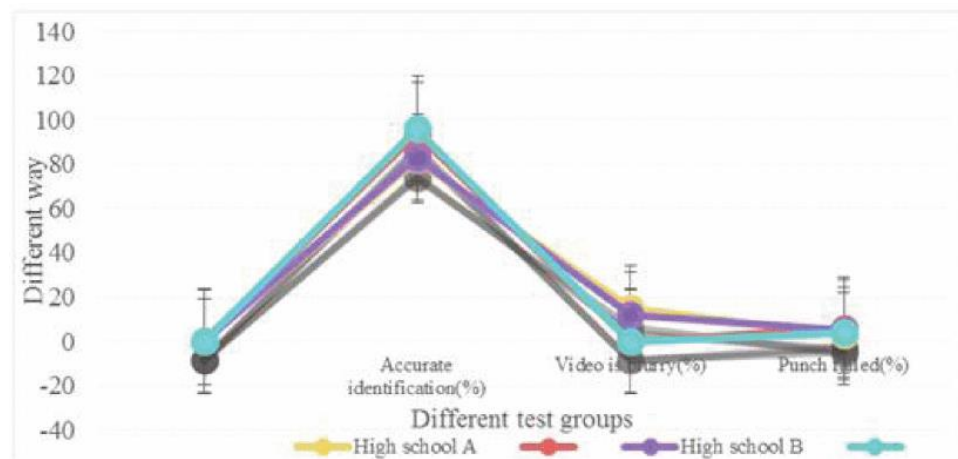
FIGURE 2. Video face recognition accuracy.

4.2 STABILITY ANALYSIS OF SYSTEM

The face recognition attendance system for real-time video processing performs video punching every two hours. Comparing the data of the face recognition attendance system and manual fingerprint punching, the sign-in success is 1 and the failure is 0. The data collection results are shown in Table 2 and Figure 4. An error occurs in the face recognition attendance system from 7 am to 9 am; from 13 noon to 21 pm, the face recognition attendance system and manual fingerprint punch card can correctly identify the check-in. The experimental results show that the length of time when the smart machine is turned on may bring some experimental errors, indicating that the human-machine interactive testing instrument needs to be pre-powered on for two to four hours before the accuracy of the testing data can be guaranteed.

Time	High school A		High school B	
	Test group	Control group	Test group	Control group
7: 00	0	1	1	1
9: 00	1	1	0	1
11: 00	1	1	1	0
13: 00	1	1	1	1
15: 00	1	1	1	1
17: 00	1	1	1	1
19: 00	1	1	1	1
21: 00	1	1	1	1
23: 00	1	1	1	1

TABLE 2 Stability Analysis of Face Recognition Attendance System Based on Real-Time Video Process
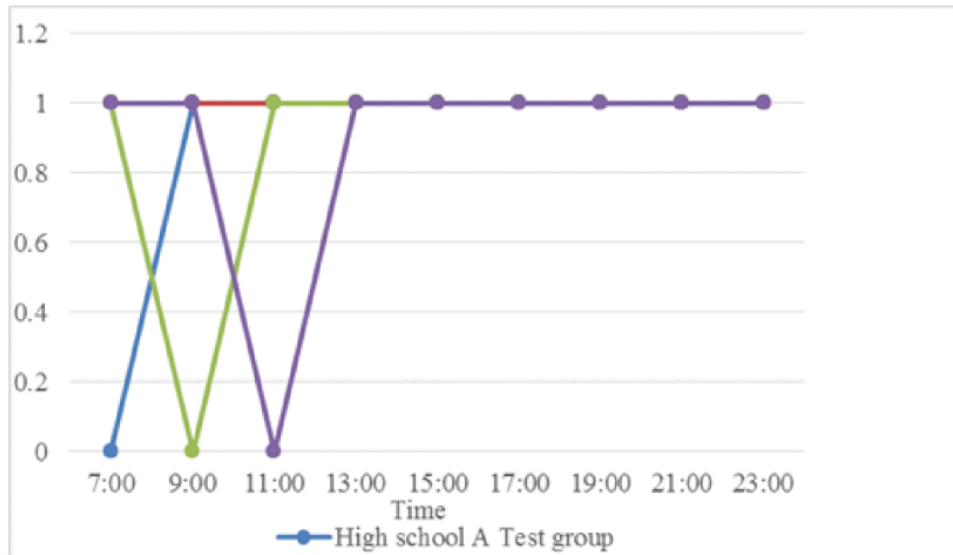
FIGURE 3.
Stability analysis of face recognition attendance system based on real-time video processing.

4.3 ANALYSIS OF THE SKIPPING RATE

Because the face recognition attendance system has a real-time video function, it can count the number of people online in real time. Compared with the traditional fingerprint check-in, students' rate of skipping classes will change. The survey data is shown in Table 3 and Figure 5. The results showed that after using the face recognition system, the skipping rate of the two universities was significantly lower than that of the control group, only about 13%. Therefore, the face recognition attendance system can effectively increase the attendance rate of university classrooms, and is an effective method to restrain students from skipping classes.

| Check student attendance	High school A	High school B
Not named	93 (93%)	94 (94%)
Traditional roll call	73 (73%)	70 (70%)
Video face recognition	13 (13%)	12 (12%)

TABLE 3 Statistical Table for Checking Student Attendance
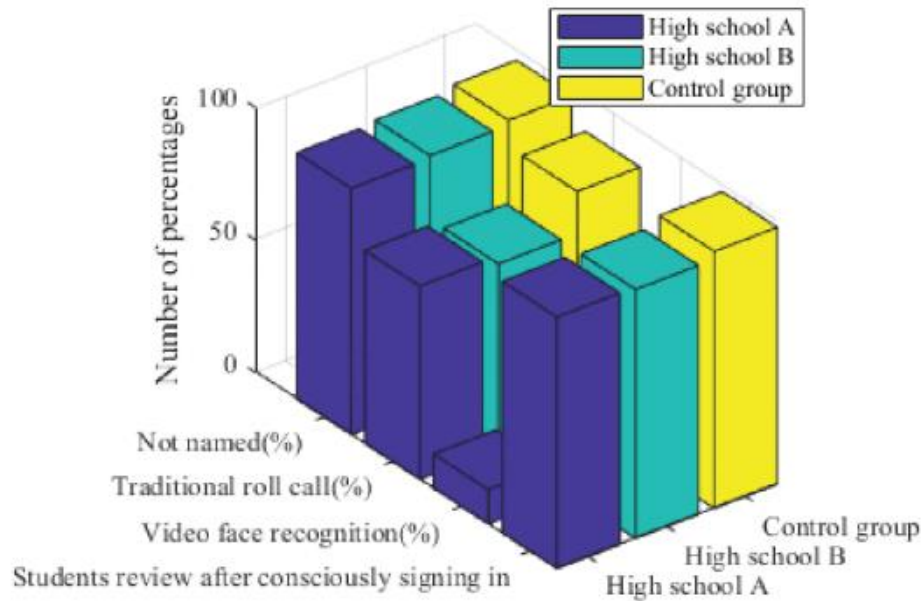
FIGURE 4. Statistics chart for checking student attendance.

4.4. SYSTEM INTERFACE SETTINGS

From the amount of change in Table 4 and Figure 6, it can be seen that by recognizing the student's face as the attendance interface, the successful attendance and time information of the confirmed student is displayed on the screen. By selecting face detection and recognition, the video images of the attendance students can be described by the face recognition attendance system multi-person video. Compared with the traditional punch card signing, this method greatly improves the efficiency, and can prevent early leave and skip class. By regularly extracting images, seeing that the students 'handling of the case is transparent, the inspection method is an imperceptible process to a process where the user perceives no signs, it is a sign of an automated way. After repeated testing, the test results of the system under different test sample numbers are as follows: when the input student is 10 ~ 20, the recognition and sign-in correct rate is 85%; when the input student is 20 ~ 50, the correct rate is 80%. There is an error rate of about 20% in the test results. Most students face information errors that will change, such as changes in facial features, accessories, cosmetics and lighting caused by medical plastics, making it impossible to extract the correct logo from the picture; Another main reason is the accuracy of identification code comparison. The system fails to correctly judge that the two identifiers are very similar. Under various perfect conditions, make sure to adapt to various situations.

Test number	Correct rate
10～20	85%
20～25	80%
25～30	78%
30～35	75%

TABLE 4 Test Number and Accuracy Rate Table
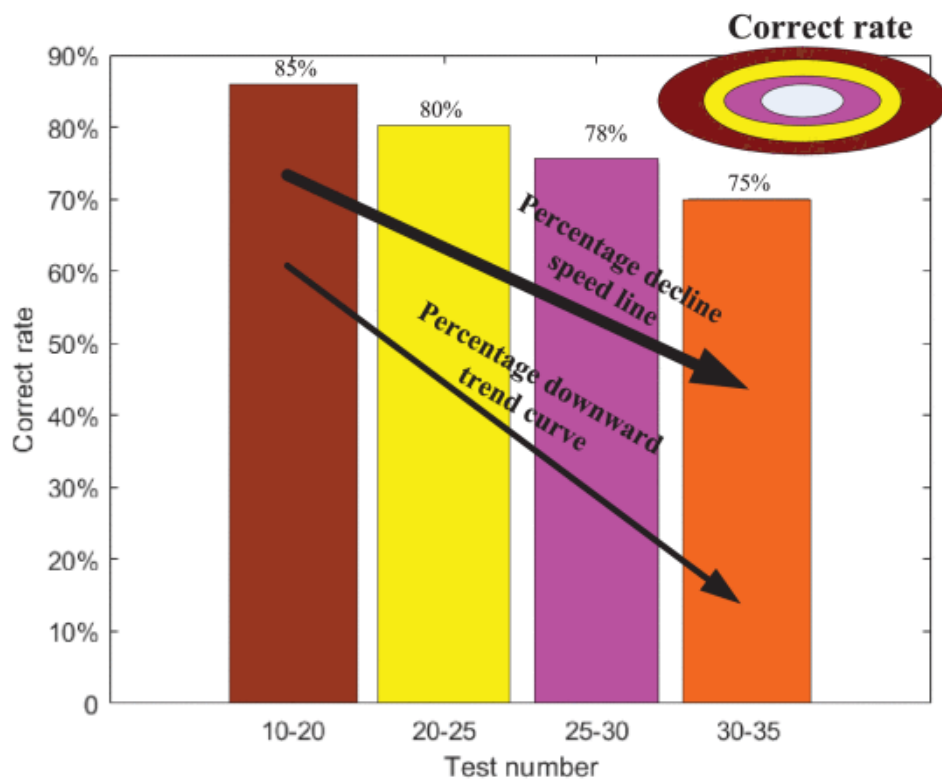
FIGURE 5. Test number and accuracy rate chart

CHAPTER 5

CONCLUSION

A College attendance management for students has become one of the hot issues in the society, so the management of college students should be strengthened. The increasing the rate of absenteeism. not only has a negative impact on students' psychology and physiology, but also maintains the normal order of university teaching and hinders the quality of teaching. At the same time, it will have a very unfavorable situation training and the formation of university spirit and discipline.

In this article, a face recognition attendance system based on real-time video processing is designed, and two colleges in a province are selected for real-time check-in and inspection of student attendance. This article mainly sets four directions to consider the problems: the accuracy rate of the face recognition system in the actual check-in, the stability of the face recognition attendance system with real-time video processing, and the truancy rate of the face recognition attendance system with real-time video processing It is difficult to analyse the interface settings of the face recognition attendance system using real-time video processing. Research data shows that the accuracy of the video face recognition system is about 82%. The face recognition time attendance system and manual fingerprint punching are more stable and correctly identify check-ins, and the rate of skipping classes is significantly reduced compared with the control group, only about 13%. Compared with the control group, the efficiency is greatly improved, which can prevent students from leaving early and skipping classes.

The attendance system realizes the expected attendance results through face recognition technology with the help of a computer, which fully reflects the feasibility design of the overall algorithm. The students who have completed the attendance sign-in system quickly completed the tasks, got rid of the complicated sign of roll call, and soon realized the sign of operation and function. The system has made tremendous innovations, greatly improving the attendance rate and the reliability of face recognition technology. It is worthy of further exploration and realization by our scientists.

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