Design and Implementation of Examination Room Sign-in System Based on Face Recognition SDK

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Abstract: In the current examination room sign-in audit mode, most examination rooms still verify the identity information of candidates by manually collecting and comparing information such as admission tickets, which is not only time-consuming and labor-intensive, but also has a large recognition error rate. Face recognition technology can not only reduce the workload of invigilators, but also efficiently and accurately identify and confirm the authenticity of candidates' identities. In view of this, this paper uses Java language and the face recognition SDK provided by the third-party platform to design and implement the examination room sign-in system on Android mobile phone, which collects and extracts the features of the examinee's face information, and compares it with the picture information in the face database. Candidates can only participate in the examination after successful face comparison. The system has the characteristics of fast detection speed, high accuracy of recognition results and off-line use.

1. Introduction

In the current examination room sign-in audit mode, most examination rooms still verify the identity information of candidates by manually collecting and comparing information such as admission tickets. Although the operation mode is simple, these methods of verifying the identity of candidates by artificial naked eyes are often inefficient, cumbersome and have a high error rate [1]. Face recognition technology has developed rapidly in recent years, and it has been widely used in many fields and daily life, such as face verification in railway stations, identity verification of bank cards, etc. At the same time, it also provides a new feasible scheme to solve the problem of examination room sign-in.

The development of this system combines the open SDK of ArcSoft face recognition platform, using Java language, and with the help of the face recognition offline SDK (ArcFace-V3.0) interface provided by ArcSoft open platform [2], designed and developed an examination room sign-in system on Android mobile phone, which extracts and collects the examinee's ID according to the features of face information, and compares it with the picture information in the face database. Candidates can only participate in the examination after face comparison.

Among them, the principle of face recognition is to compare the face features of candidates with the photo data of ID cards and other documents [3], without collecting too much other identity information, it can be applied to various types of examination room sign-in, with fast detection speed and high accuracy of identification results. Therefore, the examinee's identity verification terminal can verify the authenticity of the examinee's identity only by comparing the facial features. In this paper, Android mobile phone is selected as the verification terminal, which has a small device body and flexible and simple operation.

2. Business Process Analysis

2.1. General Process Overview

As shown in Figure 1, the core business of face recognition is mainly divided into three processes:

(1) Face detection: The algorithm model is used to detect the pictures or video frames collected by the shooting equipment, and the face data is obtained, which is convenient for subsequent recognition and other operations.

(2) Feature extraction: extract face features from the images to be compared and the images in the face database, so as to facilitate the subsequent comparison.

(3) Face recognition: There are two modes: 1:1 comparison and 1:N search. The role of the former is to verify the authenticity of the identity, while that of the latter is to clarify the specific affiliation of the identity. Because the examination is a large-scale application scenario, this paper mainly studies the 1:N search mode.
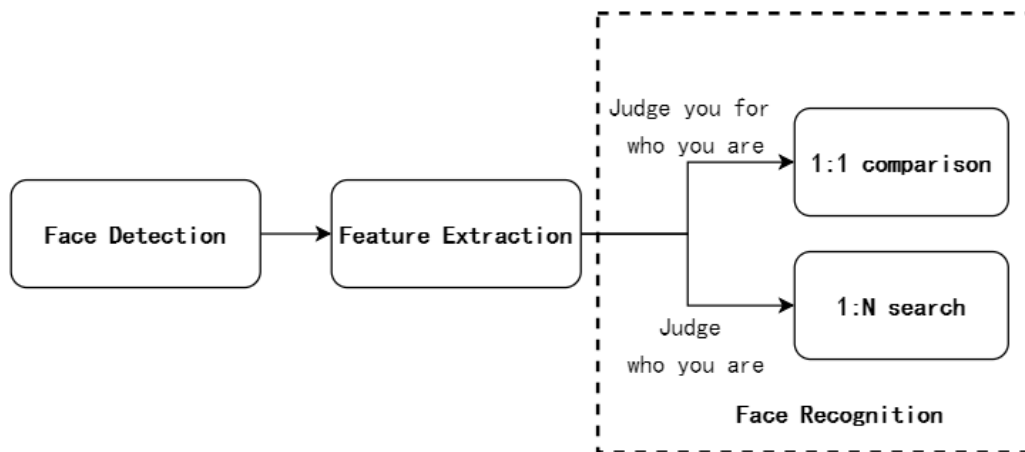

Figure 1: Flow chart of face recognition core business

2.2. Face 1: N Search

For the 1:N search mode, first collect and store the face picture set to be recognized in the local face database, then collect the face picture of the user to be recognized in real time from the video stream (using RGB monocular camera mode), compare it with the face set in the face database, and return the search result. The specific flow chart is shown in Figure 2.
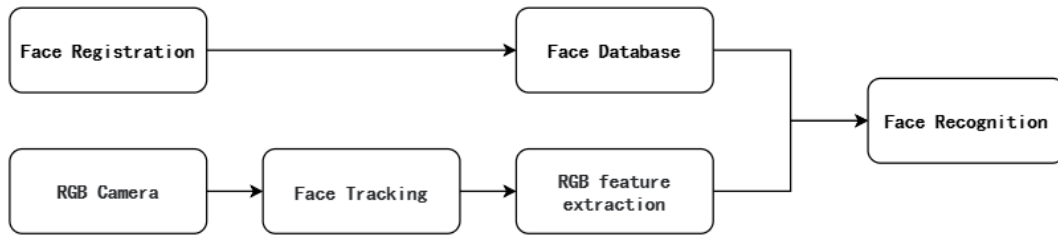
Figure 2: Face 1: N search flow chart

3. System Framework

3.1. Hardware System

In the whole system framework, the hardware framework is an indispensable part of it. The input and processing of examinee information and the operation of face recognition program all depend on the support of hardware devices. As a simple, portable and powerful embedded device, smart phone is no longer a single communication tool, but has developed towards personal mobile computer, providing an implementation platform for instant and offline face recognition verification. At present, most low-priced smart phones in China can fully meet the hardware development and requirements of this system.

3.2. Software System

The software system consists of three modules: the examinee's face information acquisition and detection module, the examinee's face recognition module and the examinee's face database module [4].As shown in Figure 3, the functions of each module are as follows.

(1) Candidate's face information acquisition and detection module: This module is mainly responsible for the acquisition and detection of exam face information [5].

(2) Candidate face recognition module: The function of this module is to collect the face pictures of the users to be recognized in real time from the video stream, compare them with the face collections in the face database, and return the search results.

(3) Candidate face database module: The function of this module is mainly to store the candidate's ID picture information [6-7].
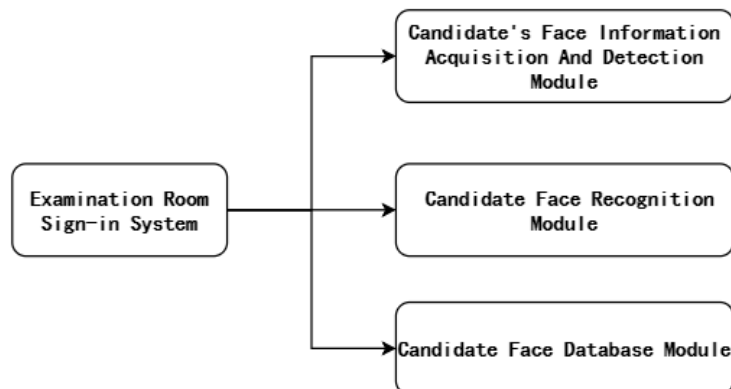

Figure 3: Overall module structure diagram of the system

3.3. Development Environment

At present, the operating systems used by popular smartphones are Android, iOS, Harmony OS, etc. Android operating system occupies a large share in the current application market because of its convenience and openness. At the same time, with the same configuration and version, the price of its mobile phone will generally appear relatively lower. Therefore, the running platform of this system adopts Android10.0 system.

For Android mobile phone applications, the development platform is Android Studio, and the requirements of its development environment are relatively simple, so you can start to do projects without too much environment configuration. The development environment of this system is mainly on Microsoft's Windows 10 operating system, the development environment language is Java, and the API is Android SDK and ArcSoft face recognition offline SDK.

4. System Design and Implementation

4.1. ArcSoft Face Recognition SDK

In order to simplify the development of system software and reduce the difficulty of actual face recognition development, this system adopts SDK (Software Development Kit) technology provided by the third-party AI development platform [8-9]. In this system, the face recognition SDK provided by ArcSoft Vision Development Platform is the first choice. With the help of the API interface of SDK, the face recognition function is designed and implemented on Android phones [10]. ArcSoft SDK includes the functions of face detection (for static image recognition), face tracking (for dynamic image recognition), face feature extraction, face feature comparison, face attribute detection, living body detection, image quality detection, etc. The functional structure diagram is shown in Figure 4. Based on the SDK development mode, the development process of system software content can be significantly simplified, and the high accuracy of face recognition can be ensured, thus improving the efficiency of examination room sign-in.
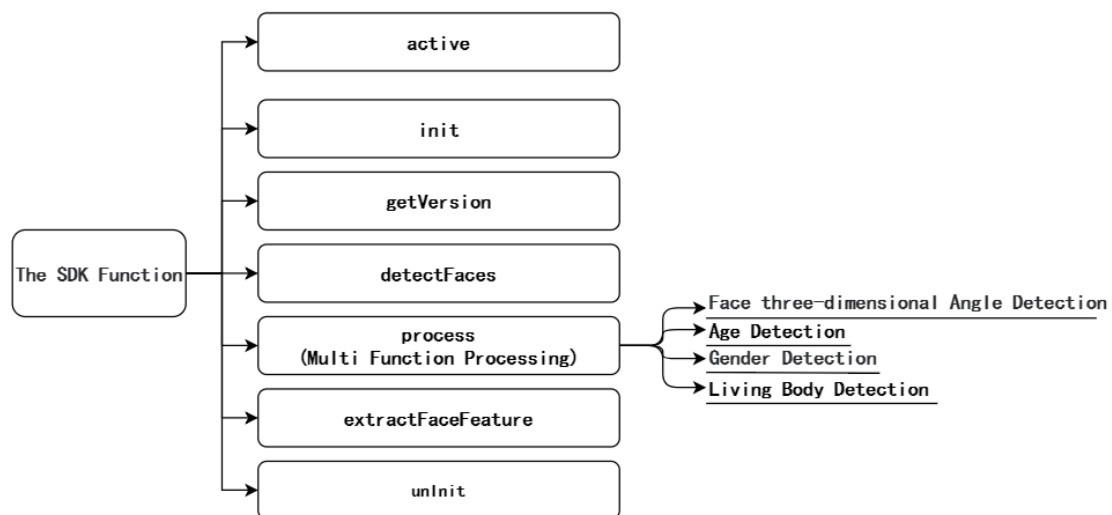

Figure 4: ArcSoft SDK function package

4.2. Acquisition of "Face Recognition SDK"

First, register a legal user account through ArcSoft Visual Development Platform, and use this

account to log in to the development platform [11]. To obtain the required SDK, the operation steps are as follows.

(1) Create the corresponding application, select the SDK, corresponding platform and version to download, and then download the SDK after confirmation.

(2) Check APPID and SDKKEY, and click the download icon to get SDK development kit.

4.3. Authorization of "Face Recognition SDK"

Hong soft vision development platform allocates many APPIDs and SDKKEYs for face recognition SDK, but one appid and SDK key can only activate one hardware device. Therefore, here, in order to use the face recognition SDK normally and redevelop it, it is necessary to independently authorize the equipment operated by this system. When the equipment is authorized for the first time, it needs to be authorized online or offline. After the authorization is successful, the equipment can run the program developed based on SDK offline.

5. System Test and Analysis

In order to verify that this system can basically achieve the expected results of the examination room sign-in, a certain test is carried out on this system, which is mainly divided into different light and dark scenes and recognition rates of different sample numbers. According to the actual demand, this system must meet both high recognition accuracy and fast processing speed.

Firstly, the recognition accuracy and rate in bright scene and dark environment are tested respectively. After testing, the offline SDK of ArcSoft face recognition can recognize normally in both cases, and the speed of face recognition is faster when the light is sufficient. The recognition effect is shown in Figure 5.
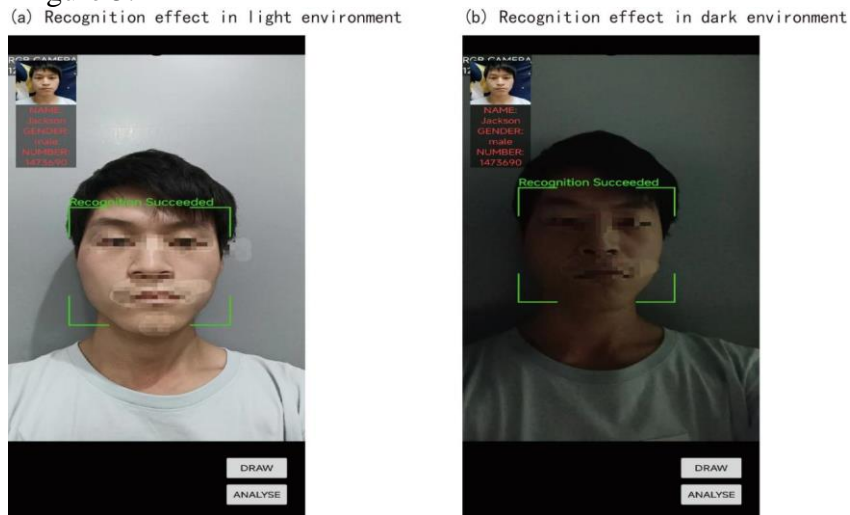

Figure 5: Test results

Then, in order to ensure the good practicability of this system, the performance of the system should be tested from the processing speed of face recognition. Here, the recognition completion time of different samples is tested several times, and the average recognition completion time is calculated. The test results are shown in Table 1.

It can be seen from table 1 that when the sample size is less than 10,000, the identification time is roughly between 100 ms and 120 ms, and the whole system runs stably with good performance.

Therefore, in the ordinary lighting environment, this system can achieve high authentication accuracy and fast face recognition rate, which can meet the requirements of efficient, accurate and

rapid authentication of each examinee's identity when the school examination room signs in.

Table 1: Identification completion time test table

sample number	Test time 1 (ms)	Test time 2 (ms)	Test time 3 (ms)	Average recognition completion time(ms)
1000	110.481	102.346	101.730	104.852
3000	119.935	104.092	110.415	111.480
5000	103.188	119.213	101.340	107.913
8000	113.121	100.864	109.301	107.762
10000	107.149	109.298	129.234	115.227

6. Conclusion

In this paper, ArcSoft face recognition offline SDK is used to develop the examination room sign-in system for Android application, which has good structural stability, and can solve the problems existing in the current national education examination management. The experimental test shows that the system has high recognition rate and accuracy, and meets certain work needs. At the same time, by combining the most popular smart phones in the current market, the system can initially construct a set of intelligent system designed to solve the examination room sign-in work. The portability and low cost of the equipment itself can basically be used as a powerful tool to realize the examination room sign-in management.

Acknowledgement

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