Research on the Application of English Course Online Examination System Based on Face Recognition Technology

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Abstract. With the development of information and technology, the English course online examination has been promoted comprehensively. However, in online examination, the authentication link mostly relies on the manual authentication method, which has the limitation of the manual identification. Based on this problem, this paper proposes an online examination system for English courses which is based on face recognition technology. Face Recognition is used to judge the correctness of the user’s login identity by invoking the Baidu Face Recognition API for online live Face detection and comparison.

1. Introduction
As online examination for College English courses has been becoming more and more popular, Non-paper examination has become an indispensable part of teaching and management process in colleges and universities gradually. But, the reform of new ways of examination is confronted with new problems in the online examination, such as the large number of examinees at the same time, heavy workload of the examinees’ ID-check, and the unscientific validity of the artificial ID-check, etc.

In recent years, with the development of Internet of things and AI technology, the emergence of face recognition technology provides a new and more ideal method to solve the above problems. As a new technology, face recognition technology has been relatively mature. It has been well-applied in attendance checking, real-name authentication and other occasions. It will make the management of college English online examination fairer, smarter and more scientific by using face recognition technology to conduct identity checks.

2. Introduction of Face Recognition Technology
Face recognition is a kind of biometric technology based on human face information. The first step of the face recognition is to detect the presence of a human face. If there is a face, it will provide more information of the size and location as well as the information of each organ of the face. According to the information, we can extract the features and identities of the human beings. Then it will match and recognize with the existing human faces of the system. Face recognition includes face acquisition, face detection, image preprocessing, feature information extraction and face matching and recognition.

2.1. Face Collection
Face collection refers to use a camera to collect the person’s face file or form the face file with the photograph, then generate the face code and store in the end.
2.2.  Face Detection
Face detection is to determine whether there is a face in a given image or video based on certain methods. If there is, the size, position and posture of the face are determined. Face detection is a key point in face recognition. It belongs to the field of target detection from the perspective of problem domain. The application area of face detection is not only applied to face recognition system, but also can be used for website identity authentication, social software verification and inspection of security mechanism system.

2.3.  Image Preprocessing
Image preprocessing mainly removes the irrelevant information of the image and minimizes the interference caused by light, external environment or imaging system, so that the features of the image can be clearly displayed.

2.4.  Extraction of the Feature Information
The process of face recognition is also a process of classification. During the process of machine learning, pattern recognition, and image processing, feature information extraction is performed from the very beginning of a set of raw data. And it also establishes derived values (features) that are designed to provide information and non-redundant features for subsequent learning and generalization steps. In some cases, it can gain better interpretability. Feature extraction is related to dimension reduction. The quality of features has a critical effect on generalization performance.

2.5.  Face Matching and Recognition
Face recognition is to extract the features of the face to be confirmed and then classify them by matching them with the face features in the server image database. The extracted feature information data of the face image is searched and matched with the feature information template stored in the database, and a threshold is set to output the matched result. Face recognition is to compare the face feature information waiting to be recognized with the existing face feature template. And it will do comparison and judgement according to the degree of similarity to face identity information. This process is divided into two categories: one is confirmation, which is a one-to-one image comparison process; the other is recognition, which is a process of image matching and comparison.

3.  Advantages of English Course Online Examination Combined with Face Recognition Certification

3.1.  Description of specimens
With the development of science and technology, intellectual mobile terminals have been popularized on a large scale, so it is possible to carry out face recognition through cameras of intelligent mobile terminals. Face recognition technology has been widely used in various scenes of public life, such as login authentication, attendance authentication, access control authentication, face identity ID payment and other scenes. At present, there are mainly the following ways of authentication:

| Verification mode                  | Accuracy  | Efficiency | Pass rate of Identification | Influence factors                        |
|-----------------------------------|-----------|------------|----------------------------|------------------------------------------|
| Artificial validation             | Average   | Low        | \                          | Subjective assessment                    |
| Fingerprint machine verification  | High      | Average    | Average                   | Finger peeling, sweating, etc. will affect efficiency; Large workload of feature collection; Fingerprints can be duplicated and faked. |
| Face recognition                  | High      | High       | High                      | Light intensity                          |
As can be seen from the table above, artificial verification has the characteristics of subjectivity. In consequence, the surrogate examinee is difficult to be identified accurately. If the fingerprint identification method is adopted in the exam, the surrogate examinee can pass the detection easily by copying the fingerprint of the examinee to make the corresponding template. In this way, the authenticity of identity identification users cannot be guaranteed, nor can it guarantee the fairness of the examination. Only can we choose face recognition technology which is easy to collect information and very convenient to employ in the examination. It also has the characteristics of high accuracy and reliability. It will become an inevitable trend to adopt face recognition authentication in English course examination of colleges and universities. Therefore, the application of face recognition technology in English course examination can determine the identity of candidates accurately and improve the fairness of online examination effectively.

4. Realization of Face Recognition Authentication in English Course Examination

4.1. System Development Environment
The system development language uses Java+Mysql data and SSM framework which is very popular. It takes IDEA as the development tool, and Redis as the database to alleviate the high concurrency problem.

4.2. Face Recognition API
The face recognition module of this system employs Baidu AI open platform to build face database, which is used to store all face features. Face database management and face comparison are carried out step by step according to the corresponding API documents to complete face comparison recognition of 1:N. By calling Baidu face recognition API, the registration and login of face data of students can be realized to verify the information of candidates and prevent cheating in exams. Baidu face recognition API provides targeted face attendance solution, perfect integration, to help developers to build a smart identity system with high efficiency and excellent anti-cheating ability. It provides AIO all-inclusive service with combination of GPU server. It also offers many basic functions, such as face detection, attribute analysis, face alignment and vivo detection, etc. It supports millions of super-large face libraries and outputs search results in milliseconds.

4.3. System Functional Structure
This system is mainly used for English online examination identity authentication. The functional structure is shown in Fig.1:

After face recognition registration, users take photos of themselves through mobile devices such as mobile phones at the mobile APP terminal. The management staff checks the authenticity of the corresponding photos and whether the quality of the photos meet the requirements in the background. After the approval, the photos cannot be modified.

Face recognition login achieves that users login English examination system. The face identity online authentication checks it, if passed, then log into the system directly.

Face recognition detection will carry out face recognition verification of candidates in the test-taking process. It can prevent surrogate examinees in the test effectively.

Due to space limitations, other online examination features will not be described in details.

4.4. Business Process of Face Recognition Validation
As shown in Figure 2, this module adopts face recognition of Baidu Open Platform. As cloud face recognition verification, it conducts trial and error on face samples, and realizes the function of recognizing face images successfully. The detection process of face recognition is as follows:
Fig. 1 System Functional Structure Diagram  

Fig. 2 Business Flow Chart of Face Recognition Module

Step 1: Collect your own face image through mobile phone or face recognition terminal, and obtain the recognition result UID, score and live value through identification interface.

Step 2: Upload the recognition results UID, score and live value to the Baidu cloud and compare the users UID in the cloud face inventory.

Step 3: In vivo detection, the cloud could determine whether the living object was alive through Face liveness score online and make a judgment based on the preset threshold value. The registration is not allowed to log in, if the living object detection is less than the threshold value. If it is greater than the threshold value, will move to the judgment stage. It will make a contrast between the eigenvalue information obtained by the acquisition module and the stored eigenvalue information in the template database. Then, it will find a face image or video that is closest to the face to be recognized and output the image or video.

Step 4: Acquaintance judgment. After passing in vivo detection, online similarity judgment can be made by calling Baidu API. According to the preset threshold, if it is higher than the threshold, the login will be successful; otherwise, the login will fail.

Baidu Face recognition provides functions such as face detection, face search, face comparison, etc., which can be called by the SDK for developers. The following is an introduction to the face detection function:

```java
/*Face @param imageBase64 */
public DetectFaceResponse detectFaceBase64(String imageBase64) {
    ... // Face detection
    Gson gson = new Gson();
    String jsonStr = client.detect(imageBase64, imageType, options).toString();
    DetectFaceResponse res = gson.fromJson(jsonStr, DetectFaceResponse.class);
    return res;
}
```
4.5. Test Results
In the actual test of identity verification, it recorded the automatic face recognition of identity verification of five online examinations. And the time required was compared respectively. The specific situation is shown in Fig.3:

![Fig.3 Failure characteristics of specimen](image)

The system has been tested and analyzed for 5 times, and the rate of correct face recognition is hovering around 90%. In terms of passing efficiency, about 2 seconds per person. The overall passing efficiency and accuracy are close to the actual business requirements, which can be fully used in practical applications.

5. Conclusion
In this paper, we design an English course online examination system by using face recognition verification. By calling the Baidu API for face recognition detection, the efficiency of online English course examination authentication is effectively improved. It can ensure the fairness and equity of online examination by putting an end to surrogate examinees.

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