

# Research on the Key Application of Computer Biometric Technology in Power Self-Service Terminal

Hui ZHU, Chen LI, Bei YU, Xin LI, Mengyuan LI<sup>1</sup>

State Grid Huitongjincai (Beijing) Information Technology CO., LTD, China

**Abstract.** Biometric is a unique feature that can carry out identity verification and measurement. Biometric tech is a tech on account of computer tech, integrating sound, light, sensors and other technical means, and on account of the characteristics of organisms, which is difficult to forge, not easy to lose, carried with organisms, and easy to use. At present, biometric tech has been widely used in many fields, but it is still in the initial and exploratory stage in the field of power business self-service. Biometric tech has important utilization advantages in the field of power business self-service, especially in the field of identity recognition. On account of this, in order to enrich the functional utilization and user experience of power business AIDS, this paper makes a more in-depth research and analysis on the embedding of computer biometric tech into power related business processes. The experimental test shows that for the same person, the different number of face samples will lead to a certain gap in the recognition rate; when the number of collected face samples increases, the time for face recognition will increase; the average recognition rate is above 93%, achieving the desired effect. The possible reason for the analysis experimental results is that when the camera collects the image of the face to be recognized, the face detection stage produces misdetection, so that part of the recognized pictures are not real faces, which will lead to the decline of the overall recognition rate.

**Keywords.** Biometric Tech, Speech Recognition, Face Recognition, Integrated Service Self-service Terminal

## 1. Introduction

At present, the business types of computer self-service terminals in most power business halls are still more traditional payment, printing invoices, etc., while the typical business processing represented by reporting and loading, renaming, etc. can only be handled manually through the counter. Users need to submit identity documents such as ID card when handling the business of loading and renaming. The counter of power business hall needs to verify their identity offline, which not only has a large workload, long cycle, but also is prone to error. Starting with the business handling of the power business hall, this paper analyzes the typical scenarios and methods of the utilization of computer biometric tech in the power self-service terminal, so as to ameliorate the intelligence of user business self-service handling and the convenience of identity authentication [1]. Biometric recognition is a method of identity verification and recognition based on the

---

<sup>1</sup> Corresponding Author: Mengyuan LI, State Grid Huitongjincai (Beijing) Information Technology CO., LTD; e-mail: limengyuan@sgec.sgcc.com.cn

unique biological features of the human body. The following are several common biometric recognition methods:

1. Fingerprint recognition: Fingerprints are unique biological features of each person, and fingerprint recognition verifies identity by collecting and comparing fingerprint images. It is widely used in Door security, mobile phone unlocking and other fields.

2. Iris recognition: The iris is the colored circular part of the human eye, which verifies identity through feature extraction and matching of iris images. Iris recognition has high accuracy and stability, and is commonly used in high security level identity recognition systems.

3. Face recognition: Face recognition utilizes information such as feature points and contours in facial images for identity verification. It can capture facial images through a camera and compare them with pre stored templates, and is widely used in fields such as security and social media.

4. Voiceprint recognition: Voiceprint recognition performs identity verification by extracting and comparing individual voice features. Everyone's voice has unique voiceprint features, and voiceprint recognition can be applied to scenarios such as telephone banking and voice assistants.

5. Palmprint recognition: Palmprint is a texture pattern on the skin of the palm, which is used for identity verification by extracting and comparing palmprint images. Palmprint recognition has certain application potential in fields such as personal recognition and crime investigation.

These biometric recognition methods are based on the inherent biological features of the human body, which are unique, difficult to forge, and highly reliable. They are widely used in fields such as security access control, criminal investigation, and financial transactions, providing an efficient and accurate technical means for identity verification and individual identification [2-3].

2. Principle of Computer Biometric Tech and Its Industrial Utilization Status

2.1. Principle of Computer Biometric Tech

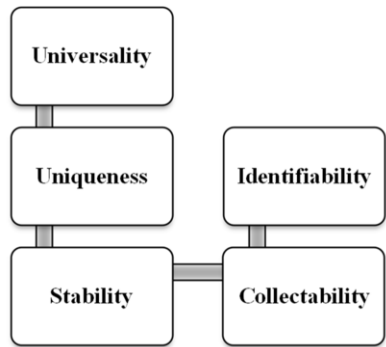


Figure 1. Characteristics of computer biometric tech

As a tech for automatic identification or authentication on account of human physiological or behavioral characteristics, the physiological and behavioral characteristics used by computer biometric recognition tech include physiological and behavioral characteristics, and have several typical characteristics as shown in Figure 1

below. Through the organic combination of computer, sensor and biostatistics, the identification of personal identity is realized by using the inherent physiological and behavioral characteristics of human body.

In the process of capturing biometrics, the computer biometric system will extract the unique biological features and convert them into digital symbols. Then, these symbols are used as feature templates and stored in databases, smart cards or bar code cards. The computer biometric system determines the biological identity according to the match or mismatch through interactive comparison. The calculation of the accuracy  $F$  of the computer biometric process is shown in the following Eqs (1)-(2), where  $s$  represents the number of successful recognition and  $k$  represents the total number of recognition.

$$F = \frac{s}{k} \tag{1}$$

$$s = \mu \pm \sqrt{\alpha^2 - 4\alpha\beta} \tag{2}$$

Industry utilization status of computer biometric tech

With the increasing maturity of computer biometric tech, it has been widely used in finance, telecommunications, transportation, entertainment, smart parks and other industries. Taking face recognition tech as an example, its main utilization direction is identity recognition and verification. In the process of identity recognition, the user's face is scanned, living body detection and face quality detection through the camera. After image processing and algorithm analysis, it is compared with the user's basic portrait data to complete identity verification. Typical computer biometric steps are shown in Figure 2 below.

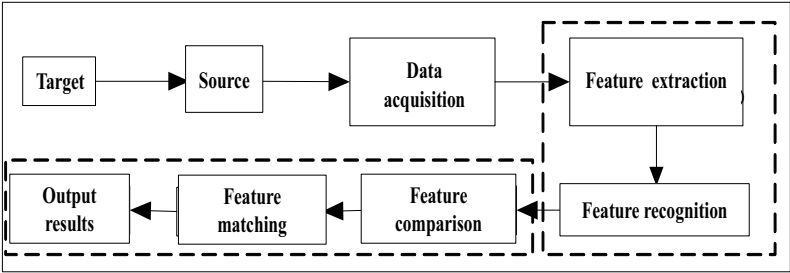


Figure 2. Typical computer biometric steps

Difficulties in the utilization of biometric tech in power self-service terminal

Although biometric tech includes many types as shown in Figure 3 below and can be better suitable for different utilization scenarios, there are still many problems and difficulties to be solved in the current basic utilization of computer biometric tech in power informatization. First of all, since biometric recognition is on account of the user's original info data, such as the basic data of facial info, State Grid Company has not established a basic info database [4]. For facial info recognition, comparison and verification, it is necessary to borrow the basic data database of a third party. Secondly, the voice data needs to be on account of Putonghua to expand the basic database of dialects and some common foreign languages across the country, and the basic info database needs to be integrated and synchronized with the official authoritative database.

At present, the public security face info basic database and general voice database are databases in the external network environment of the national network. It is difficult to open up the internal and external network environment and ensure real-time data interaction in the utilization of computer biometric tech.

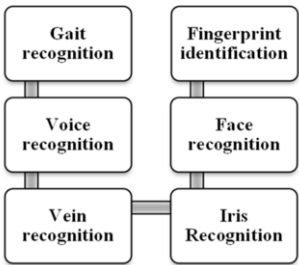


Figure 3. Types of biometric tech

3. Optimization Scheme of Computer Biometric Tech in Power Self-Service Terminal

3.1. Ameliorate the Computing Power of Biometric Self-Service Terminal

Firstly, in view of the huge amount of computing power required by computer biometric tech, the computing program needs to be deployed on the server of self-service terminal equipment, and the system computing power can be effectively ameliorated through the efficient GPU algorithm, and then the GPU virtualization tech is used to form a GPU computing power resource pool to make full and rational use of GPU computing power. Graphic operation is characterized by intensive operation of a large number of same type data, such as matrix operation of graphic data. The micro architecture of GPU is designed for numerical calculation suitable for matrix type.

There are a large number of repeatedly designed calculation units. This kind of calculation can be divided into many independent numerical calculation threads, and there is no logical correlation between data like program execution. GPU is actually a set of graphics functions implemented by hardware. These functions are mainly used for the operations required to draw various graphics. These operations related to pixels, light and shadow processing, 3D coordinate transformation and so on are accelerated by GPU hardware.

3.2. Strengthen the Training and Learning of Biometric Terminal Algorithm

Strengthen the training and learning of speech recognition algorithm and ameliorate the noise reduction processing ability to meet the high accuracy speech recognition interaction in the scene of changeable users [5-6]. Traditional noise signal processing methods have poor scalability, and different methods are needed in different noise environments. Although neural network deep learning can deal with all noise situations, this method needs a large number of training samples. First, preprocess the noisy speech signal to get the preprocessed speech signal. The speech endpoint detection tech is used to detect the endpoint of the speech signal to determine the effective starting point and ending point of the speech signal. According to the effective starting point and ending

point, the whole speech signal is cut, and the step noisy speech signal is sliced into a fixed length. The noisy speech signal slice is used as the input of the deep noise reduction model, and the clean speech signal is obtained through the deep noise reduction model.

4. Experimental Results

This section gives the performance indicators of the entire embedded face recognition access control system test and a detailed experimental analysis. Including the test and analysis of face detection rate, face recognition rate test and analysis of several aspects.

4.1. Face Detection Part Test

In the process of human face recognition, the primary task is the correct detection of human face, and the effect of human face detection directly determines the results of human face recognition. Therefore, this paper makes statistics on the face detection rate of different face poses of people under different lighting conditions. The face classifier used in this system is haarcascade\_frontalface\_alt.xml classifier in OpenCV source [7]. During the whole test, each person collected 20 image samples under different face posture conditions, such as 20 faces under normal light conditions, and 100 samples before the face detection rate is calculated. The specific statistical results are shown in Table 1 and Figure 4.

Table 1. Face detection rate

Face posture	Normal light detection rate	Darker light detection rate
Is the face	95%	90%
side face	86%	77%
Wearing glasses on the face	95%	85%
Face without glasses	94%	89%
Face smile	93%	86%

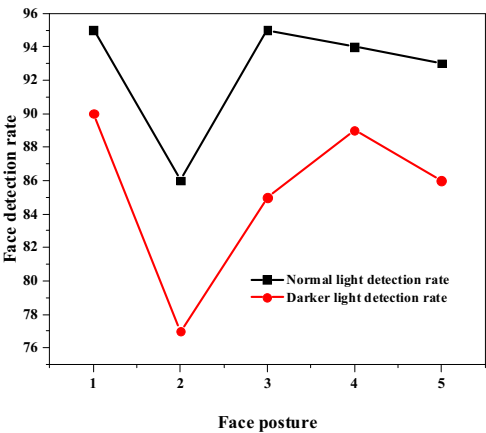


Figure 4. Comparison of face detection rate

It can be seen from the above experimental results that under the normal natural light irradiation conditions, the success rate of face detection is more than 91%. Among them, in the face detection, wearing glasses and not wearing glasses do not have much impact on the face detection rate, and the detection rate of side face is lower than that of the face. The average face detection rate under light conditions was 85%. On, this says that light conditions are-robust to face detection algorithm. At the same time, the face detection rate is less affected by the expression changes. Therefore, the detection algorithm and face classifier used in this system can get more ideal detection effects [8-10].

## 5. Conclusion

In summary, with the rise of mobile internet, the business of traditional power business hall has been gradually replaced by PC terminal or mobile terminal. In the face of some special customer groups, the business acceptance capacity of the power business hall must meet the needs of the current customer groups, try to break through the original service mode, and innovate a more flexible and better service mode. Therefore, innovating computer biometric tech and improving the service quality of power companies with a more convenient, fast and humanized service mode is not only the development direction of business hall in the future, but also has important practical value. Strengthening the exploration and optimization of computer biometric tech is also the future tech development trend and the practical demand for the sustainable development of power industry. The performance and running time of the system are tested in detail, and the applications suitable for the system are analyzed.

## References

- [1] Duan Peipei, Yuan Xin, Hou Na, et al. Utilization of biometric tech in intelligent terminals [J]. Computer knowledge and tech, 2017 (03): 15-16.
- [2] Han Yufeng, Wang Xiaolin, Zhang Chuanwen. Research and utilization of biometric recognition tech [J]. Microcomputer info, 2012 (3): 36-38.
- [3] Jiang Hongchao, Zhang Gaowei. Fingerprint detail feature extraction on account of limit tracking [J]. Computer Engineering, 2017 (8): 24-30.
- [4] Qi Shuang. Utilization of biometric tech in Internet financial security authentication [J]. Industry and Tech Forum, 2015 (22): 80-80.
- [5] Sun Xiaofeng. Biometric tech and its utilization in mechanical manufacturing automation [J]. Science and wealth, 2018 (11): 61.
- [6] Sun Decai, Yu Shuqin. Role and risk of biometric tech in customer identification [J]. Times Finance (late), 2016 (06): 87-92.
- [7] Wang Junshan, Zhang Wenming. Categories of biometric tech and its utilization in identity recognition [J]. Henan science and tech, 2017 (15): 137 -157.
- [8] Wang Youguang. Development of biometric recognition system on account of machine vision and motion control [D]. Guangdong University of tech, 2014, 17-18.
- [9] Yan Kunru, Liu Dan. Analysis on the subject of tech intervention and its ethical regulations. Taking biometric tech as an example [J]. Journal of Northeast University (Social Science Edition), 2017 (01): 143.
- [10] Zhang Ning, Zang Yali, Tian Jie. Integration of biometrics and cryptography -- a new secure identity authentication scheme [J]. Journal of cryptography, 2015 (2): 92-95.