Biometric Identification Technology and Development Trend of Physiological Characteristics

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Abstract. Biometric recognition is an interdisciplinary and comprehensive technology that combines computer technology with optics, acoustics, sensors and biostatistical technology closely, with the help of physiological and behavioral characteristics common to human beings to authenticate the identity of the individual. Physical characteristics are born with innate characteristics, while behavioral characteristics are habitual characteristics formed by long-term accumulation of behavior, most of them have acquired characteristics. Usually, fingerprints, hand, faces, irises, finger vein, DNA, palmprints and retinas are classified as human physiological characteristics.

1. Introduction
At present, there are several common recognition technologies in the field of biometrics: fingerprint identification, iris recognition, thermogram recognition, palmprint recognition, retinal recognition, DNA recognition, signature recognition, hand recognition, face recognition and speech recognition, etc. Face, fingerprint, finger vein, irises, DNA, palmprint, thermogram, etc [1]. Are classified as physiological features. These recognition techniques have been widely used in finance, public security organs, attendance, medicine and health departments that need individual identification. In the public security organs, biometric identification system is needed to compare the fingerprints left by criminals at the scene of the crime with the fingerprint database that has been established in the public security organs to determine the individuals to whom the fingerprints belong and the locking of the suspects [2]. In IT, the use of individual biometrics to replace traditional passwords, prevent others from illegally performing, and ensure the security of personal computers. In the financial trading industry, by encrypting individual biometric information into chips, more secure transactions can be ensured.

2. Common recognition technologies

2.1. Fingerprint recognition.
Fingerprint identification technology is to use image acquisition device to obtain fingerprint image [3], and then analyze the global and local characteristic points of fingerprint such as valley, kurtosis, bifurcation point, bifurcation point and so on by computer program software [4]. Fingerprint identification is a kind of long history research and mature identification technology [5], which can be
used to identify individuals reliably by fingerprint identification.[6].

With the development of pattern recognition and computer technology, automatic fingerprint recognition has been developing more and more[7]. The first to invest in automatic fingerprint recognition technology is the United States[8], and other developed countries are also engaged in research. Because in recent years the fingerprint collection device[9], the PC's price performance ratio increased significantly, fingerprint identification as a kind of identity authentication technology already has a more practical software and hardware products, including fingerprint collection device, recognition software and corresponding software development kit, etc[10].

2.2. Iris recognition

Iris recognition technology is based on individual iris diversity and lifetime invariance to authenticate the identity of the individual. The iris, located inside the pupil of the eye, is a ring, and each iris has unique structural features that make it difficult to change its structure through surgery[11]. At present, there is no Iris repetition in the world, even if the iris of the same person's left and right eyes are very different, even though the iris information of all mankind is registered in a database. The occurrence of repetition is minimal. Although the overall shape of the iris is genetically determined, many of its details are influenced by environmental factors (For example: the condition of the embryo). Therefore, it is almost impossible to reproduce the iris through natural means. In addition, the eye is the most sensitive parts of the body, it is very difficult and dangerous to modify the iris structure through surgery, it also became the iris "optical fingerprint" as a person and a favorable factors. Therefore, the iris recognition technology used in individual identification will achieve a very good effect, but the cost of iris acquisition equipment is too high to accept for people[12].

2.3. Retinal recognition

An optical method is used to obtain the vascular images of the retina on the surface of the human eyeball, which can be used as the basis for individual identification. This method is called retinal recognition technology. If the retina on the surface of the eyeball had not been damaged, the blood vessels distributed on it for biometric use would not have changed from the age of three. Similar to iris recognition technology, it is recognized as the most reliable biometric recognition technology at present. Considering that laser irradiation on the back of the eyeball can capture the features used for recognition, it is difficult to recognize the retina in practical application. The retina technology has the advantages that it is basically a life - invariant biological characteristic, meanwhile, it is in a concealed position, is difficult to be forged , and the acquired process belongs to a non - contact type , so that the retina technology is clean and sanitary , The same shortcomings: the high cost of the retinal image collection, the immature technology, may bring health damage to the human body.

2.4. Face recognition

Face recognition is based on the analysis of the features of the face and the relative position of the eyes, nose and mouth. Standard video and thermal Imaging has become two kinds of techniques for obtaining face Images [13]. The standard video is captured by camera to obtain faces images, and the thermal imaging is the formation of facial images through a hot wire generated by blood in the facial capillaries [14].

2.5. Palmprint recognition

Human palmprint is also unique and stable. By studying and analyzing palmprint midline, dot and texture characteristics, we can do individual identification. Palmprint recognition plays an important role in biometrics research. At present, the two methods of obtaining palmprint image are mainly offline palmprint and on-line palmprint. The off-line palmprint method is mainly to press the ink-coated palm on the white paper, leave the figure of the palm on the white paper, and scan it to obtain the digital palm image. The online palmprint method is acquired automatically through a special palmprint acquisition device, and the images collected are more ideal.
2.6. Hand recognition
The technique of hand shape recognition is based on the structure drawing of the human hand, and the individual identification is carried out by analyzing the information contained in the finger structure diagram. The results of scientists’ experiments show that the shape of the hand is stable for a long time, and the hand shapes of any two people are different, and the hand images are easy to obtain. So it has become the research direction of biometric recognition field.

2.7 Finger vein recognition
Finger vein recognition technology was developed by Hitachi in the medical field and gradually applied to personal identification. It is one of the world's cutting-edge of authentication technology with high precision, high speed, because it is the use of the individual's internal biometric identity authentication technology, because of its high security and industry attention. This technology started early in foreign countries, the end of the 20th century, the study of finger vein authentication technology began in the middle of the Hitachi institute, Japan's Hitachi has been using finger vein image recognition technology[15].

The vein recognition technology is a venous image through infrared transmission of the fingers, and the identification and identification of the venous images are performed. Finger vein recognition technology is widely used in Japan, but it also attracts other countries. Southeast Asian countries such as Singapore have also gradually adopted Hitachi's finger vein access system, and the office of the New York branch of the U.S. central Treasury Department has adopted a mobile phleboid device. It is believed that with the continuous improvement of the security level requirements, there will be a large potential demand market for venous identification. The finger vein plays an important role in the biometric identification family, and has been recognized internationally because of its high security features[16].

2.8. DNA recognition
There are differences in the structure of DNA in different human cells, so it is used as a biological feature for individual identification. DNA in human body has unique and eternal characteristics in the whole human being. With high accuracy and authority. DNA mode is the same in every cell and tissue of the human body, which determines that its authentication effect is much better than other biometric identification technology. At present, it is used by public security organs to identify criminals. DNA recognition have the problem of people's acceptance, meanwhile DNA acquisition must be in the related laboratories, Therefore, it is difficult to achieve real-time performance for it takes too long.

3. The Development trend of Biometrics in the Future
Biometrics is the most convenient and safe identification technology. Biometric technology has a very broad development. It can be applied to almost every aspect of People's Daily lives.

It is rated as the top ten new technology that can change the future world. With the increasing of the society's requirement for identification, the importance of biometrics will become more and more important. It is mainly reflected in the following aspects:

3.1 Multi-feature information fusion
At present, the research of biometric recognition technology is still in the process of continuous development, how to further improve the accuracy and robustness of system identification is a technical problem in this research field. The above biometric identification technology has a specific scope in practical application, so it has great limitations[17]. Statistics show that up to now, there is no single biometric recognition technology that can achieve a perfect and error-free state. Therefore, in order to improve the recognition performance of biological systems, a new research direction has emerged in the field of biometric recognition.

The combination of multiple individual authentication information, including a variety of biometric features, has become a feasible solution. for example, The fusion of fingerprint and finger vein. Before
fusion, The matching scores of fingerprint identification system and venous recognition system are normalized. By comparing and analyzing different normalized models, found. the suitable model. By the improved matching fusion algorithm, the optimal or suboptimal allocation weight of different populations is obtained by adaptive algorithm. The fusion of the two biological characteristics of fingerprint and finger vein in the matching layer is realized, and the recognition rate of the system is improved effectively[18].

3.2 Real-time requirements
Biometric recognition system requires a lot of numerical processing, including image preprocessing, feature extraction, recognition and classification, etc. Real-time and fast computing ability is the key to meet the specific performance requirements of the system. There are two main ways to implement the algorithm: one is to improve the algorithm at the software level, to improve the efficiency of the algorithm, and the other is to implement feature recognition on the hardware level.

3.3 Combination of Biometrics and traditional identity Authentication
The intelligent IC card uses its own storage function and computing function to store the personal biometric information in the smart card and realize the function of offline authentication in the inquiry field, which not only improves the efficiency of authentication, but also improves the efficiency of authentication. And it saves the cost of online query. Therefore, the combination of biometric identification technology and IC card for traditional identity authentication has a promising future. The Technical level of Biometrics Research in China at present is still a certain distance compared with the developed countries in Europe. But the pace of research almost keep pace with countries in Europe.

In particular, some achievements have been achieved in the fields of fingerprint, iris, face and palmprint recognition in recent years. At the same time, there are a lot of technical problems in this field. This needs to include China and other countries in the world to continuously explore solutions to promote biometric identification technology to a higher level.

**Fund projects:** Scientific Research Project of Shandong University of political Science and Law (2017Z08B); Sichuan Provincial Center for the study of Medical Health and the Rule of Law (YF17-Q19); Supported by Program for Young Innovative Research Team in Shandong University of Political Science and Law.

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