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Design of Face Recognition System Based on Computer Network

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Abstract: With the changes of society and the progress of the times, computers and network technologies have made great progress. As an important guarantee in the security field, face recognition technology has a wider application range. The combination of computer network and face recognition technology can not only realize multi-node, long-distance security detection, but also effectively improve the reliability and practicability of the entire security system. In this paper, the key technologies in computer network and face recognition technology are briefly described and the design scheme of face recognition system based on computer network technology is given.

1. Introduction

Face recognition technology is one of the biometric technologies. Biometric technology refers to the identification of certain inherent characteristics or specific behaviors of the human body through specific algorithms. These biometric features mainly include fingerprints, irises, retinas, facial features, sounds, and the like. Biometric technology generally consists of three processes, namely feature sampling, feature extraction and data matching. Feature sampling is the process of collecting original feature data by means of sensors, cameras, and the like. Feature extraction is the extraction of information from the collected data that reflects and distinguishes individual characteristics. The data matching process is a process of sorting or consistently detecting the similarity between biometrics by an algorithm. Face recognition, as its name implies, is a recognition technique for detecting and recognizing the facial characteristics of a living being, thereby judging identity. Compared with other recognition technologies such as fingerprint recognition technology, face recognition does not require mutual contact between host and object, and is more popular in applications.

2. The Meaning and Technical Difficulties of Face Recognition

2.1 The Meaning of Face Recognition

Since the development of human society, security issue has become one of the important issues that have plagued many fields. Before, we did daily activities such as home and office, we often relied on traditional symbolic passwords for security management. However, as the number of people's services continues to increase, symbolic passwords are difficult to remember. At the same time, the development of computer technology has greatly improved the efficiency of password cracking, and the security risks caused by symbolic passwords are getting higher and higher. In some places where people are highly mobile, such as airports, stations, etc., traditional identification not only affects work efficiency, but also takes time and effort.

In recent years, feature detection technology based on biometric technology has been widely used. Compared with traditional detection and recognition, biometric technology is not only efficient and convenient, but also better for security control. At present, countries all over the world are vigorously promoting and popularizing bio-identification-based security systems. Face recognition technology has unparalleled advantages over other biometric technologies. First, face recognition technology can achieve long-distance authentication. Secondly, because the processing of ID cards requires face photos, the face database is the most complete database. Finally, compared to other feature database, the face database entry method is more concise and the data characteristics are more stable.

2.2 Technical Difficulties of Face Recognition

There are five technical difficulties in face recognition technology shown as following. First, light changes have a great influence on face recognition. How to preprocess or normalize face images is the key in face recognition. Second, imaging education and distance, that is, the change of face pose will cause the rotation of face image. How to overcome the lack of information caused by this rotation is an important topic in the research field of face recognition technology. Third, the difference in data alignment caused by the same individual due to age change is a more prominent and difficult problem in face recognition. Fourth, the amount of data required for face recognition is large, and a normal face image requires a large amount of data to be stored efficiently. In face recognition, how to design an efficient matching algorithm is an important part of improving face recognition efficiency. Fifth, the design of face recognition system based on computer network is also a technical difficulty.

3. Design of Face Recognition System Based on Computer Network

The application of computer network technology can effectively extend the application distance of the face recognition system, and at the same time realize the comparison and identification of multi-node data. At present, the face recognition system based on computer network technology is a means of identification mainly used by ports, stations and other people with high mobility and high detection performance requirements. The application of computer network technology can also improve the efficiency of data comparison, and the auxiliary means such as multi-machine parallel can compress the operation time on a large scale.

The face recognition system based on computer network is constructed as shown in Figure 1 below.

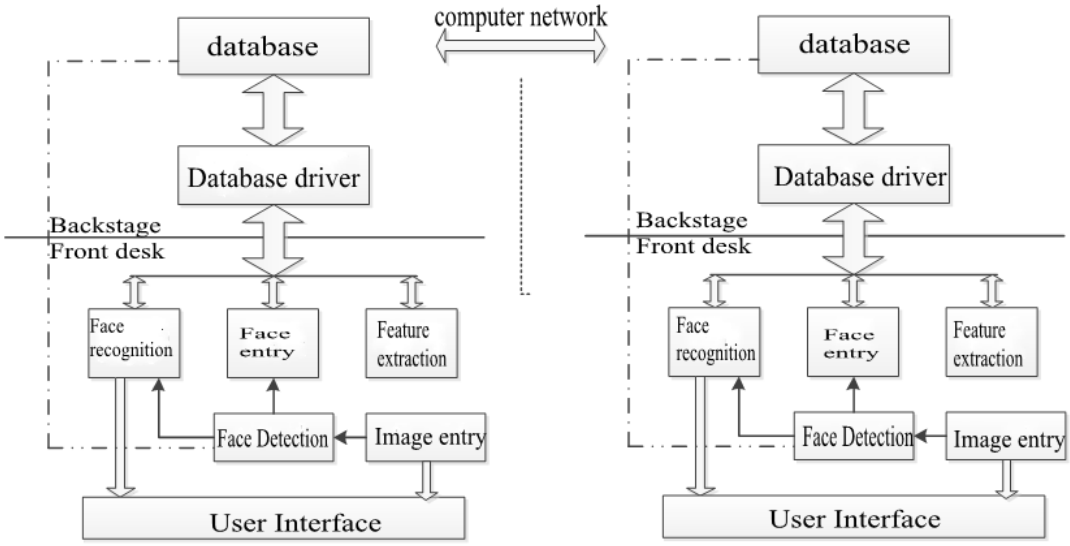

Figure 1 System composition

As can be seen from Figure 1, the system mainly adopts modular design. The whole system can be divided into three parts, namely computer network, face information input and recognition. In the face information input module, the face information is first input through the camera, and the face recognition is to extract and recognize the facial features through a specific algorithm. Feature extraction refers to the extraction of key information of face images using a specific extraction algorithm. Due to the diversity and instability of face images, the extraction of facial features is more complicated. However, the quality of face image feature extraction is directly related to the success or failure of face recognition. How to improve the recognition rate of low-resolution images under the constraints of illumination and attitude with unconstrained conditions is an urgent challenge in this field. In this paper, the face recognition method based on multi-resolution partial

and overall feature extraction and fusion is studied.

The partial features mainly describe the details of the face, and the overall features mainly summarize the outline and general features of the face. Face image information of different resolutions contains different face recognition characteristics. Figure 2 is a flow chart of face recognition and attribute analysis. Figure 3 depicts the main flow of partial and overall multi-resolution feature extraction.

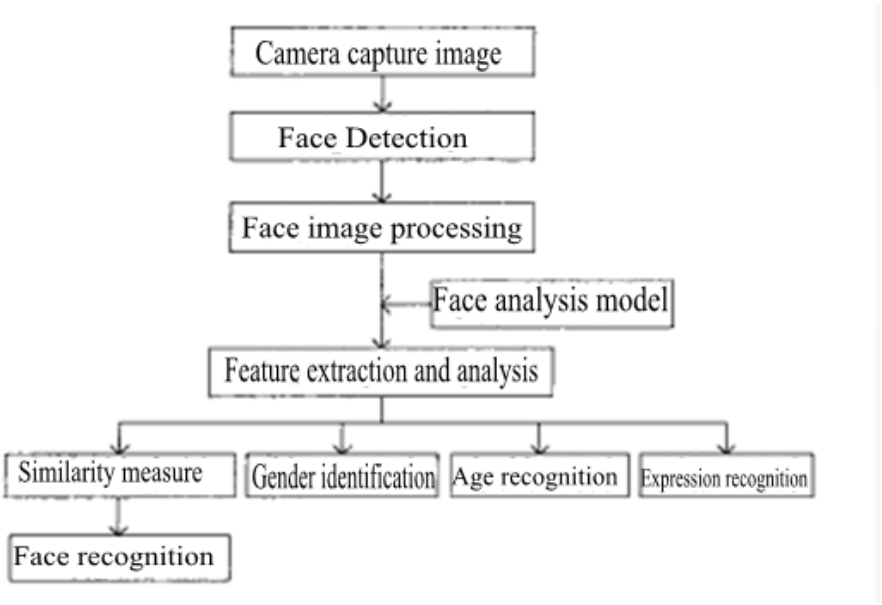

Figure 2 Flow chart of face recognition and attribute analysis

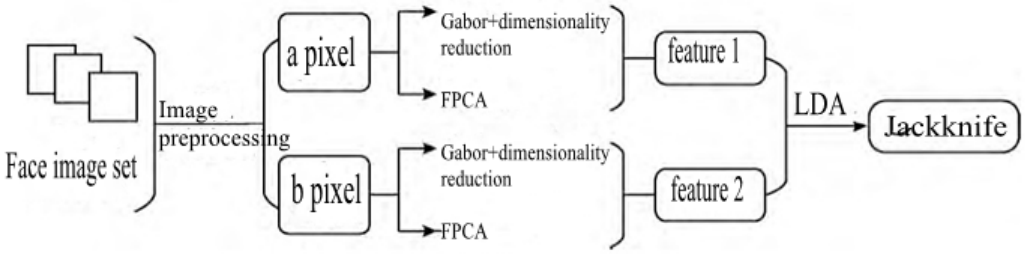

Figure 3 partial and overall multi-resolution feature extraction

In Figure 3, the variables a and b represent the face images of the two pixels, respectively. Gabor wavelet not only has good spatial locality when extracting image texture features, but also has very good robustness to low-resolution images caused by external conditions such as illumination and attitude. The formula for the two-dimensional Gabor wavelet kernel function is described as following.

$$\Psi_{k,v}(x,y)=\frac{k^2}{2\delta^2}\exp(-\frac{k^2(x^2+y^2)}{2\delta^2}).\exp(-\frac{2ikx}{y\delta^2}) \quad (1)$$

In this formula, $k=\begin{pmatrix}k_x\\k_y\end{pmatrix}=2^{\frac{v+2}{2}x}\begin{pmatrix}\cos\theta\\\sin\theta\end{pmatrix}$, x and y respectively represent the coordinate

values of the face image pixels in spatial coordinates, and the value of $\frac{k}{\delta}$ determines the size of the Gaussian window, where $\delta = 2\pi$. In the extraction of facial texture features, the experimental results show that the best results are obtained when 5 different scales and 8 different directions are selected. The figure below is a comparison of the selection of scale 3, direction 4 and scale 5, direction 8.

The recognition rate corresponding to different feature dimensions is shown in Figure 4.

Characteristic dimension	Average recognition rate of different algorithms %					
	M-GFL1	M-GFL2	M-GFL3	M-FGFL1	M-FGFL2	M-FGFL3
4	0.706	0.707	0.666	0.768	0.771	0.724
6	0.711	0.736	0.778	0.806	0.743	0.801
8	0.817	0.843	0.812	0.861	0.905	0.874
10	0.810	0.823	0.799	0.849	0.891	0.848
12	0.849	0.836	0.799	0.861	0.860	0.846
14	0.848	0.852	0.843	0.859	0.928	0.916

Figure 4 Face image recognition rate corresponding to different algorithms and dimensions

When the multi-machine performs face recognition in parallel, the feature data of the face is transmitted between different computers through the network, and each host node processes and checks the feature quantity of the face image in parallel. During this process, once the face images are matched, all calculations and data transfer processes are terminated. In today's rapid development of computer and information technology, the hardware bottleneck of data processing can basically be solved by the configuration of the computer. The overall performance of the system often depends on whether the specific algorithm is accurate.

4. Conclusion

Face recognition technology has penetrated into all activities of our lives, especially in terms of network applications and security detection. On social networks, the development of many social products is based on face recognition technology. With the rapid development of computer and network technology and artificial intelligence, the rapid development of face recognition technology will show more and more broad application prospects.

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