

# Research on Face Recognition Technology Based on Computer Neural Network

Min Tu

Jiangxi Police College, Nanchang, Jiangxi, 330000

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**Abstract:** Face recognition undergoes three stages of full reliance on artificial, human-computer interaction, and machine automatic recognition, free from the initial recognition of a single frontal grayscale image to the development of three-dimensional face recognition on the basis of research on multi-pose face recognition with the realization of dynamic face recognition as a carrier, and achieves certain results. In China, although face recognition technology started late, it has developed rapidly and received strong support from the country. At present, many universities and research institutes in China have very good research foundations in the field of image processing and pattern recognition, and have actively carried out basic research on human biometric recognition technology including face recognition, and have achieved good results. Research results show that in the near future, China's research in this field will enter the world's advanced ranks. Face recognition is one of the most classical problems in the field of identification. At present, there are many solutions and good experimental results obtained. However, a general-purpose face recognition system that can be practically applied and used for arbitrary backgrounds and arbitrary gestures has not yet appeared. Therefore, face recognition goes into the application field to improve the effectiveness of the extracted facial features and classifier optimization, and etc.

## 1. Introduction

With the development of informatization, digitization, and networking, the security of the country and society is facing new challenges. Under this environment, traditional security technologies present many drawbacks and deficiencies. Due to the rapid development of artificial intelligence and e-commerce in recent years, face recognition technology as a kind of biometric authentication is regarded as one of the most promising biometrics and biometric authentication methods. A typical function in human vision is the face recognition technology. This recognition technology mainly involves digital image processing, computer graphics, pattern recognition, physiology, and cognitive science, and it is related to identification based on its biological characteristics. Methods and human-computer interaction are closely linked. Relative to fingerprints, retinas, irises, genes, and other biometric recognition systems, face recognition is more easily accepted by users because of its high reliability, difficulty in counterfeiting, relative stability, and being more friendly and direct. The face recognition technology is free from the initial recognition of background single grayscale images. Based on the research of multifaceted (face, side) face recognition, the realization of dynamic face recognition as a carrier to 3D face recognition. Development has achieved certain results, but it must be clearly understood that there are still some issues such as the complexity of the image background leading to many faces that are similar to human faces: 1 The human face is not immutable and will change with the environment and time. Difficult to describe; 2 faces will be covered by beards, eyes, hats and other objects; 3 in the environment and observe the face of the face is changing; 4 face expression and so on, this is the face of the problem of face recognition technology to be solved At the same time, it is also the general direction of development. Face recognition technology is a multidisciplinary subject composed of digital image processing, pattern recognition, computer vision, artificial neural networks and biological characteristics. It requires researchers to have a solid theoretical foundation and rich experience. In addition, the robustness of the face recognition method is more affected by its own and the complexity of the environment, such as the change of the expression, posture, environment of the image and the light intensity, as well as the influence of eyes, beards and other

obstructions. Face recognition technology is becoming a challenging topic in the 21st century.

## 2. Face Recognition System Overview

Face Detection Positioning [1] is to detect whether there is a face in the image. If it is detected, it will be separated from the background and determine its position and size. In the detection system, the input is an image containing a face, and the output is a parameterized description of whether the number, scale, position, pose, and facial features of the face and face are included in the image. Extraction of facial image features to be identified, namely feature extraction and selection, matching and recognition of face images in existing databases, first preprocessing before feature extraction, and human faces based on face location results Transform to the same location and size, and if necessary, illuminate the image to overcome the effects of lighting changes. After the facial features to be identified are extracted, feature matching can be performed.

There are many methods for face recognition research. As far as I've been concerned, the research on face recognition has two main directions: one is a holistic approach. This kind of method considers the overall attributes, including methods with feature faces, template matching methods, algebraic feature methods, hidden Markov model methods, and neural network methods. The other method is based on feature analysis. The relative ratios of face reference points and other shape parameters that describe facial features of the face constitute the feature vectors for face recognition, and then the distance between the vectors is extracted by extracting the local contours and grayscales. Information to design specific identification algorithms for comparison. Overall, the analysis based on the whole is better than the analysis based on components, but it can not be ignored that there are many influencing factors based on the overall analysis, such as the influence of lighting, viewing angle and the size of the face, so the standardization of the image has become crucial One step.

## 3. Feature Extraction

Currently, face image feature extraction methods mainly include methods based on algebraic features and methods based on geometric features [6]. Among them, principal component analysis (PCA) is a commonly used feature extraction method. It is based on second-order statistics and can extract major components that are not related. Fisher linear discriminant analysis (FDA) is from the high-dimensional feature space. Take out the most discriminative low-dimensional features, these features can gather all samples of the same category together; Kernel Principal Component Analysis (KPCA) is the use of non-linear mapping, mapping the inseparable samples in the input space to a high-dimensional hidden space, Make the sample linearly separable. According to literature research [2], we can know that PCA can meet real-time performance to a certain extent, but its efficiency is not very high. In contrast, Fisher linear analysis has an improved recognition rate than PCA, but it does not increase much, and its real-time performance is inferior to PCA. Similarly, KPCA has a higher recognition rate than PCA, but it takes longer. Therefore, generally speaking, in this paper, we choose PCA for face feature extraction to meet the requirements of real-time and short time-consuming requirements [3].

Principal component analysis (PCA) is a commonly used classification method for extracting information [4]. Its basic working principle is: Finding the main features and extracting them from the sample space of the research object. This is a method of comparing the original indicators that have multiple correlations to their features and then converting them into smaller quantities. Several new comprehensive indicators of multivariate statistical methods. PCA can retain most of the information of the original sample to a great extent, and reduce the number of original variables and the data dimensions and data redundancy. It is easy to obtain an easily-trained result set, which greatly improves the efficiency of feature extraction.

#### 4. Face Recognition Classifier Design Based on BP Neural Network

The BP algorithm is a supervised learning algorithm [5]. Its main idea is: for the given  $q$  learning samples  $P_1, P_2, \dots, P_q$ , and the known output samples are  $T_1, T_2, \dots, T_q$ . The purpose of BP network learning is to use the error between the actual output of the network  $A_1, A_2, \dots, A_q$ , and the corresponding output vectors  $T_1, T_2, \dots, T_q$  to modify its weight so that  $A_k$  ( $k = 1, 2, \dots, q$ ) are close to the expected maximum  $T_k$ , which minimizes the squared error sum of the BP network output layer. Throughout the entire period, the system continuously calculates the changes in network weights and deviations relative to the direction of the slope of the error function, which in turn causes the output to gradually approach the target value. The BP algorithm consists of two parts: forward transmission and back propagation. As shown in Figure 2, in the forward propagation process, the input information is transmitted to the output layer after the layer-by-layer calculation of the hidden layer. During the transmission process, the state of each layer of neurons only affects the state of the next layer of neurons. If the value of the output layer does not reach the expected output target, the system calculates the error change value of the output layer and then reverses the propagation. In the back-propagation process, the network propagates the error information back along the original connecting path and then modifies the weight of each layer of neurons until the output of the output layer reaches the desired target. Let BP neural network have  $P$  inputs,  $r$  input neurons, and  $s_1$  neurons in the hidden layer. The activation function is  $F_1$ . There are  $s_2$  neurons in the output layer. The corresponding activation function is  $F_2$ . The output is  $A$  and the target vector is  $T$ .

In order to train a BP network, it is necessary to calculate the network weighted input vector, network output, and error vector, and then calculate the sum of squared errors. When the sum of squared errors of the trained vectors is smaller than the target error, the training is stopped. Otherwise, you need to calculate the error change at the input layer, and then use the back-propagation learning rules to adjust the weights, and repeat the above process. After completing the training of the network, enter a vector that is not in the training set for the network. At this time, the network will output the result in a chemical way. Before writing the network program, we must first determine the input vector  $P$  and the target vector  $T$  according to the specific problem, and determine the structure of the neural network that needs to be designed, including the number of layers of the network, the number of neurons in each layer of the network, and the initial value. The choice of weights. In this article, after reference analysis and experimental analysis, we chose to use a three-layer neural network and increase the number of neurons in the hidden layer. In addition, because many systems are non-linear, the choice of initial weights plays a decisive role in network learning and training, and this paper determines the size of the initial weights according to the expected output value. In the actual design process, the initial weight should not be too large, otherwise it will saturate the  $S$  function. The output of this study is 0 or 1, and this design chooses the random number in the  $(-1, 1)$  interval as the initial weight.

The concrete flow of PCA-based face feature extraction and BP neural network matching is as follows: (1) Each image in the original face image set is normalized by size to obtain a normalized face image. Set; (2) Calculate the characteristic subspace and the projection coefficient of each face in the feature subspace using the classical PCA method. Among them, the feature subspace is composed of eigenvectors arranged in descending order of eigenvalues; (3) the major components of feature importance in the feature subspace are selected according to the degree of importance; (4) the features with large importance will be selected. The vector is input into the BP neural network for training until the neural network converges or satisfies the conditions for stopping the training; (5) Face recognition process.

#### 5. Conclusion

This paper only does basic research and experiments on feature extraction and recognition of human face. To achieve a more perfect face recognition system, there are still many other

algorithms that need to be considered. How to make the algorithm more widely used, there is still a lot of work to be done, such as face location in multi-face images, extraction of face features, and normalization of face images to suit the characteristics of the next step Face recognition methods; for example, the identification of specific characteristics of special groups of people, the elderly, children, men and women. Because the eigenface method is very sensitive to any changes in the face, even if only the change of position will cause a large distance between faces, you can consider a part of a face, such as the positioning of the eyes, and then perform the centering Face orientation and normalization may be used to obtain images that are more suitable for subsequent recognition.

## References

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