Based on Figure Segment and BP Neural Network Met Face Recognition Method

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Abstract: Face recognition technology today has become one of hotspots and difficulty in research of pattern recognition. After numerous scientific research personnel after years of efforts, it has made many achievements in this field. But because of the complexity of the face recognition problem itself, there are many critical problems need to solve and achieve common application. This paper first introduces the background of face recognition. Development situation and the main method of face recognition uses feature extraction based on wavelet transform and KL transform and uses the BP neural network as the classifier of face recognition methods. It simulates results to have a certain effect. It shows that this method is a feasible method for face recognition.

Keywords: BP neural network, face recognition, Kl transform, pattern recognition, wavelet transform.

1. INTRODUCTION

Face is different from person to person. Even if a pair of twins, the face also there must be some differences. Humans in judging a person's identity are generally judged by face from the face the judgment of the information to more than 90%. These proposed for face recognition provides the theoretical basis and practice basis [1]. While humans in expression, age, hair and the light of the great changes, such as cases, it can according to the face recognition without difficulties out of a person. But it is very difficult to create a fully automatic face recognition system. It involves pattern recognition, image processing, computer vision, physiology, psychology, knowledge of database and cognitive science, etc. With creatures, such as fingerprints, genetic and palmprint identification system, compared to face recognition system is more direct and friendly. The user does not have any psychological barriers [2]. Through the analysis of facial expression and posture it can obtain other recognition system hard to get some information. Face recognition technology application background and can be used for the public security criminal identification system, driver's license and passport with actual holder of check, such as Banks and monitoring system of the customs and the automatic entrance guard system, video conference, the intelligent robot research and medicine and so on.

Entrance control range is very wide. It can be a security check at the entrance of buildings, units or private house. It can also be the entrance to a computer system or information system control [3].

Now more commonly are used means of inspection. Researchers frequently goes with security guards repeatedly inspection certificate more troublesome. And safety factor is not high also. In very strict secrecy departments in addition to the documents, you can also add other biometric methods, such as fingerprint recognition, palm recognition, speech recognition, etc. [4]. Face recognition, by contrast, has the characteristics of direct, convenient and friendly interface. Overall procedure of the proposed framework for annotating faces on personal photos is seen from Fig. (**1**). The current safety management of computer system usually uses a password password management of characters and Numbers. The password is easily forgotten or cracks if it uses face as the password convenient and safe.

Generally it needs to be done before feature extraction geometry normalization and gray scale normalization. Refers to the former according to the result of face positioning face change to the same location and size of the image it refers to image processing, such as illumination compensation in order to overcome the influence of illumination change. The characteristics of the specific form are along with the different recognition methods. Such as in the recognition method based on geometric features, this step is to extract the feature points and then construct feature vectors. In statistical recognition, face method is to use the structure characteristics of the feature vector of face image correlation matrix. The hidden markov method is trained on the multiple sample image space sequence a hidden markov model, its parameters is the characteristic value. The template matching method is with correlation coefficient characteristics. Most of the neural network method is directly after using normalized gray image as input. The output of the network is identified as a result. There is no specific feature extraction process.

2. FACE IMAGE PREPROCESSING

The pretreatment of the input image is a very important step in image recognition system. The purpose of the pretreatment is to remove noise and strengthen the useful information. the main idea of MD2DPCA is seen from Fig. (**2**). The input measurement instruments or other factors are caused by the degradation phenomenon to compensate and
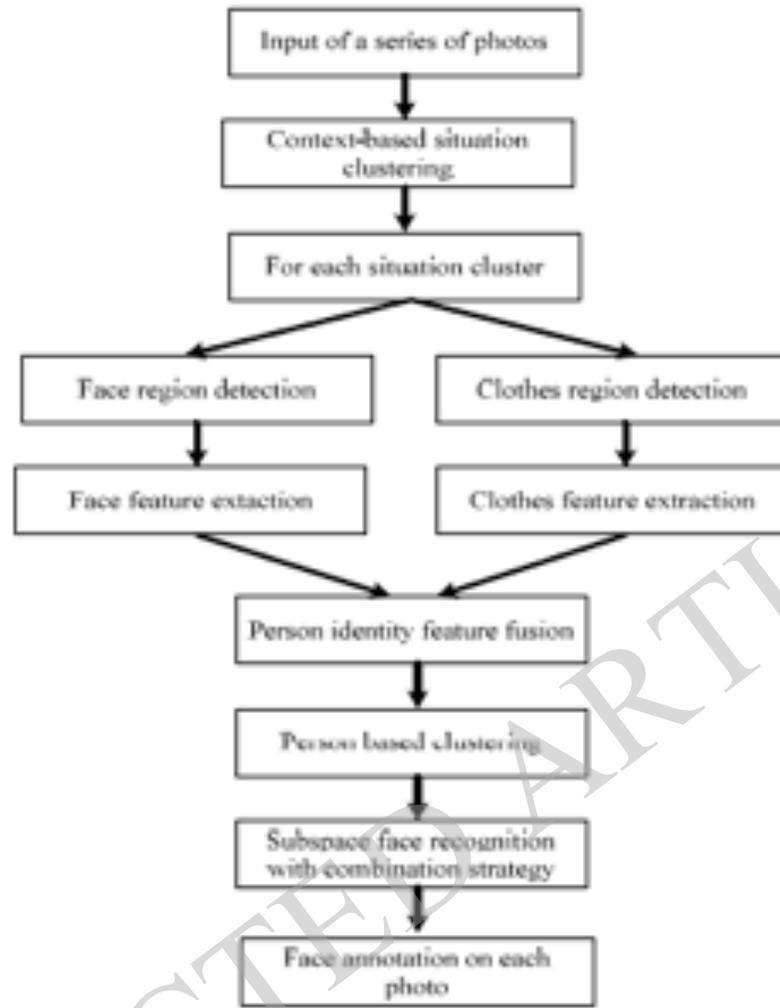
Fig. (1). Overall procedure of the proposed framework for annotating faces on personal photos.

recovery. Pretreatment to perform or not completely depends on the quality of the image and the research questions.

If the image is not clear, the general improvement of methods such as histogram equalization and image sharpening is removal of some background also belongs to the preprocessing operations. Background removal is necessary. Facial recognition will not pure face to face recognition. Literature points out at the same time. Face recognition objects should be pure face [5]. It should not include the hair, shoulders and background data. These irrelevant data can lead to incorrect decision boundary. If unknown face image containing information other than pure face, good chance is facial information played a key role in decision-making. It is no longer in the true sense of face recognition. This article uses the pure face segmentation method based on eye position estimation. From the extracted from the original face is crucial to identify pure face.

$$F_\theta(\mathrm{x,y}) = \begin{cases} 0, & I(\mathrm{x,y}) < \theta \\ 255, & I(\mathrm{x,y}) > \theta \end{cases} \qquad (1)$$

In order to make the different imaging conditions, such as light intensity, direction, distance and the photograph of a

face image consistent is as far as possible to reduce the influence of environmental factors. Guarantee has good recognition effect and carry on the pretreatment of face images.

Good normalization can effectively enhance the system's resistance of imaging process uncertainty. Normalized content mainly includes two aspects: one is scale normalization, also known as the position calibration.

$$P = \bigcup_{t=1}^{q} P_{\theta_1} = \{\langle P_i, P_j \rangle | \exists \theta\} \qquad (2)$$

It helps to solve by imaging distance and attitude cause differences in size and angle of a face. It is gray to a paraphrase under different light intensity and light source direction for the compensation for the image of the to abate simply caused by light transform image signal transformation. Some samples in ORL face database are seen from Fig. (**3**). This article uses wavelet transform combining with KL transform methods for feature extraction, while the same face is in different illumination angle. Light intensity under the difference in feature space have bigger difference, but the adoption of wavelet transform extracts the low-frequency image part of angle, light, size and facial

Fig. (2). The main idea of MD2DPCA.

expression insensitivity of interference information, so this article for gray scale normalization is omitted.

In the vast majority of human face recognition technology, the location, especially the accurate positioning of the eyes, is because the eyes spacing is affected by light or expression change minimum. It is often used as a normalized standard geometric characteristics or the size of the image. Eye location method are many, there are regional segmentation, edge extraction and gray projection methods such as template matching norm of flavour mouth. Region segmentation method of binary image of the human eye first region segmentation, and then set a series of experience value and support functions of coarse positioning eyes. The method for the human eye is closed and with glasses. Edge extraction is the first to carry on the edge of face image are extracted. It uses the hough transform to detect the eye to construct a include eyes and eyelids eye template, with a series of functions from the perspective of energy to find eyelids. This method need to do a lot of pretreatment.

$$new\_p = (new\_p' - mean\_p)/std\_p \qquad (3)$$

Too much eye template parameters should not be used for the individual differences too big face. Gray projection method of face image for the projection of the horizontal and vertical direction, according to the distribution of peaks and troughs information to locate the eyes. This kind of method locates speed faster, but the distribution of peaks and troughs are very sensitive to the change of different faces and gestures. Positioning accuracy is poorer and trapped in local minimum easily and cause the failure of positioning. Template matching is an effective pattern recognition, but the size and direction of the face image is normalized. In this paper, according to the geometrical characteristics of the human eye position it makes decision rules, according to the rules to find possible human eye center in binary image. Through template matching, it is to find the optimal center position of pure face segmentation.
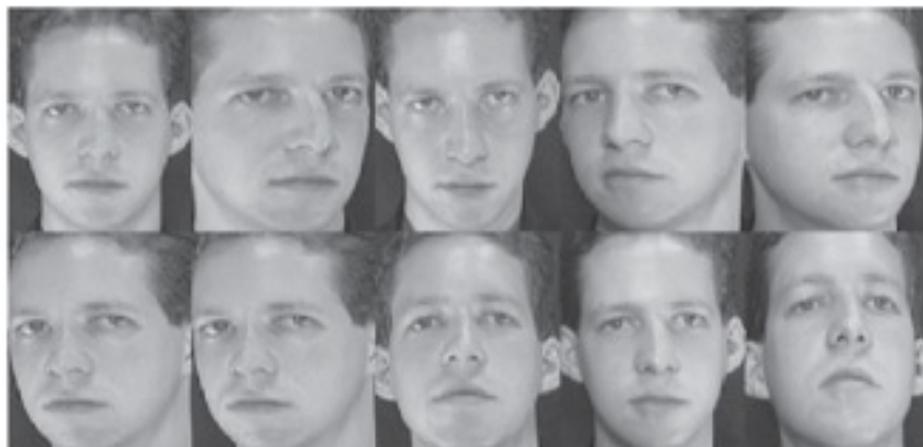

Fig. (3). Some samples in ORL face database.

3. FEATURE EXTRACTION

Feature extraction is one of the basic problems of pattern recognition research. For image recognition, the effective image feature extracting is complete. The primary task is of image recognition. The characteristics of the currently used for image recognition can be divided into the following several kinds. Visual characteristics, such as the edge of the image, outline, texture or area, etc. In face recognition with the most intuitive is characterized by geometric features, namely facial features to the size and position. Although such characteristics has advantages of low dimension, due to the same person for expression and light conditions often lead to changes in their larger changes in the size and relative position. The recognition effect is not satisfactory . Gray statistical characteristic is such as histogram features and principal component. The image as a two-dimensional random process can introduce moments of the statistical as image features to describe and analysis.

$$\varphi(\mathrm{x}) = \sqrt{2} \sum_{n \in z} h(\mathrm{n}) \varphi(2\,\mathrm{x} - \mathrm{n}) \qquad (4)$$

They can on the basis of retain the main classification information significantly reduce the dimensions of the feature. Transform coefficient characteristics to make various mathematical transform. The image can be transform coefficient as a characteristic of the image, such as Fourier transform, Hough transform and Hadamard transform are widely used in image feature extraction. This kind of method has the advantage of calculation is more convenient, but its related to ability is not strong. The recognition rate of several algorithms on ORL face database is seen from Fig. (**4**). The coefficient of feature dimension is still larger. It reflects the image of an inner attribute, the image as a matrix can be on the various algebraic transformation or various kinds of matrix decomposition. Due to the eigenvector matrix reflects a kind of algebraic properties of the matrix, the invariance thus can be used to as image characteristics. In face recognition, the typical method is used to extract the image algebra feature matrix singular value decomposition.
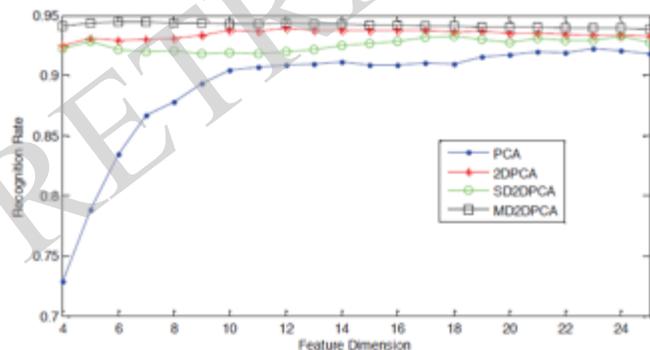

Fig. (4). The recognition rate of several algorithms on ORL face database.

Feature extraction is another a way to reduce the number of features. The analysis of high-dimensional data set often is a very complicated work. Pattern recognition system often suffer high dimensional problem. Feature extraction process is to data space transform into feature space, before the object classification process which uses variable transformation makes some variables more important than the other variables. It can be seen as a dimension reduction. We call those more important variable characteristics. If the secondary variables can be ignored, then it is to reach the purpose of the required dimension reduction. Although compared with the original data space, feature space dimension reduced a lot, but it remains the most essential information data content. In addition, in statistical sense, a secondary component may come from the mode or noise comes from the inherent characteristics of irrelevant interference. As a result, there may be benefits to remove these components field.

The application of wavelet analysis in mathematics, a new field and a rapid development is after more than ten years of exploration research. Important mathematical formalization system has been established more solid theoretical basis. Compared with the Fourier transform and the window Fourier transform, wavelet transform is the local transformation of time domain and frequency domain, which can effectively extract information from signal, through scaling and translation operation functions such as the function or signal multi-scale refinement analysis. It solves the Fourier transform and solve many difficult problems, which is known as the mathematical microscope. Wavelet transform is essentially the signal with a set of different scales of high-pass filtering and low pass filter. The signal of high frequency and low frequency component processing and analyze decomposed into different frequency bands. It repeats the filtering process, until it reaches preset worshiping. Wavelet transform is a milestone in the history of the development of signal analysis progress. It becomes an international academic groups and disciplines. The hot spot in the common in signal analysis, speech synthesis, image recognition, computer vision, data compression and CT imaging. The analysis of the seismic exploration, the atmosphere and ocean wave, fractal neo-confucianism, fluid jet and celestial mechanics have been an important scientific significance and application value. In addition to the distortion of the differential equation problem, the principle can use Fourier analysis and use the wavelet analysis and obtain a better result. In order to overcome no time domain Fourier transform localization, as well as the defects of fixed resolution, short time Fourier transform hope basis function is used to decompose the signal short duration of the high frequency function and duration longer low frequency function. Strictly speaking is enough smoothness asked the basis function, the function itself and its derivatives at infinity downhill with compactly supported set and the disappearance of the higher order moment. Its Fourier function is concentrated near the origin.

4. THE STRUCTURE OF THE BP NEURAL NETWORK

Face recognition problem belongs to the difficult problems in pattern recognition. In theory, the traditional pattern recognition methods can be used for face recognition. But owing to face the although have no fixed pattern in the shape of a fixed structure particularity. It makes its recognition method also very special. Neural network is used in face recognition. It can obtain satisfactory results. Neural network has the self organization and self learning ability. It

can directly input data and to learn. In the process of learning, it can adaptively found hidden in the sample data and the inherent characteristics of regularity.

$$C_{j,m,n} = (H \otimes H)C_{j+1} \tag{5}$$

The self-learning ability and the traditional pattern recognition technology, the latter often rely on programmers to identify a priori knowledge of the rules of the of the neural network to objects in the sample space distribution state need not make any assumptions, but the relationship between the learning samples from the data directly, so they can also solve those because don't know the sample distribution to solve the problem of identification. Through the different categories of face samples input network was trained, it can form accurate classifier.

Neural network has generalization ability. It can be according to the similarity between samples, who are similar to those of the training sample used to identify the right of the face. In face recognition, given to identify the image faces is tend to be part of or constitute some of the characteristics of human face patterns such as fuzzy. Neural network generalization ability can the sample to recover from this situation, so as to realize the right of human face recognition. This processing power of facial features, it is very important aspect of neural network used for face recognition.

Network is nonlinear, it can find the system the complex interaction between the input variables. In a linear system. A change of input to produce is proportional to the output. The influence of the input is limited to the input value in itself. In nonlinear systems, the influence of input determines the other input values, this influence relations is a higher-order functions. This characteristic is very suitable for face the very complex patterns. The running time of several algorithms on Yale face database is seen from Fig. (**5**). Face of the relationship between the various features they are usually nonlinear, neural network to the complex mode system provides a good solution.

BP algorithm is the error of the output layer used to estimate the error of the output layer of leading directly. Then use the error estimation more before a layer of error. It has achieved the error of all the other layers. Thus formed will be output to show the error along with the input signals in the opposite direction to the network through the input transfer process. As a result, people and the algorithm is called back propagation algorithm. BP algorithm for short uses BP algorithm for the multistage acyclic network known as the BP network learning. Although the precision of this kind of error estimate itself will continue to fall with the backward propagation of error in itself, but it is also for multilayer network training provides a very efficient way. This algorithm has received the widespread attention for many years.

CONCLUSION

Face recognition system is a kind of pattern recognition system based on image information processing. It mainly includes the face image feature extraction and pattern recognition of two parts. Feature extraction part is extracted

from face image to reflect different people face the difference of effective information. Pattern recognition is to extract information from the pattern classification. The relationship is between the two parts in the form of cascade. The final classification result is decided by the two parts together.
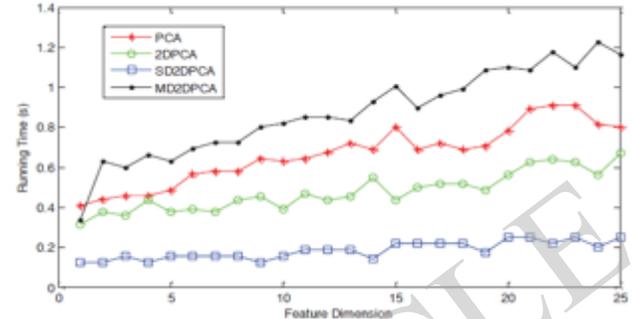

Fig. (5). The running time of several algorithms on Yale face database.

Phase of feature extraction in the feature extraction method of face recognition, on the basis of comparative study, is proposed based on wavelet transform and KL transform combining feature extraction method. First, after the pretreatment of image wavelet transform, extracting the low frequency coefficient is of image contains a human face image. The vast majority of information and energy in achieves a certain level to reduce the data dimension. Then, the wavelet transform is to the low frequency vector to KL transform. KL transform based on minimum mean square error criterion for dimension compression is a widely used method of feature extraction in low frequency coefficient after wavelet transform image KL transform. It is made for general scattering matrix as the initial matrix, get the face recognition feature vector. Through the experiment, it proved the validity of this method.

CONFLICT OF INTEREST

The authors confirm that this article content has no conflict of interest.

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