

Review And Comparative Study of Face Recognition Using Different Neural Networking algorithm

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ABSTRACT- Face recognition systems have gained a great deal of popularity due to the wide range of applications that they have proved to be useful. From a commercial standpoint, face recognition is practical in security systems for law enforcement situations at places like airports and international borders where the need arises for identification of individuals [1]. In this paper we have discussed about the three different techniques of face recognition such as Face Recognition Using Principal Component Analysis With Back Propagation Neural Network, face recognition using gabot filter, Face Recognition Using Wavelet Transform And Artificial Neural Network. The Merits and drawbacks of each technique and their comparative study and decide whether which technique is more useful in future.

Keywords: Principal Component Analysis, Back Propagation Neural Network, Wavelet Transform, Artificial Neural Network, Face Recognition, Gabor Filter, Extraction etc.

I. INTRODUCTION

Human beings can distinguish a particular face from many depending on a number of factors. One of the main objective of computer vision is to create such a face recognition system that can emulate and eventually surpass this capability of humans. In recent years we can see that researches in face recognition techniques have gained significant momentum [2]. Due to reasons of security issue since the 9/11 terrorist attacks, a sophisticated security system become more important in our daily life, especially for person identification. Nowadays, there are various ways to identify a person, which could be classified into two categories, such as biometric and non-biometric methods[1].

Biometric-based techniques have emerged as the most promising option for recognizing individuals in recent years since ,instead of authenticating people and granting them access to physical and virtual domains based on passwords, PINs, smart cards, plastic cards, tokens, keys and so forth, these methods examine an individual's physiological and/or behavioral characteristics in order to determine and/or ascertain his identity. Passwords and PINs are hard to remember and can be stolen or guessed; cards, tokens, keys and the like can be misplaced, forgotten or duplicated; magnetic cards can become corrupted and unreadable. However, an individual's biological traits cannot be misplaced, forgotten, stolen or forged[1].

II. FACE RECOGNITION TECHNIQUES

In this paper we have discussed about the three different techniques of face recognition

1. Face Recognition Using Principal Component Analysis With Back Propagation Neural Network.
2. Face recognition using gabor filter.
3. Face Recognition Using Wavelet Transform And Artificial Neural Network.

A. Face Recognition Using Principal Component Analysis with Back Propagation Neural Network.

PCA is a common statistical technique for finding the patterns in high dimensional data's Feature extraction, also called Dimensionality Reduction, is done by PCA for a three main purposes like

- i) To reduce dimension of the data to more tractable limits
- ii) To capture salient class-specific features of the data,
- iii) To eliminate redundancy[3].

The (BPNN) Back-Propagation is the best known and widely used learning algorithm in training multilayer perceptrons (MLP). The MLP refer to the network consisting of a set of sensory units (source nodes) that constitute the input layer, one or more hidden layers of computation nodes, and an output layer of computation nodes.

The input signal propagates through the network in a forward direction, from left to right and on a layer-by-layer basis. Back propagation is a multi-layer feed forward, supervised learning network based on gradient descent learning rule. Here recognition is performed by both PCA and Back propagation Neural Networks .BPNN mathematically models the behavior of the feature vectors by appropriate descriptions and then exploits the statistical behavior of the feature vectors to define decision regions corresponding to different classes. Any new pattern can be classified depending on which decision region it would be falling in. All these processes are implemented for Face Recognition, based on the basic block diagram as shown in fig 1 [3].

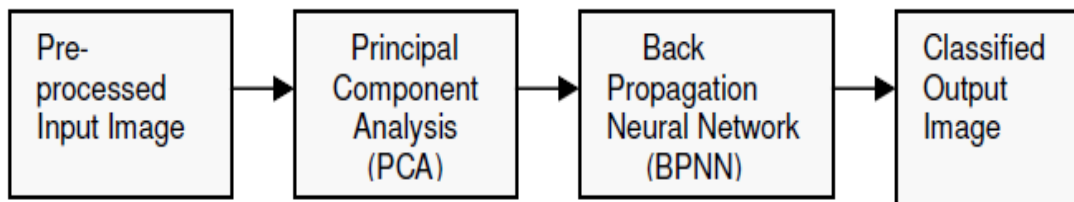


Fig. 1 Basic Block Diagram

B. Face recognition using gabor filter

Face recognition using Gabor filter are more preferred and largely studied because this method uses Gabor wavelet transform for both finding feature points and extracting feature vectors. Such as Lin-Lin proposes a classification based face detection method using Gabor filter features. Considering the desirable characteristics of spatial locality and orientation relativities of the Gabor filter using four Gabor filter for extracting facial features from local image[4].

➤ GABOR TRANSFORM

If Gaussian window is used in STFT, it is also named Gabor Transform, which is widely used due to its less leakage in time-frequency domain The major advantage of SHFT is that it could provide us the time-frequency location of the signal, which we are interested in, and some of their applications in Pattern recognition. Gabor filters are examples of Wavelets having two bases for

images, Pixels are localized in space & Fourier are localized in frequency, so such filters can be used for measuring frequency locally. The Gabor transform can be explained as

$$G(t, \omega) = \int_{-\infty}^{\infty} e^{-\frac{(t-\tau)^2}{2}} e^{-j\omega\tau} x(\tau) d\tau$$

The Gabor transform is like the short time Fourier transforms. We can see that the Gabor transform kernel is the Fourier transform kernel plus a Gaussian function. Therefore we can make a lot of transforms like the Gabor transform. Since the Gaussian signal is more concentrated than the rectangular function in the frequency domain, the frequency resolution of the Gabor transform is much better than short time Fourier transform, Gabor transform, or name.

➤ PRINCIPAL GABOR FILTER

In this work we propose novel orthogonal filters constructed as a linear combination of the original Gabor filters. These filters are capable of achieving similar recognition rates than the original ones, but using a far more compact face representation. Since the novel filters are derived from correlation matrices of the original filters by means of principal component analysis, we call them principal Gabor filters. Since exhibiting desirable properties through Traditional Gabor Filter, such as orientation selectivity or spatial locality, Gabor filters have also some shortcomings which crucially affect the characteristics and size of the Gabor representation of a given face pattern. To overcome this problem we are employing orthonormal linear combinations of the original Gabor filters rather than the filters themselves for deriving the Gabor face representation. The filters, named principal Gabor filters for the fact that they are computed by means of principal component analysis by short time Fourier transform (STFT)[4].

C. Face Recognition Using Wavelet Transform And Artificial Neural Network

The face recognition system is structured into three sections namely

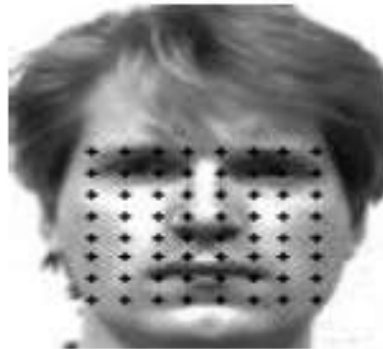
- The Image Acquisition and Analysis Section
- The Feature Extraction Section
- The Neural Network Classifier [5]

➤ ACQUISITION AND FEATURE EXTRACTION USING WAVELET TRANSFORM

The facial photograph of the subject is captured. The image is converted into the PGM format. The image is enhanced if required. This constitutes the reprocessing step. The image enhancement is carried out using Digital Image Enhancement techniques. The image is fed to the program by specifying the image filename at the command line. In order to create the wavelet, we identify feature points on the face. We choose the corners of the eyes and corner of the lips as shown below. These points are selected by mouse clicks.



Once these four points have been identified the program execution is resumed by right-clicking on the image. The program calculates the dimensions of the inner region of the face depending upon the ratios of the distances between the above placed points. The wavelet is then placed on the inner region of the face. A selection of 8 X 8 points gives the ideal trade off between image representation and computational speed. The wavelet points are as shown below[5].



➤ THE NEURAL NETWORK CLASSIFIER

1) Training of Neural Networks

Neural networks have been trained to perform complex functions in various fields of application including pattern recognition, identification, classification, speech, vision and control systems. One ANN is used for each person in the database in which face descriptors are used as inputs to train the networks. During training of the ANN's, the faces descriptors that belong to same person are used as positive examples for the person's network (such that network gives 1 as output), and negative examples for the others network. (such that network gives 0 as output). Following figure shows schematic diagram for the networks training.

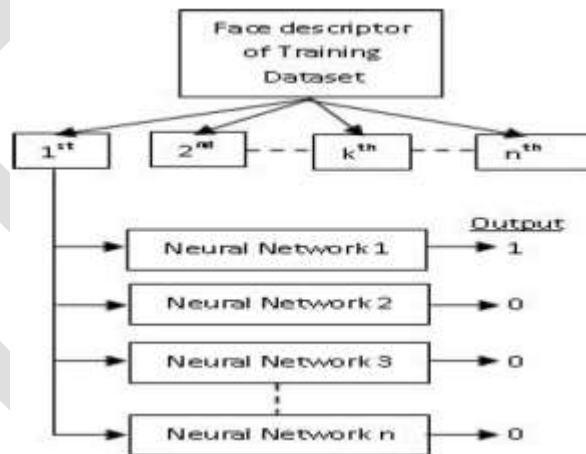


Figure 1: Training of neural

2) Simulation of ANN for Recognition

New test image is taken for recognition. These new descriptors are given as an input to every network; further these networks are simulated. Compare the simulated results and if the maximum output exceeds the predefined threshold level, then it is confirmed that this new face belongs to the recognized person with the maximum output[5].

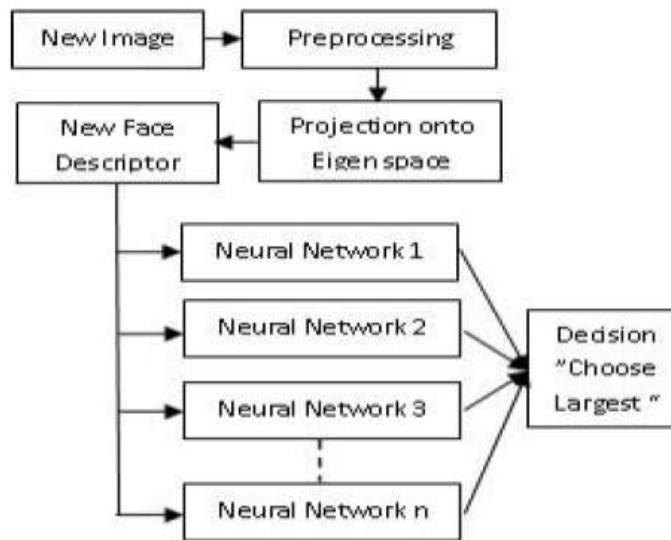


Figure 2 : Testing of neural network

III. SUBJECTS AND METHODS

- Different face recognition techniques and their advantages paired with weaknesses are given below in tabular form

Name Of Techniques	Strengths	Weaknesses
1. Face Recognition Using Principal Component Analysis With Back Propagation Neural Network.	1. Recognition is simple and efficient compared to other matching approaches. 2. Data compression is achieved by the low dimensional subspace representation. 3. Raw intensity data are used directly for learning and recognition without any significant low-level or mid-level processing. 4. No knowledge of geometry and reflectance of faces is required[1].	1. The method is very sensitive to scale, therefore, a low-level preprocessing is still necessary for scale normalization. 2. The Eigen face representation is, in a least squared sense, faithful to the original images, its recognition rate decreases for recognition under varying pose and illumination. 3. These experiments were made only with frontal views. The problem can be far more difficult when there exists extreme change in pose as well as in expression and disguise[1].
2.Face recognition using gabor filter.	1. The effectiveness of the system has been justified over a face database with face images captured in different illumination and orientation conditions of face. 2. This method can successfully reduce noise that result due to sharp	1. The Gabor filters are not orthogonal one to another and are, hence, correlated is probably the most important. 2. This makes the information contained in the Gabor face representation redundant and also affects the size of the representation[4].

	<p>transition in grey values.</p> <p>3. One of the most successful face recognition methods is based on graph matching of coefficients which are obtained from Gabor filter responses[4].</p>	
<p>3. Face Recognition Using Wavelet Transform And Artificial Neural Network</p>	<p>1. This method indicates that the high speed recognition over PCA based method which is widely used for feature extraction.</p> <p>2. Artificial Neural Network acts as a reliable classifier</p> <p>3. The combination of Wavelet and ANN exhibits the most favorable performance, it has the lowest overall training time, the lowest redundant data, and the highest recognition rates [5].</p>	<p>1. The direct use of wavelet coefficients may not extract the most discriminative features.</p> <p>2. There is much redundant or irrelevant information contained in wavelet coefficients.</p> <p>3. It can not recover new meaning underlying features which has more discriminative power[6].</p>

IV.CONCLUSION

In this paper we have compared three different techniques for face recognition along with their strengths and weaknesses. The study shows that face recognition using PCA with BPNN provides a high accuracy rate .PCA combined with BPNN works better than the individual PCA. This method has an acceptance ratio of more than 90% and the execution time of only a few seconds while Gabor filters for face recognition is to construct a filter bank with filters of different scales and orientations. Finally, the combination of Wavelet and ANN exhibits the most favorable performance, it has the lowest overall training time, the lowest redundant data, and the highest recognition rates when compared to similar so-far-introduced methods .Hence it is concluded that face recognition using wavelet transform and artificial neural network is the best one for recognizing face and it is also possible to obtained high face recognition rate equal to 98% by using this technique.

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