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Image Enhancement Using Gabor Algorithm

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ABSTRACT

This paper provides a study on Face Recognition Algorithms; several methods are used to extract image face features vector, which presents small inter-person variation. This feature vector is feed to a multilayer perception to carry out the face recognition or identity verification tasks. Proposed system consists in a combination of Gabor and Eigen faces to obtain the feature vector. Evaluation results show that proposed system provides robustness against changes in illumination, wardrobe, facial expressions, scale, and position inside the captured image, as well as inclination, noise contamination and filtering. Proposed scheme also provides some tolerance to changes on the age of the person under analysis. Evaluation results using the proposed scheme with identification and verification configurations are given and compared with other feature extraction methods to show the desirable features of proposed algorithm**.**

1. Algorithm

step1: Defining the hardware (integrated webcam or external surveillance system like webcam).

step2: using image acquisition toolbox we define the pixel range and number of frames.

step3: generate mat lab code for the video captured from the hardware.

step4: map each and every frame and using vector extraction which consists of implementation of artificial neural networks.

step5: implementing noise reduction functions identify faced and non-faced objects.

step6: implementing Eigen face-Gabor algorithm for features extraction for face recognisation.

1.1 Gabor Algorithm

1.1.1 For neural network training on receptive field features:

Step1: The feature vectors have to be extracted and are given to a ANN.

Step2: The pre processed database images are of size nXm pixels.

Step3: To estimate the features vector, the picture containing the face under analysis is segmented.

Step4: we get central points; those central points are called receptive fields which are the feature vectors.

1.1.2 For neural network training on gabor features:

Step1: For gabor feature extraction, we convolve the image I with every gabor filter of the gabor filter family at every pixel (*x; y*)

$$G(x,y;f_k,\theta_m)= \sum_{x'} . \sum_{y'} I(x-x', y-y')\, h(x', y'; f_k, \theta_m)$$

Where I(x,y) is the pixel intensity.

Step2: The phase information of G(fk ; µm) can be taken as a feature, because it contains information about the edge locations and other details in the image *I*.

F1(x; y; fk; µm) = phase(G(x; y; fk; µm))

Step3: The amplitude of G(fk ; µm) can be taken as a feature, and it contains some oriented frequency spectrum in every local of the image *I*.

F2(x; y; fk; µm) = |G(x; y; fk; µm) |

Keywords

Gabor filter, Eigen face, Neural network.

2. INTRODUCTION

Gabor transforms owing to their excellent localization in time and frequency domains, find an increasing number of applications in signal processing and mathematical analysis. These transforms are analogous to Fourier transforms except that they localize the signal in both frequency and time domain. Gabor expansion of signal refers to expansion of an arbitrary signal into a series of elementary terms which are time-frequency shifted copies of a given "Gabor atom" [1]. It is well-known that the main difficulty involved in the Gabor expansion is to select a suitable set of Gabor coefficients [2]. Several algorithms and analytical methods describe the procedure to evaluate the coefficients [3], but none of them is practically able to produce results with extreme accuracy in small time durations, especially when the discrete signal length is very large.

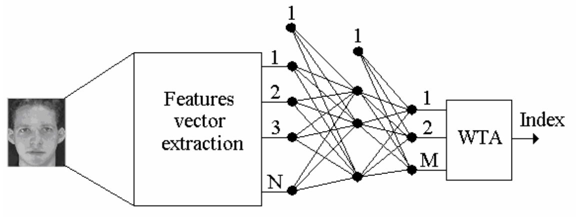


Fig. 1 Proposed face identification system

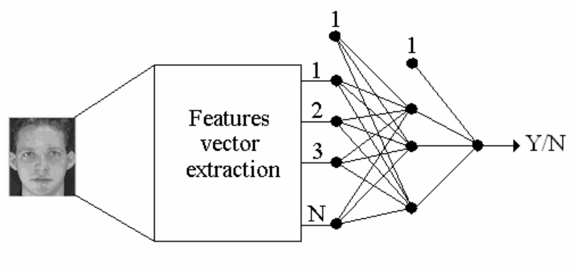


Fig. 2 Block diagram of proposed identity verification system

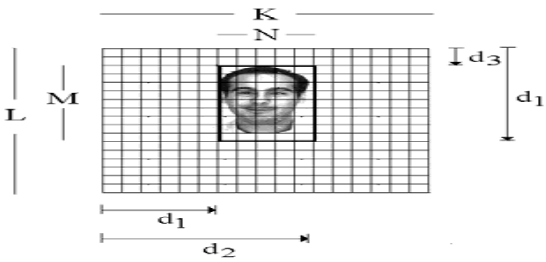


Fig. 3 Face segmentation method

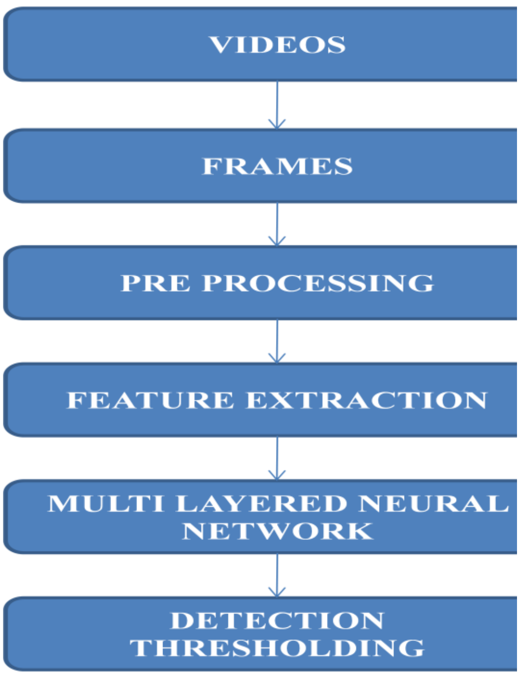


Fig.4 Flow chart of face recognisation

3. Proposed system

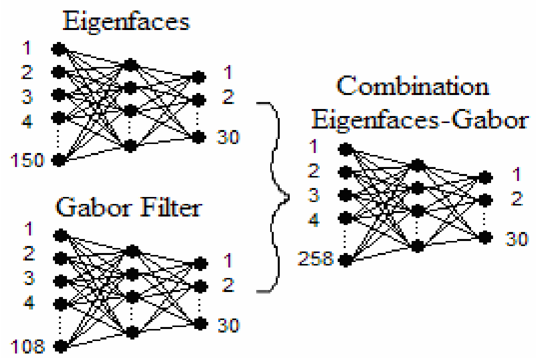
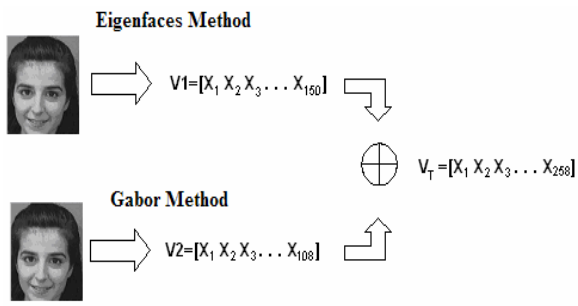


Fig. 5 Combination of Eigen faces and Gabor in a neuronal network.



Evaluation results shown that proposed face Recognition Gabor-Eigen faces algorithm provides better performance than other previously proposed methods such as the Eigen faces, Gabor, discrete Cosine transforms and the discrete Walsh transform based methods. Fig 4 shows the way in which the features vectors were united for the combination. One can see that the input vector for the neuronal network has a greater length.

4. METHODOLOGY

We use the following methods to implement the paper.

4.1 Gabor expansion:

To estimate the features vector, firstly the region of the picture containing the face under analysis is segmented as shown in Fig. 3, using . Next NM captured image is divided in $MxMy$ receptive fields each one of size $(2Nx+1)(2Ny+1)$ where $Nx=(N-Mx)/2Mx$, $Ny=(MMy)/2My$. This fact allows that the features vector size be independent of the captured image size.

4.2 Eigen faces:

The objective of the recognition by the Eigen faces method is to extract relevant information from face image, encode this information as efficiently as possible and compare them with each model stored in a database. In mathematical terms, we wish to find the principal components of the distribution of faces, or the eigenvectors of the covariance matrix of the set of face images.

The idea of using eigenfaces was motivated by a technique developed by Sirovich and Kirby for efficiently representing pictures of faces using principal component analysis. They argued that a collection of face images can be approximately reconstructed by storing a small collection of weights for each face and a small set of standard pictures.

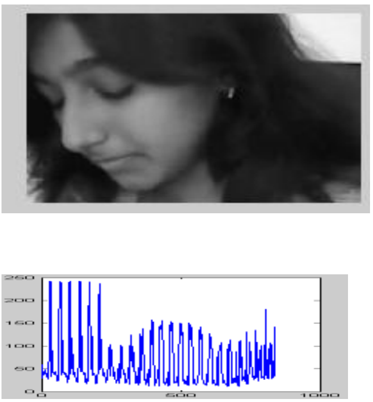
4.3 Discrete Walsh transforms:

The discrete Walsh transform (DWT) is one of the most important techniques as well as the discrete Fourier transform in the field of signal processing. The DWT works well for digital signals due to the fundamental function called the Walsh function. The Walsh function has only +/- and is the system of orthogonal functions. In general, the Walsh function can be generated by the Kronecker's product of the Hadamard matrix H's.

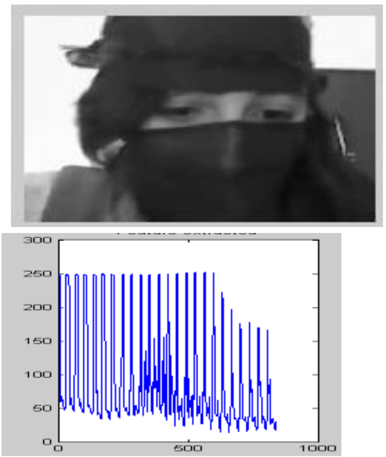
4.4 Feature extraction:

In pattern recognition image processing, feature extraction is a special form of dimensionality reduction. When the input data to an algorithm is too large to be processed and it is suspected to be notoriously redundant (much data, but not much information) then the input data will be transformed into a reduced representation set of features (also named features vector). Transforming the input data into the set of features is called feature extraction. If the features extracted are carefully chosen it is expected that the features set will extract the relevant information from the input data in order to perform the desired task using this reduced representation instead of the full size input.

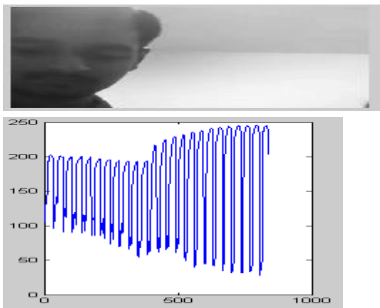
5. Snapshots



(A)



(B)



(C)

Fig.6 outputs

6. CONCLUSIONS

In this paper we proposed an automatic face recognition system in which the face image is divided in 108 receptive fields. The feature vector is then fed into a multilayer neural network to recognize the face image. The proposed identity verification system can verify correctly the input face images with different illumination level, different facial expression, with some accessories, as well as when the face images pass through some common image processing such as filtering, contamination by noise and geometrical transformation (rotating, shifting, resizing).

Computer simulation shows that the proposed system performs better than some previously proposed algorithms using such as the Eigen faces method, the Discrete Cosine Transform and the Discrete Walsh Transform. The combination of methods to obtain the feature vector, such as Gabor and Eigen faces, deliver a higher percentage of recognition. Therefore, the system proposed in this paper is a combined system.

Finally, we can emphasize four advantages of the proposed system: Compact extraction of the face information, easy implementation, robustness against several condition changes and common image processing.

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