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HUMAN EMOTION REGONITION USING FACIAL EXPRESSION DETECTION

Dr.M.Sundaram[1], M.Priyanka[2], Bhavani Sankari.J[3], Jesi.P[3], Poongodi.M[3]

Professor[1], Assistant Professor[2], UG Students[3]

Department of Electronics and Communication Engineering,

Kamaraj College of Engineering and Technology, Virudhunagar, India.

Abstract*—The basic goal of the human–computer-interaction (HCI) system is to improve the interactions between users and computers by making computers more user friendly and receptive to user's needs. Automatic facial expression recognition (FER) plays an important role in HCI systems and it has been studied extensively over the past twenty years. It's a true challenge to build an automated system which equals human ability to detect faces and estimates human body dimensions from an image or a video. In this project Principal Component Analysis (PCA) is proposed for facial expression detection. The most relevant eigenfaces have been selected using Principal Component Analysis (PCA). With these eigenfaces the input test images are classified based on the maximum similarity score of the expression. Finally the emotion of the test image is determined by finding the maximum score of the expression.

***Keywords*—*Eigenvectors, Eigen values, PCA, Face recognition,Image processing, Facial expression recognition.*

I. INTRODUCTION

Human face recognition, as one of the most successful applications of image analysis and understanding, has received significant attention in the last decade .Images used for facial expression recognition are static images or image sequence contains potentially more information than a still image, so it reads a gray image from the file specified by the database[1].This paper provides the knowledge of eigenfaces .The mathematical formulae and operators used in the PCA algorithm are describe in this paper. Eigen values and mean values are the operator used by PCA algorithm to match the most relevant eigenface. Mathematical description is provide in this paper[2].In this paper, a method has been presented to design an Eigenvector based facial expression recognition system. Eigenvector of the testing image and all the stored eigenvector is computed. To make the system more efficient instead of the whole image is processed[1-2]. In this paper the distance between the expression of test image and those mean are compare using Canberra-distance classifiers. Thus specific expression has been recognized. Similarly, distance between the expression of trained image and the input image as testing image accuracy of expression recognition has been calculated[3]. PCA is the most popular appearance based method used mainly for dimensionality reduction in compression and recognition problem.PCA can not only decrease computational complexity with a linear transform, but also make the distribution of face image data more compact for classification, it have become popular feature extraction methods for face recognition[5].on the other hand , PCA method cannot only effectively reduce the dimension of human face images , but also retain its key identifying information.

II. EXISTING METHODOLOGY

In order to determine the intensity of the particular expression is Euclidean distance from the mean of the projected neutral images is calculated. The Euclidean distance of a projected test image from all the projected train images are calculated and the minimum value is chosen in order to find out the train image which is most similar to the image. This method is only for calculating the mean distance of the facial components.

Objective :

- To detect face and facial components to extract the facial expression.
- To increase the accuracy rate of predicting the expressions (Neutral, Happy, Sad, Surprise).
-

III. PROPOSED METHODOLOGY

Here we are going for the PCA method. Because of the more efficiency. The proposed approach to the facial expression recognition involves, the train images are utilized to create a low dimensional face space. This is done by performing PCA in the training image set and taking the greater Eigen values.

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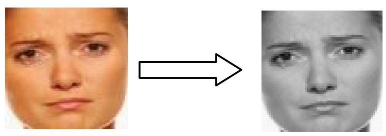
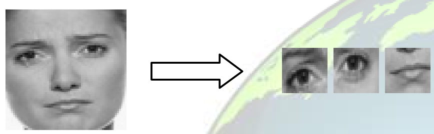
A. Pre Processing:

The preprocessing step involves the image acquisition and cropping. In image acquisition the test images are converted into gray-scale images before going for further processing. After that the face, lefteye, righteye and mouth are cropped from the input image.





The below diagram shows the basic block diagram for the proposed methodology

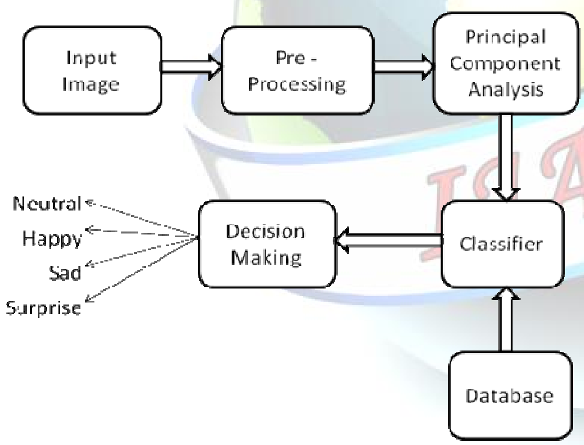


Fig.Block Diagram

B. *PCA:*

Principal Component Analysis(PCA) is a standard technique used in statistical pattern recognition and signal processing for data reduction and Feature extraction. Principal Component Analysis (PCA) is a dimensionality reduction technique based on extracting the desired number of principal components of the multi-dimensional data. [4] discussed about efficient content-based medical image retrieval, dignified according to the Patterns for Next generation Database systems (PANDA) framework for pattern representation and management. The proposed scheme use 2-D Wavelet Transform that involves block-based low-level feature extraction from images.

The purpose of PCA is to reduce the large dimensionality of the data space (observed variables) to the smaller intrinsic dimensionality of feature space (independent variables), which are needed to describe the data economically. This is the case when there is a strong correlation between observed variables.

The first principal component is the linear combination of the original dimensions that has the maximum variance the n-th principal component is the linear combination with the highest variance, subject to being orthogonal to the n -1 first principal components.

The PCA algorithm PCA method can not only effectively reduce the dimension of human face images, but also retain its key identifying information. In mathematical terms, recognition of images using PCA takes three basic steps. The transformation matrix is first created using the training images. Next, the training images are projected onto the matrix columns. Finally, the test images are identified by projecting these into the subspace and comparing them with the trained images in the subspace domain.

The PCA algorithm is shown in the following

Performing PCA:
[Coeff, Score, latent] = princomp (X) X is n b p data matrix. Rows of X correspond to observations and columns to variables.
Coeff: Coeff is a p-by-p matrix, each column containing coefficients for one principal component. The columns are in order of decreasing component variance.
Score: Representation of X is principal component. Space rows of score correspond to observation, columns to components.
Latent: Eigen values of the covariance matrix of X. It is the variance of Score.

Flowchart:

The steps involved in the process is mentionedin the flowcharts as follows

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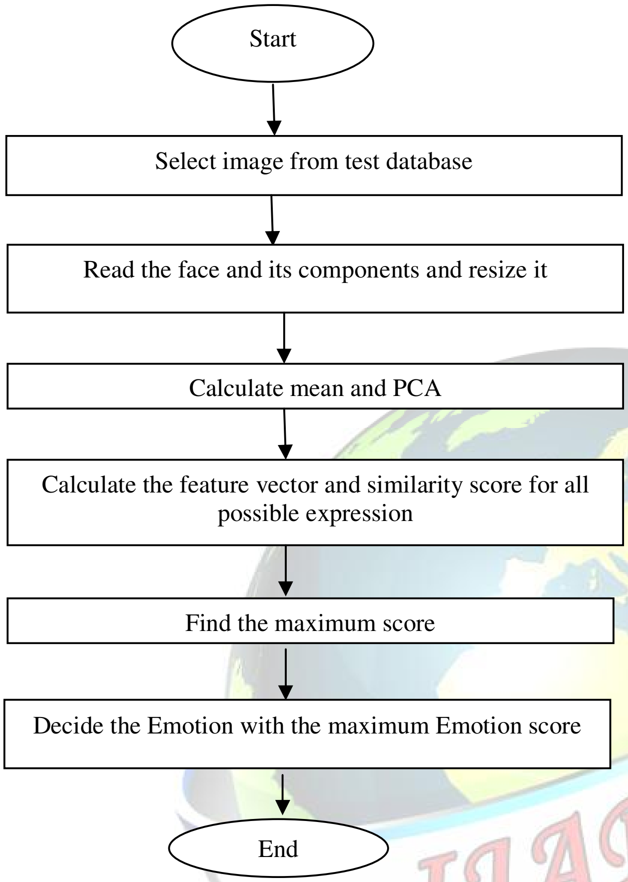

The steps in PCA algorithm is shown in the following :

1.Let a face image X(x, y) be a two dimensional (m x n) array of intensity values. An image may also be considering the vector of dimension m n. Let the training set of images $\{X_1, X_2, X_3, \ldots\ldots X_N\}$.The average face of the set is defined by

$$\bar{X} = \frac{1}{N}\sum_{i=1}^{N} X_i$$

2. Calculate the covariance matrix to represent the scatter degree of all feature vectors related to the average vector. The Covariance matrix C is defined by

$$C=\frac{1}{N}\sum_{i=1}^{N}(X-\bar{X})(X_i-\bar{X})^T$$

3. The Eigenvectors and corresponding eigenvalues are computed by using

$$CV = \lambda V$$

Where V is the set of eigenvectors associated with its eigenvalue.

4. Sort the eigenvector according to their corresponding eigenvalues from high to low.

5. Each of the mean centered image project into eigenspace using

$$W_i = V_i^T(X_i-\bar{X})$$

6. In the testing phase each test image should be mean centered, now project the test image into the same eigenspace as defined during the training phase.

7. This projected image is now compared with projected training image in eigenspace. The training image that is closest to the test image will be matched as used to identify.

IV. RESULTS

We have implemented a facial expression recognition system using Principal component analysis method. This approach has been studied using image database.The success of implementation depends on pre-processing stage on the images because of illumination and feature extraction. Automatic face expression recognition systems find applications in several interesting areas. With the recent advances in robotics, especially humanoid robots, the urgency in the requirement of a robust expression recognition system is evident. As robots begin to interact more and more with humans and start becoming a part of our living spaces and work spaces, they need to become more intelligent in terms of understanding the human's moods and emotions. Expression recognition systems will help in creating this intelligent visual interface between the man and the machine.The results of this project is shown here with the scores.

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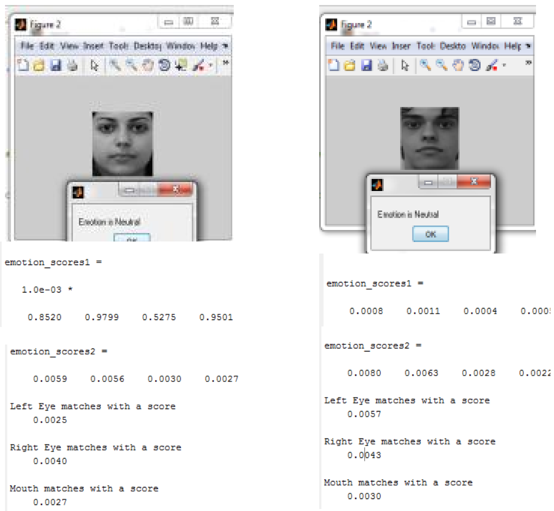

Fig 4.1 Neutral Emotion

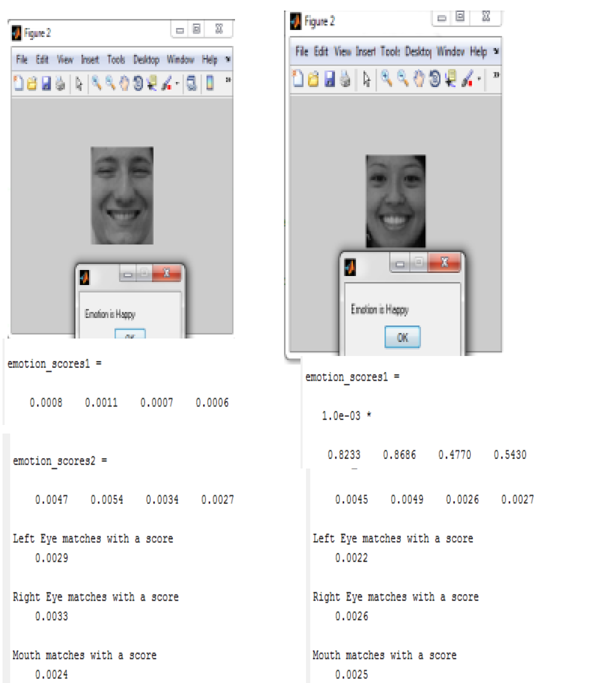

Fig 4.2 Happy Emotion

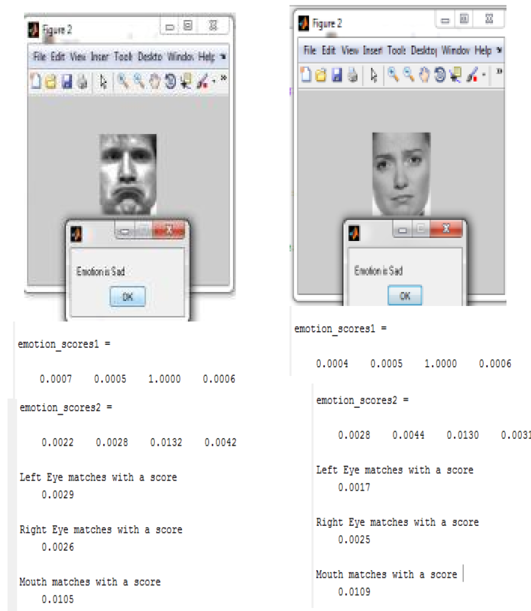

Fig 4.3 Sad Emotion

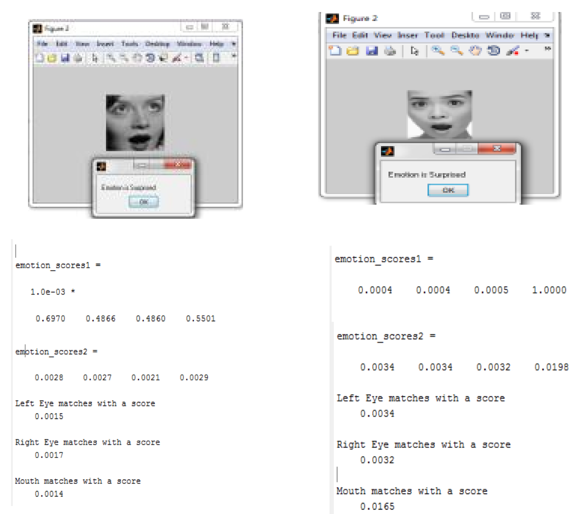

Fig 4.4 Surprised Emotion

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V. CONCLUSION

As human to machine interaction of the human facial expression by using emotion recognition is determined. We are matching the input images and the test images during the PCA method. The most relevant eigenfaces values are calculated with these eigenfaces of the classification based on the maximum similarity score of the expression is verified .Finaly the emotion of the test image is obtained..

VI. *Reference*

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