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Human Emotional State Recognition Using Facial Expression Detection

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Abstract *–A human face does not only identify an individual but also communicates useful information about a person's emotional state. No wonder automatic face expression recognition has become an area of immense interest within the computer science, psychology, medicine and human-computer interaction research communities. Various feature extraction techniques based on statistical to geometrical data have been used for recognition of expressions from static images as well as real time videos. This paper reviews various techniques of facial expression recognition systems using MATLAB.*

Keywords *– Face detection, Facial expression recognition, PCA.*

I. INTRODUCTION

In human-to-human conversation, the articulation and perception of facial expressions form a communication channel in addition to voice which carries vital information about the mental, emotional, and even physical state of the persons in conversation. In their simplest form of facial expressions of a person is happy or angry. In a more subtle view, expressions can provide either intended or unintended feedback from listener to speaker to indicate understanding of, sympathy for, or even disbelief toward what the speaker is saying. A generally established prediction is that computing will move to the background, absorbing itself into the fabric of our everyday living bringing the human user to the forefront. To achieve this, the next generation computing needed such as pervasive computing and ambient intelligence. It will need to develop human-centred user interfaces that readily react to multimodal human communication occurring naturally. Such interfaces will need to have the ability to identify and realize the intentions and emotions as expressed by social and affective indicators. This vision of the future motivates the research for automated recognition of nonverbal actions and expression. Facial expression recognition has attracted increasing attention in computer vision, pattern recognition, and human-computer interaction research communities. Automatic recognition of facial expressions therefore forms the essence of various next generation computing tools including affective computing technologies, intelligent tutoring systems, patient profiled personal wellness monitoring systems, etc. Human face varies from one person to another due to gender, due to different age groups and other physical characteristics. Therefore the detection of face is more challenging task in computer vision. Figure 1 shows the generic representation of face detection arrangement [4].

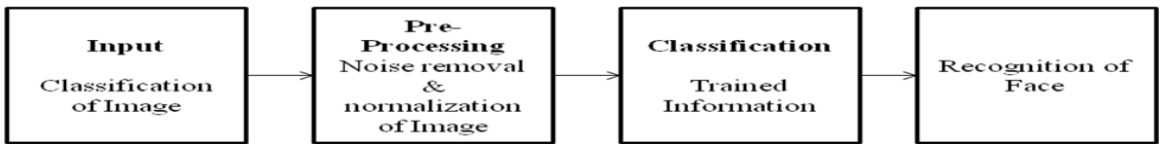

Figure 1: A Generic Representation of Face Detection

In the face detection, the input block stores the captured image which finds the face area from the image. The face area provides to the pre-processing block which removes the unwanted noise and it also normalize the image. The output is provided to the trainer module, trains the image and decides whether the image belongs to the face class or not and finally it will provide the information about the recognition of face [1].

II. FACIAL EXPRESSION RECOGNITION – AN OVERVIEW

The importance of facial expression system is widely recognized in social interaction and social intelligence. The system analysis has been an active research topic since 19th century. The facial expression recognition system was introduced in 1978 by Suwa et. al. The main issue of building a facial expression recognition system is face detection and alignment, image normalization, feature extraction, and classification. There are number of techniques which we use for recognizing the facial expression.In an efficient algorithm for

motion detection based facial expression recognition using optical flow proposed an efficient algorithm for facial motion detection. This technique is based on optical flow technique which extracts the necessary motion vectors. Optical flow reflects the image changes due to motion during the interval of time. This algorithm works on frames of segmented image and gives us their result which is depending on motion vectors. The strongest degree of similarity determines the facial emotions. The algorithm examine the work on the basis of Action unite (AU) coded facial expression database. By using this method the matching can recognize the facial expression. There are four types to recognize that expression. The first type uses emotion space to recognize facial expression. The second type is to recognize facial expression of an image frame by using optical flow. The third type is to use active shape models to recognize facial expression. The fourth type is to recognize the facial expression by using neural network [3].Face is a complex multidimensional visual model and for developing a model for face recognition is difficult task. This paper presents coding and decoding methodology for face recognition. For face recognition there are many types of database images available of an individual face with different condition (expression, illumination, etc). In this paper [2] discussed that the method of eigenfaces are calculated by using Principal component analysis (PCA).

III. METHDOLOGY

In this article the basic system proposed four stages: face detection, pre-processing, principle componenet anaysis (PCA) and classification.

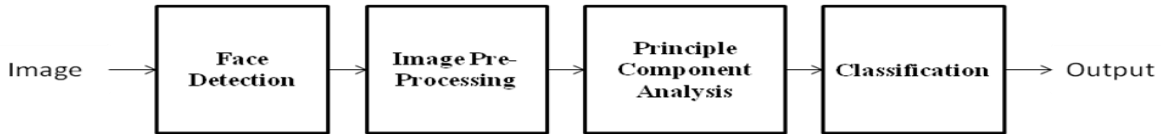

Figure 2: Basic step of Facial Expression Recognition System

The first stage is face detection method. In this method the database of images are allmost identical enviournment of distance, background, etc. the collection of all the images includes different poses of several neutral, anger, happiness, etc. expressions. For creating any type of database some images used for training and some for testing, both of which include number of expressions. he proposed technique is depend on coding and decoding method. First the information is extracted, encoded and then matched with the database of model. Next is the pre- processing module, in this the image gets normalized and it also remove the noise from the image. In eigenface library the database image set divides into two sets- training dataset and testing dataset.The train images are utilized to create a low dimensional face space. This is done by performing Principal Component Analysis (PCA) in the training image set and taking the principal components (i.e. Eigen vectors with greater Eigen values). In this process, projected versions of all the train images are also created. The test images also projected on face space. Then the Euclidian 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 test image. Then the Euclidian 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 test image.

The figure 3 shows overview of the proposed system.[5]

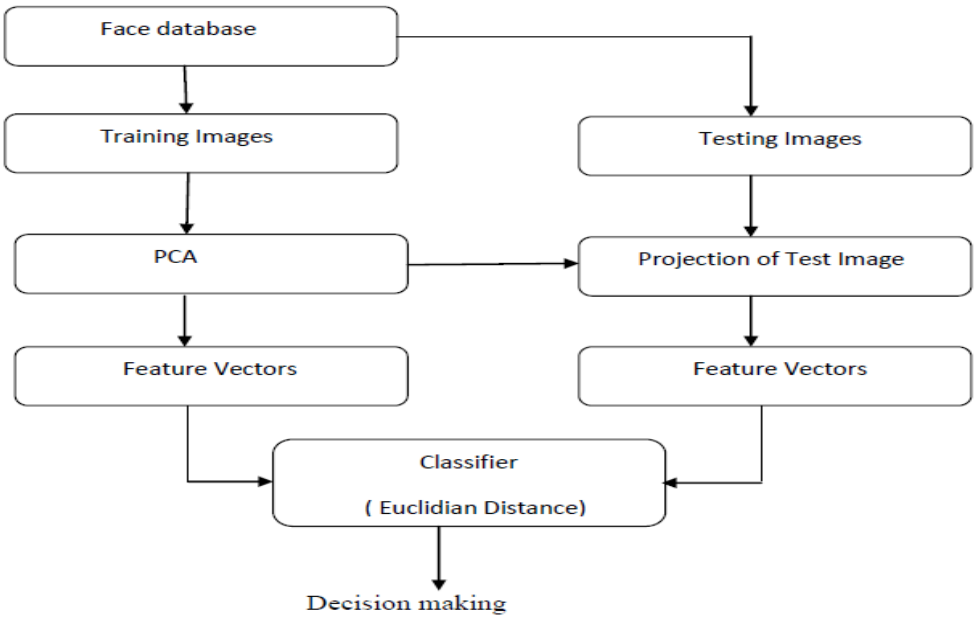

Figure 3: Overview of the proposed system

IV. RESULT

Table I. Confusion Matrix Of Five Basic Facial Expression

	Happy	Sad	Disgust	Anger	Neutral
Happy	**90**	10	00	00	00
Sad	00	**95**	00	00	05
Disgust	00	00	**90**	10	00
Anger	00	00	12.5	**87.5**	00
Neutral	00	02	00	00	**98**

V. CONCLUSION

In this project the particular method using Principal Component Analysis for facial expression detection was initially started with 3 training images and 6 testing images from each class of expression. After that the same procedure was repeated by increasing the number of training images from each class of expression and decreasing the number of testing images. The principal components are selected for each class independently to reduce the eigenspace. With these eigenvectors the input test images were classified based on Euclidian distance. The proposed method was tested on database of 30 different persons with different expressions. The proposed PCA method has the greater accuracy with consistency. The recognition rate was greater even with the small number of training images which demonstrated that it is fast, relatively simple, and works well in a constrained environment.

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