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Facial Expression Recognition Using Feature Vectors

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ABSTRACT: Facial expressions are the facial changes in response to a person's internal emotional states, intentions, or social communications. Though facial expressions obviously are not to equate with emotions, in the computer vision community, the term "facial expression recognition" often refers to the classification of facial features in one of the six basic emotions: happiness, sadness, fear, disgust, surprise and anger. Facial expressions play an important role in our relations. This paper proposes a pre processing for getting accuracy in output using Gamma Intensity Correction and a feature extraction process using Gray Level Co-occurrence Matrix. Feature Extraction has its key role of dimensionality reduction in Facial Expression Recognition. Gray Level Co-occurrence Matrix method is used to extract the feature vectors with better accuracy and high computational speed. With these feature vector values expressions can be recognized using Artificial Neural Network.

KEYWORDS: Expression Recognition, Gamma Intensity Correction, Gray Level Co-occurrence Matrix, feature vectors , accuracy and Artificial Neural Network.

I.INTRODUCTION

Facial expression is one or more motions or positions of the muscles beneath the skin of the face. This movement gives the information about emotions of an individual to observing person. Facial expressions are a form of nonverbal communication. Humans can adopt a facial expression voluntarily or involuntarily, and the neural mechanisms responsible for controlling the expression differ in each case. Voluntary facial expressions are often socially conditioned and follow a cortical route in human brain. On the other hand, involuntary facial expressions are believed to be innate and follow a sub cortical route in human brain.

Facial recognition is often an emotional experience for the brain and the amygdale is highly involved in the recognition process. As with every computational practice, in affect detection by facial processing, some obstacles need to be surpassed, in order to fully unlock the hidden potential of the overall algorithm or method employed. Thus accuracy in feature extraction and minimum time of execution to recognizing all types of facial expressions and recognition efficiency are the major issues to be considered as far as existing AFERS are concerned.

II.RELATED WORK

Hongying Meng, Bernardino Romera-Paredes and Nadia Bianchi-Berthouze are poposed Emotion Recognition on Dynamic Facial Expression Features on 2011. This paper uses Local Binary Patterns (LBPs) to capture the local textural patterns from each frame of the video. The reason to apply the LBP algorithm to all the pixels in a frame rather than just to the face region is to maintain information of other visual cues (e.g., head movement and shoulder) present in the video. The second descriptor is used to extract motion information of the facial expression. Motion History Histograms (MHH) is computed to capture the movement activity of each pixel in the face. Each of the two operators described above contains only partial information.

Marian Stewart Bartlett, Gwen C. Littlewort, Mark G. Frank, Claudia Lainscsek, Ian R. Fasel and Javier R. Movellan are proposed Automatic Recognition of Facial Actions, September 2006. The facial action coding system is used in this paper. A human coder decomposes facial expressions in terms of 46 component movements, which roughly correspond

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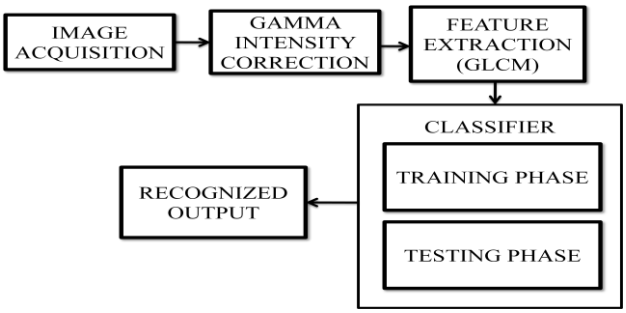
to the individual facial muscles. FACS provides an objective and comprehensive language for describing facial expressions and relating them back to what is known about their meaning from the behavioral science literature.

III.MATERIALS AND METHODS

The first step is acquisition of image database with different expression of different person. It is then followed pre processing, the best and accurate output of the pre processing stage is given as the input for feature extraction. Finally, the feature vectors of various expressions of different persons are extracted and used for training the database then accordingly the test images are recognized.



A.Gamma Intensity Correction

This method can control the overall brightness of an image by changing the gamma parameter. It is used to correct the lighting variations in the face image.

1) Procedure

- Let the input image be I(x,y)
- To calculate gamma correction parameter f(I(x,y)) , take exponential of the input image I(x,y)

$$f(I(x, y)) = I(x, y)^{1/\gamma} \quad (1)$$

Where, γ – value of the image depends on the darkness or brightness.

To find the value of 'γ'

Assume a canonically illuminated face image be $I_c(x, y)$. The difference between the transformed image and the predefined canonically illuminated image must be minimized

$$\gamma = \arg\min_{\gamma^*} \sum_{x,y} [I(x, y)^{1/\gamma^*} - I_c(x, y)]^2 \quad (2)$$

Now, if $1/\gamma < 1$ the process is known as gamma compression. If $1/\gamma > 1$, then it is known as gamma expansion.

B. Gray Level Co-occurrence Matrix

A co-occurrence matrix, also referred to as a co-occurrence distribution, is defined over an image to be the distribution of co-occurring values at a given offset. It represents the distance and angular spatial relationship over an image sub-region of specific size. The GLCM is calculates how often a pixel with gray-level (grayscale intensity or Tone) value i occurs horizontally, vertically, or diagonally to adjacent pixels with the value j. GLCM is the most accurate method for quantifying Texture. It also increases the speed of calculation. It takes all the above three aspects of the texture into account. It uses a neighborhood operation within moving window image areas. GLCM records what gray level value occurs next to what others and how often they occur. Calculation based on GLCM yield numbers whose relative value interprets a particular kind of texture.

C. *Artificial Neural Networks*

Artificial neural networks (ANN) are based on approximate models of the brain. Basic building block of an ANN is the neuron. An artificial neuron is a simple non-linear combiner. When operating within a neural network, the neuron, receives inputs from previous neurons. Each input is multiplied by the connection weight. To generate the final output, the sum of the inputs are passed through the filter called transfer function

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1) Training Phase

A training set consists of expected outputs for specific inputs. Solving the network for a set of inputs and comparing the outputs to the expected values. Using the errors can estimate a correction to each weight value in the network

IV. EXPERIMENTAL RESULTS & DISCUSSION

The first step is the image acquisition and these obtained images are subjected to RGM to grayscale conversion.

A. Input images

Fig.1 Anger

Fig.1 shows the input image with the expression Anger which is converted into gray scale.

Fig.2 Fear

Fig.2 shows the input image with the expression Fear which is converted into gray scale.

Fig.3 Happy

Fig.3 shows the input image with the expression Happy which is converted into gray scale.

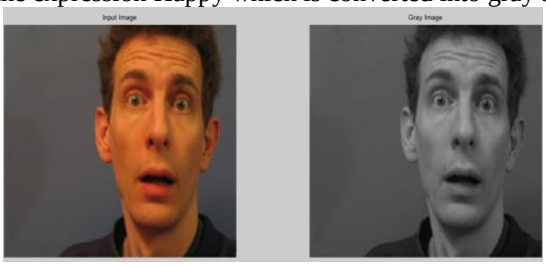

Fig.4 Surprise

Fig.4 shows the input image with the expression Surprise which is converted into gray scale.

This process is done for four various expressions in the dataset and outputs are obtained. The above figures show the output of RGB to gray scale conversion and is used to obtain feature vectors using GLCM.

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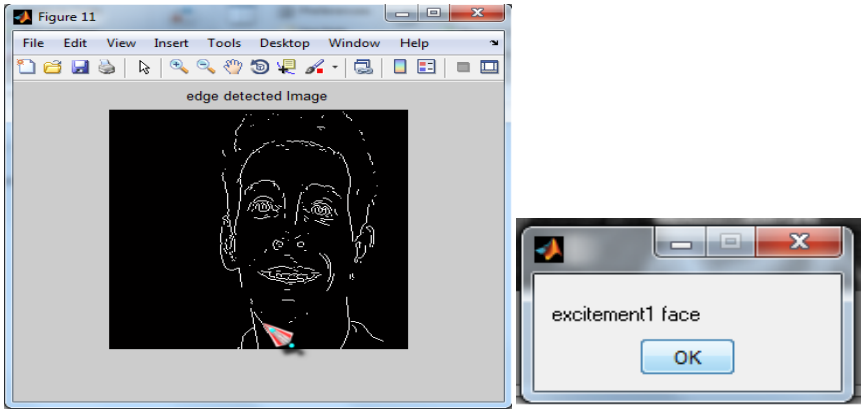
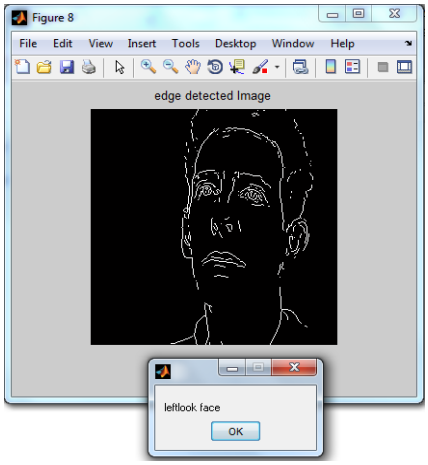
B. Sample Outputs

The training phase images with is obtained message box representing its corresponding expression using the feature vector values for the given four input images are shown here.

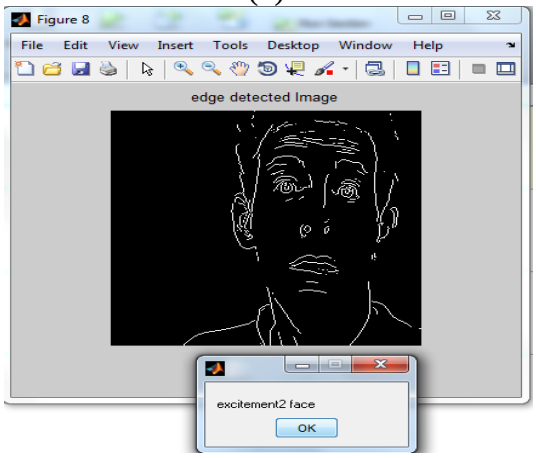
Fig.5 the various trained images



(a)



(b)



(c)

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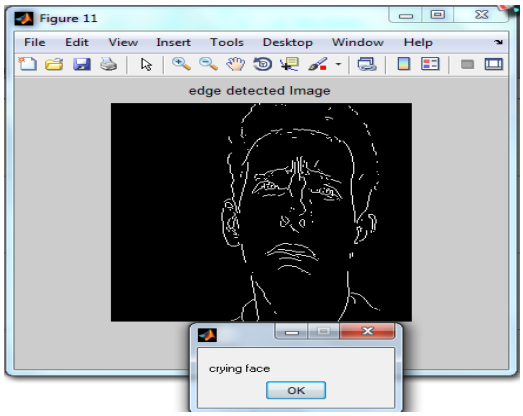

(d)

Fig.5 (a), (b), (c) and (d) show the output of the training images which recognizes the emotions such as Anger, Fear, Happy and Surprise respectively.

V.CONCLUSION

This paper proposes a pre processing method that is Gamma Intensity Correction and uses GLCM feature extraction method to reduce computational speed and obtain high accuracy. Using GLCM the extracted feature vectors are obtained and then trained the database. These training sets are tested with the similar but non-intersecting dataset. This expression recognition has its scope and application, vast areas mainly on medical fields to know the patients emotion.

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