Neha Gupta and Prof. Navneet Kaur / International Journal of Engineering Research and Applications (IJERA) ISSN: 2248-9622 www.ijera.com
Vol. 3, Issue 4, Jul-Aug 2013, pp.2002-2006

Design and Implementation of Emotion Recognition System by Using Matlab

Neha Gupta[1] and Prof. Navneet Kaur[2]
[1](M.tech Instrumentation and Control Engineering, BABA BANDHA SINGH BAHADUR ENGINEERING COLLEGE, Fatehgarh Sahib Punjab
[2](Assistance Professor Electrical Department, BABA BANDHA SINGH BAHADUR ENGINEERING COLLEGE, Fatehgarh Sahib Punjab

ABSTRACT

Facial Expression gives important information about emotion of a person. Face emotion recognition is one of main applications of machine vision that widely attended in recent years. It can be used in areas of security, entertainment and human machine interface (HMI). Emotion recognition usually uses of science image processing, speech processing, gesture signal processing and physiological signal processing. In this paper a new algorithm based on a set of images to face emotion recognition has been proposed. This process involves four stages pre-processing, edge detection, feature extraction, face detection.

KEYWORDS: Color Space, Edge Detection, Face Detection, PCA

I. INTRODUCTION

Research on emotion detection is a very challenging field that target methods to make effective human computer interaction. Image signal contains huge a mount of important information of the speaker[1]. We use facial expressions not only to express our emotions, but also to provide important communicative cues during social interaction, such as our level of interest, our desire to take a speaking turn and a continuous feedback signalling about the understanding of the information conveyed. It is reported that facial expressions have a considerable effect on a listening interlocutor; the facial expression of a speaker accounts for about 55 percent of the effect of the communicated message 38 percent of the latter is conveyed by voice intonation and 7 percent by the spoken words [2]. This study presents a computationally efficient approach for edge detection which further leads to classification of facial expression recognition from static facial images. In the presented approach various algorithm are used to produce the characteristic features such as lips and eyes. Firstly the images will be loaded in the train folder and test folder. After this these images are analyzed by series of algorithms and techniques to enhance the image input, maintain intensity and removing noise from image. Second algorithm detects the edges of image. From the edge points various distances between features is calculated and PCA (principal component analysis) is used for data reduction and next algorithm detects the face. On the basis of that distance emotions are recognize accurate emotions. The images shown below in "fig.1"expressing five emotions.

"Fig.1" original images expressing five emotions

II. RELATED WORKS

Automatic facial expression recognition (FER) with a set of specific desired accuracy and performance requirements will help one to create human-like robots and machines that are expected to enjoy truly intelligent and transparent communications with humans. Facial expression recognition deals with the problem of classifying facial images into expression classes. It has been of interest to a growing number of researchers and much progress has been made during the last two decades. Expression recognition involves a variety

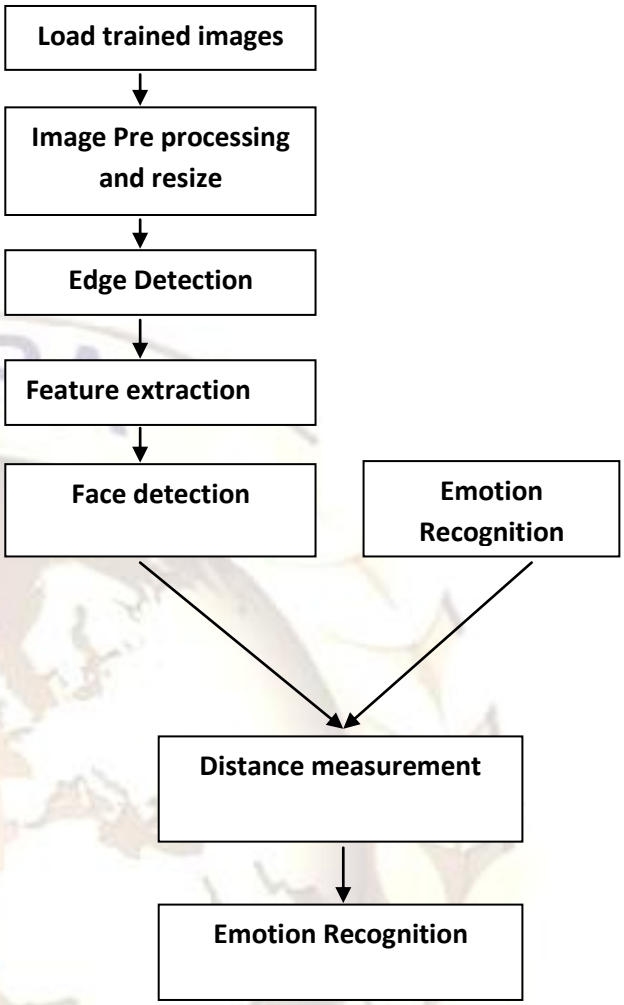
of subjects such as perceptual recognition, machine learning, affective computing etc.

The classification based facial expression recognition method uses a bank of multilayer perceptron neural networks[3]. Logarithmic Gabor filters are applied to extract the features of the Cohn –Kanade database and the feature size reduction is done by Principal Component Analysis (PCA).Another case study for face expression recognition uses a feature selection via linear programming (FSLP) method [4]. This technique performs simultaneous feature selection and classifier training. Another facial expression recognition method uses 2 D DCT and K means algorithm [5]. In this, the images of both men and women are considered and it seen that the mean recognition rate can be as high as 95% for the two databases. Another method uses two-dimensional (2 D) discrete cosine transform (DCT) over the entire face image as a feature detector and a constructive one-hidden layer feed forward neural network as a facial expression classifier [6].

An input side pruning technique is also incorporated into constructive learning process to reduce the network size without sacrificing the performance of the resulting network.This technique constructs one-hidden-layer feed forward neural network with fewer number of hidden units and weights, while simultaneously providing improved generalization and recognition performance capabilities. The rest of the paper is organized as follows. Section 3 provides the details of the proposed system architecture and section 4 concludes with the result of the work preformed.

III. SYSTEM ARCHITECTURE

Here we propose an emotion recognition system by using various different techniques. Typically an automated face expression recognition system includes a camera for capturing the facial image. It is then pre processed so as to minimize the environmental and other variations in the image. This includes the operations of image scaling and brightness adjustment. After that face ,mouth and eye region was detected i.e feature extraction. Then with the help of eyes and lips feature we classify five different emotions. A block diagram description of FER system is shown in “Fig 2”



“Fig.2” A functional block diagram of the facial recognition system.

IV. IMAGE PRE-PROCESSING AND RESIZE

The image pre-processing procedure is a very important step in the facial expression recognition task. The aim of the pre-processing phase is to obtain images which have normalized intensity, uniform size and shape. Finally, the images were scaled to the same size of 128 × 128 pixels. Fig. 3 shows examples of images after the pre-processing.

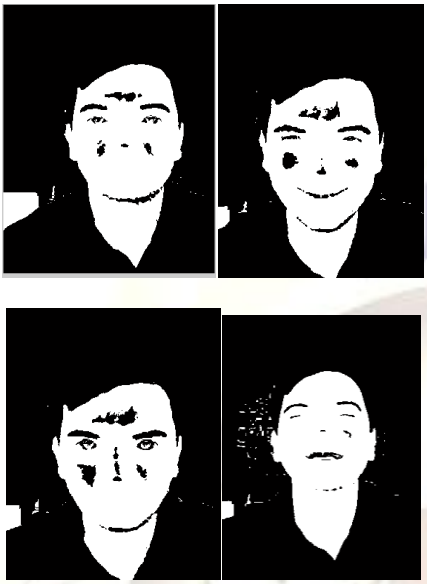
4.1. Color space transformation and lighting compensation

In order to apply to the real-time system, we adopt skin-color detection as the first step of face detection. Due to YCbCr color space transform is faster than other approaches [7][8]. We select this transform to detect human skin. However, the luminance of every image is different. It results that every image has different color distribution. Therefore, our lighting compensation is based on

luminance to modulate the range of skin-color distribution. First, we compute the average luminance Yaveg of input image.

$$Yaveg = Yi,j \quad (1)$$

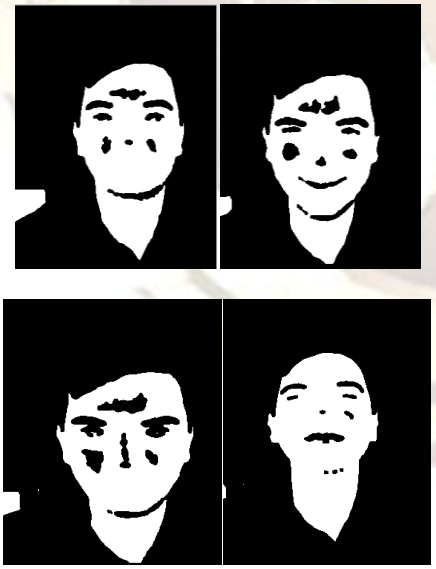
where Yi,j = 0.3R + 0.6G + 0.1B, Yi,j is normalized to the range (0,255), and i, j are the index of pixel.



"Fig.3" showing results of pre-processing step

4.2. High frequency noisy removing

Noise is removed by using noise removal algorithm. The algorithm is implemented in MATLAB. The result of noise removal is shown below:-

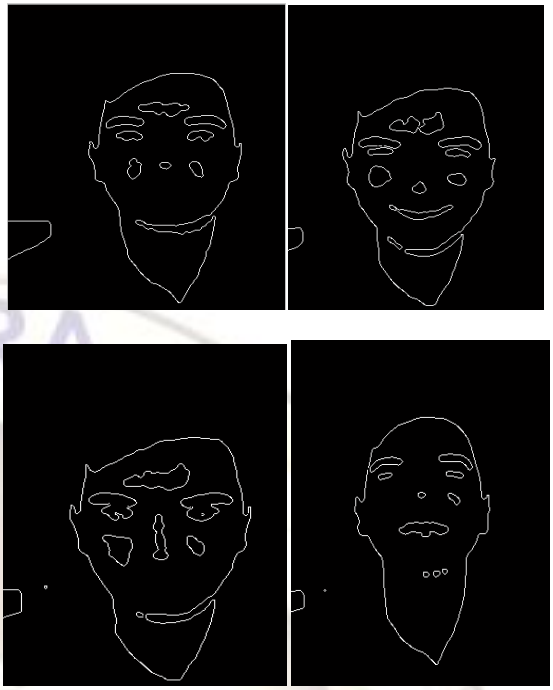


"Fig.4" showing results after noise removal

V. EDGE DETECTION AND SIZE REDUCTION

5.1 Edge Detection

Edges are detected by using commands of image processing tool box in MATLAB. Through edges we got end point of features from the images like eyes and lips. The results of edge detection are shown in "fig.4".



"Fig.5" showing results of edge detection

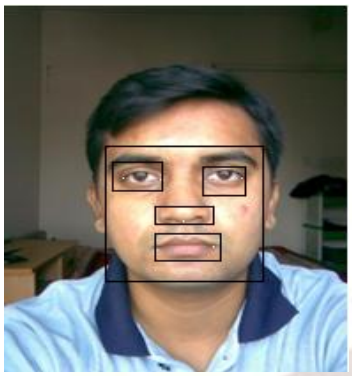
5.2 Size Reduction

A technique now commonly used for dimensionality reduction in computer vision particularly in face recognition is principal components analysis (PCA). PCA techniques also known as Karhunen-Loeve methods, choose a dimensionality Reducing linear projection that maximizes the scatter of all projected samples. The feature vectors were normalized to zero mean and further compressed using a linear data reduction method called the Principal Component Analysis [9],[10].The PCA is an orthogonal linear transformation that transforms the data to a new coordinate system such that the variance by any projection of the data is the largest forth first coordinate (called the first principal component),and then decreases along coordinates reaching the smallest value for the last coordinate. Assuming that the high variance of the data describes interesting dynamics and that low variances are linked to noise, the reductionof data dimensionality can be achieved by keeping high order principal components and ignoring lower-order ones.

VI. FACE FEATURE EXTRACTION

One common method is to extract the shape of the eyes, nose, mouth and chin, and then distinguish the faces by distance and scale of those organs. The selection face features is crucial to face recognition. To locate vital feature property of angle invariance is used[11]. The five features points have been used, all features are in the form of distance.

- Feature 1 width of left eye
- Feature 2 width of right eye
- Feature 3 width of nose
- Feature 4 width of mouth corners
- Feature 5 width of face



"Fig.6" showing 5 vital features

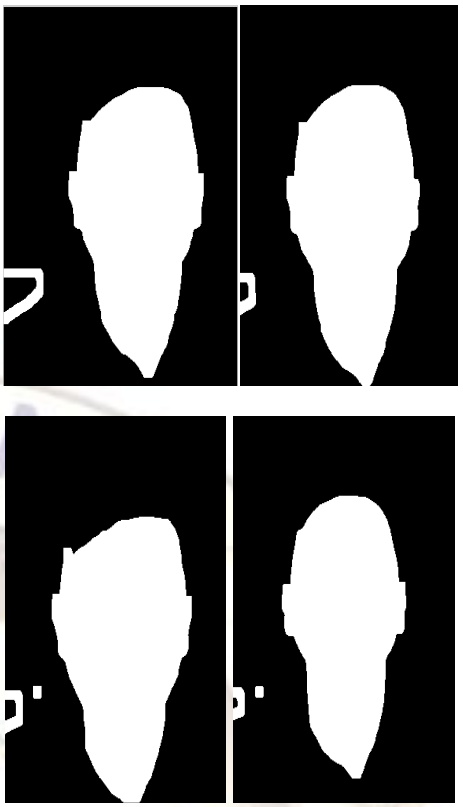
These features help in recognition of emotions. Every emotion have different values of feature vectors[11]. The value of feature vector represents absolute between features points.

VII. FACE DETECTION

Face localization aims to determine the image position of a single face; this is a simplified detection problem with the assumption that an input image contains only one face. The main concern of face detection is to identify all image regions which contain a face regardless of its orientation, background and lighting conditions. Such task is tricky since faces can have a vast assortment in terms of shape, color, size or texture[12]. At present time a lot of automatic approaches involve detecting faces in an image. By using threshold to separate skin region from an image for face detection was chosen in this algorithm.

6.1 Find Skin Color Blocks

There are several skin color regions in human face. in order to mark these regions we store four vertices of rectangle or every region. First, find the leftmost, rightmost, upmost and lowermost points. By these four points a rectangle is created around this region. Thus several skin color blocks called candidate blocks are found [12]. The results are shown in fig 7



"Fig.7" result of face detection algorithm

VIII. DISTANCE MEASUREMENT

7.1 Euclidean distance

If the features have n-dimensions then the generalized Euclidean distance formula between the feature points is given by

Euclidean Distance(u,v)=

$$\sqrt[2]{(x1 - y1)^2 + (x2\text{-}y2)^2 \_ \_ \_ \_ \_ (xn\text{-}yn)^2}$$

In this way we also calculate other distances between any features points

IX. EMOTION RECOGNITION

The recognition of emotions is based on the calculation of distances between various features points. In this step comparison between distances of testing image and neutral image is done and also it selects the best possible match of testing image from train folder. It also classifies or recognises the emotions on the basis other distances calculated. And the final results are displayed. In final results best match from training images is also shown and a text file Result.txt is displayed in MATLAB window.

X. RESULTS

We evaluated proposed algorithm by 50 still images. The size of image is 600 × 800 pixels.

The experimental result shows that our algorithm can identify 30 emotions in our test image. Besides, the identification of emotions this algorithm also shows the distance of test image from neutral image and the best match of test image from trained images. There by our proposed algorithm is suitable for use in real-time systems with high performance.

XI. CONCLUSION

In this paper, we proposed an accurate and high speed emotion detection system. The color and feature-based detections were adopted to find skin-color fast and selected candidate blocks carefully. We used lighting compensation to improve the performance of color-based scheme, and reduce the computation of feature-based scheme. The major contribution of this paper is that the proposed method can detect edges of the images and from that edges distance between various features is calculated by using Euclidean distance Formulae. This distance is different for every image posing different emotions. On the basis of this distance emotions are classified. In future work, the proposed approach can be applied to hardware implementation. Due to the proposed method has simple structure, it is suitable to be implemented in hardware to achieve very high performance and low power system.

REFRENCES

[1] Krishna Mohan KudirP, Abas Md Said, M Yunus Nayan "Emotion Detection Using Sub-image Based Features through Human Facial Expressions" International Conference on Computer & Information Science (ICCIS) 2012 volume 1.

[2] Mehrabian , "A. Communication without words" , Psychology Today,1968, 53-56.

[3] Lajevardi, S.M.; Lech, M.; "Facial Expression Recognition Using Neural Networks and Log-Gabor Filters", Digital Image Computing: Techniques and Applications IEEE 2008.

[4] Guodong Guo , Charles R. Dyer, "Simultaneous Feature Selection And Classifier Training Via Linear Programming" A Case Study For Face Expression Recognition Proceedings of the IEEE Computer Society Conference on Computer Vision and Pattern Recognition (CVPR'03) vol.1 2003, On page(s): I-346 - I-352.

[5] Liyiiig Miit, Yepi .Yiaott A-. Kliomsciriit, Rubub Kreidieh Wclrdtt,, "A New Facial Expression Recognition Technique Using 2-D Dct And KMeans Algorithm" International Conference on Image Processing (ICIP) in 2004.

[6] L. Ma and K. Khorasani , "Facial Expression Recognition Using Constructive Feedforward Neural Networks", , IEEE transactions on systems, man, and cybernetics—part b: Cybernetics, vol. 34, no. 3, June 2004.

[7] S. Gundimada, Li Tao, and v. Asari, "Face detectiontechnique based on intensity and skin color distribution,"in 2004 International Conference on Image Processing, Otc. 2004, vol. 2, pp. 1413–1416.

[8]. K. P. Seng, A. Suwandy, and L.-M. Ang, "Improved automaticFace detection technique in color images," in *IEEERegion 10 Conference TENCON 2004*, Nov. 2004, vol. 1, pp. 459–462

[9] Smith, L.I., "Tutorial on Principal Component Analysis" in 2002

[10] M. Turk, A. Pentland, "Eigenfaces for Recognition",Journal Cognitive Neuro-science, Vol. 3, 1991, pp.71-86.

[11] Ritesh Vyas, Gourav Garg, "face recognition using feature extraction and neuro-fuzzy techniques", International Journal of Electronics and Computer Science Engineering in 2012.

[12] Yu-Ting Pai, Shanq-Jang Ruan, Mon-Chau Shie and Yi-Chi Liu, —"A Simple And Accurate Color Face Detection Algorithm In Complex Backgroundl", Low Power Systems Lab, Department of Electronic Engineering, National Taiwan University of Science and Technology, No.43, Sec.4, pp. 1545 – 1548.