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Facial Expression Recognition Using Fuzzy Art

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***Abstract* - Facial expression recognition is the fast growing and ever green research field for computer vision, Artificial Intelligence and Automation. It has the important role in Human – Computer Interaction. The facial expression recognition finds major application in areas like social interaction and social intelligence. This paper presents a method for Facial Expression Recognition using Fuzzy Art. This method aims to recognize emotions in human subjects on a computer, whose facial expression are analysed by segmenting & localizing the individual frames in to regions of interest. Experimental results show that the detection accuracies of emotions for adult male, adult female, and children of 8–12 years are as high as 88%, 92%, and 96%, respectively, outperforming the percentage accuracies of the existing method .**

***Keywords* - Facial Emotion Detection, Fuzzy Logic, Human computer interaction (HCI), Image processing**

I. INTRODUCTION

Facial expression analysis has been attracting considerable attention in the advancement of human machine interface since it provides a natural and efficient way to communicate between humans. Some application areas related to face and its expressions include personal identification and access control, video phone and teleconferencing, forensic applications, human-computer interaction, automated surveillance, cosmetology, and so on. But the performance of the face detection certainly affects the performance of all the applications.

Facial Expression Recognition began from 1970s when Ekman and Friesen introduced six universal facial expressions that are happiness, sadness, anger, fear, surprise, and disgust. In addition, they developed Facial Action Coding System (FACS) that is a famous framework which describes human's facial expressions based on action units (AUs) [4].

Many methods have been proposed to detect human face in images, they can be classified into four categories: knowledge-based methods, feature-based methods, template based methods and appearance-based methods [5]. The core of our system is a Fuzzy Art Based system which is used for facial expression recognition from facial features. Fuzzy logic can be used to form linguistic models and comes with a solid qualitative base. This system recognizes six basic facial expressions namely fear, surprise, joy, sad, disgust and anger.

Rest of this paper is organized as follows. In section 2, brief review of proposed system is given. In section 3 various modules for face detection are described.

II. PROPOSED SYSTEM:

The Proposed System provides an alternative scheme for human emotion recognition from facial images, and its control, using fuzzy logic. Fuzzy C-means (FCM) clustering is used for the segmentation of the facial images into three important regions containing mouth, eyes, and eyebrows. The exact emotion is extracted from fuzzified emotions by a denormalization procedure similar to defuzzification. The proposed scheme is both robust and insensitive to noise because of the nonlinear mapping of image attributes to emotions in the fuzzy domain. Experimental results show that the detection accuracies of emotions for adult male, adult female, and children of 8–12 years are as high as 88%, 92%, and 96%, respectively, outperforming the percentage accuracies of the existing techniques.

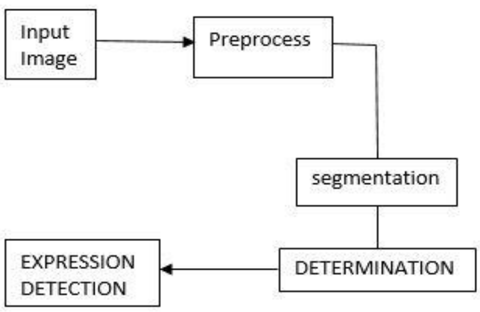

Fig 1 : Block Diagram Of Proposed Method

III. FACE DETECTION MODULE:

Preprocessing Module

We follow a number of steps to get expressions from an image. In our method, first module is mostly focus on image preprocessing. In this module first we convert binary image from RGB image. For converting binary image, we calculate the average value of

RGB for each pixel and if the average value is below than 110, we replace it by black pixel and otherwise we replace it by white pixel. By this method, we get a binary image from RGB image.

Face region detection

Here we try to find the forehead from the binary image. We start scan from the middle of the image, then want to find a continuous white pixels after a continuous black pixel. Then we want to find the maximum width of the white pixel by searching vertical both left and right site. Then, if the new width is smaller half of the previous maximum width, then we break the scan because if we reach the eyebrow then this situation will arise. Then we cut the face from the starting position of the forehead and its high will be 1.5 multiply of its width as shown fig 2.

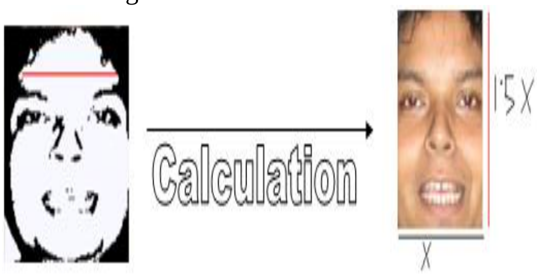

Fig 2: face detection

Segmentation and Determination of mouth module

This module is used the mouth region, we first represent the image in the L * a * b space from its conventional red–green–blue (RGB) space. The L * a * b system has the additional benefit of representing a perceptually uniform color space. It defines a uniform matrix space representation of color so that a perceptual color difference is represented by the Euclidean distance. The color information, however, is not adequate to identify the lip region. The position information of pixels together with their color would be a good feature to segment the lip region from the face. The Fuzzy C-means clustering algorithm that we employ to detect the lip region is supplied with both color and pixel-position information of the image. This module use in image segmentation in general and lip region segmentation in particular is a novel area of research.

Determination of MO in a black and white image is easier because of the presence of the white teeth. A plot of the average intensity profile against the MO reveals that the curve has several minima, out of which the first and third correspond to the inner region of the top lip and the inner region of the bottom lip, respectively. The difference between the preceding two measurements along the Y-axis gives a measure of the MO[2].

Segmentation & Determination of the Eye Region and Eyebrows

Fig 3: finding the middle position of face

The eye region in a monochrome image has a sharp contrast to the rest of the face. Consequently, the thresholding method can be employed to segment the eye region from the image. Images grabbed at poor illumination conditions have a very low average intensity value. Segmentation of the eye region in these cases is difficult because of the presence of dark eyebrows in the neighborhood of the eye region. To overcome this problem, we consider images grabbed under good illuminating conditions.

After segmentation of the image, we need to localize the left and right eyes on the image. For eyes detection, we convert the RGB face to the binary face. Now, we consider the face width by W. We scan from the W/4 to (W-W/4) to find the middle position of the two eyes as shown in figure 3. The highest white continuous pixel along the height between the ranges is the middle position Of the two eyes.

Then we find the starting high or upper position of the two eyebrows by searching vertical. For left eye, we search w/8 to mid and for right eye we search mid to w – w/8. Here w is the width of the image and mid is the middle position of the two eyes. There may be some white pixels between the eyebrow and the eye. To make the eyebrow and eye connected as shown in figure 4, we place some continuous black pixels vertically from eyebrow to the eye. For left eye, the vertical black pixel-lines are placed in between mid/2 to mid/4 and for right eye the lines are in between mid+(w-mid)/ 4 to mid+3*(w-mid)/ 4 and height eye the lines are in between mid+(w-mid)/ 4 to mid+3*(w-mid)/ 4 and height of the black pixel-lines are from the eyebrow starting height to (h-eyebrow starting position)/4.Here w is the width of the image and mid is the middle position of the two eyes and h is the height of the image. Then we find the lower position of the two eyes by searching black pixel vertically. For left eye, we search from the mid/4 to mid - mid/4 width. And for right eye, we search mid + (w-mid)/ 4 to mid+3*(w- mid)/ 4 width from image lower end to starting position of the eyebrow. Then we find the right side of the left eye by searching black pixel horizontally from the mid position to the starting position of black pixels in between the upper position and lower position of the eye br. And left side for right eye we search mid to the starting position of black pixels in between the upper position and lower position of right eye. The left side of the left eye is the starting width of the image and the right side of the right eye is the ending width of the image. Then we cut the upper position, lower position, left side and the right side of the two eyes from the RGB image.

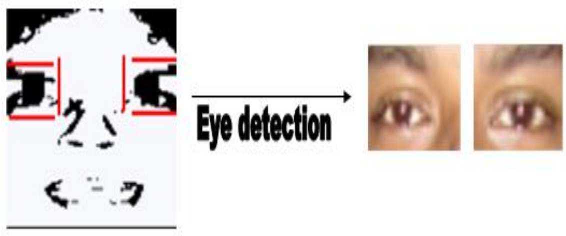

Fig 4 : Segmentation of Eye region

Emotion Detection

For emotion detection of an image, we have to find the Bezier curve of the lip, left eye and right eye. Then we convert each width of the Bezier curve to 100 and height according to its width. If the person's emotion information is available in the database, then the program will match which emotion's height is nearest the current height and the program will give the nearest emotion as output.If the person's emotion information is not available in the database, then the program calculates the average height for each emotion in the database for all people and then get a decision according to the average height.

IV. CONCLUSION AND FUTURE ENHANCEMENT

The Proposed scheme repeatability ensures the right selection of audiovisual stimulus. The proposed scheme of emotion recognition and control can be applied in system design for two different problem domains. First, it can serve as an intelligent layer in the next generation human–machine interactive system. Such a system would have extensive applications in the frontier technology of pervasive and ubiquitous computing. This scheme will used in developing emotion sensitive HCI interfaces. Second, the emotion monitoring and control scheme would be useful for psychological counseling and therapeutic applications. This is going to have an impact on our day to day life by enhancing the way we interact with computers or in our surrounding living and work places. In future we can develop this scheme with web camera to capture images of peoples and recognition of their emotions.

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