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Pasumarthi Bindu Priya , Dr Marlapalli Krishna

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Facial Expression Recognition System

[1*]Pasumarthi Bindu Priya , [2] Dr Marlapalli Krishna

[1*]M.Tech Student, Dept. of CSE, Sir C.R.Reddy College of Engineering, Eluru, AP, India.
pasumarthipriya498@gmail.com

[2]Professor, Dept. of CSE, Sir C.R.Reddy College of Engineering, Eluru, AP, India.
marlapallikrishna@gmail.com

Abstract: Emotion recognition is a prominent tough problem in machine vision systems. The significant way humans show emotions is through facial expressions. In this paper we used a 2D image processing method to recognize the facial expression by extracting of features. The proposed algorithm passes through few preprocessing steps initially. And then the preprocessed image is partitioned into two main parts Eyes and Mouth. To identify the emotions Bezier curves are drawn for main parts. The experimental result shows that the proposed technique is 80% to 85% accurate.

Keywords: Facial Emotion, Binary Conversion, Bezier Curve, Hausdorff Distance

1. INTRODUCTION

Facial Expression Acknowledgment (FER) has been drastically evolved as of late, on account of the progressions in related fields, particularly AI, picture handling and human perception. In like manner, Impact and possible use of programmed FER have been developed in a broad range of applications, including contact between human PC, robot power, and driver condition reconnaissance. Be that as it may, until this point in time, vigorous acknowledgment of outward appearances from pictures and recordings is as yet a difficult undertaking because of the trouble in precisely separating the helpful passionate highlights. These highlights are regularly spoken to in various structures, for example, static, dynamic, point-based geometric or area based appearance. Facial development highlights, which incorporate element position and shape changes, are by and large brought about by the developments of facial components and muscles over the span of passionate demeanor [5]. The facial components, particularly key components, will continually change their positions when subjects are communicating feelings. In this way, for any element speaking to a specific feeling, the geometric-based position and appearance-based shape regularly changes starting with one picture then onto the next picture in picture databases, just as in recordings. This sort of development highlights speaks to a rich pool of both static and dynamic qualities of articulations, which assume a basic job for FER.

- Knowledge-based methods
- Feature-based methods
- Template -based methods
- Appearance-based methods.

At the point when utilized independently, these strategies can't take care of the considerable number of issues of face recognition like posture, demeanor, direction, and impediment. Most of the facial expression recognition methods reported to date are focused on recognition of six primary expression categories such as: happiness, sadness, fear, anger, and disgust and grief [1]. In mid 70s Ekman and Finsen developed Facial Action Coding System (FACS), which provides the detailed description of facial expression. In their designed system the face muscle motions are divided into 44 action units and facial expression is described by their combinations [4].

2. PROPOSED METHODOLOGY

There is an inaccurate location and tracking of facial points. Also Pose, movement and rotation of the test person are limited. Glasses may hinder classification, especially thick and dark frames in detecting emotions [1]. Face Reader can analyze one face at a time. Face Reader cannot classify facial expressions in test persons with a partial facial paralysis. The flow diagram of the proposed methodology is shown in figure 1.

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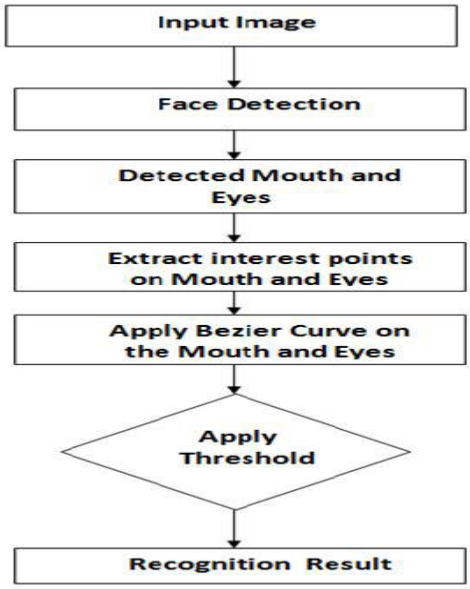

Figure 1: Flow Diagram of the proposed Methodology.

2.1 Contrast Stretching

Differentiation extending (regularly called standardization) is a basic picture upgrade method that endeavors to improve the difference in a picture by 'extending' the scope of power esteems it contains to traverse an ideal scope of qualities, for example the full scope of pixel esteems that the picture type concerned permits. It contrasts from the more complex histogram leveling in that it can just apply a straight scaling capacity to the picture pixel esteems. Accordingly the 'upgrade' is less cruel.

2.2 The Skin Colour Conversation

Skin-concealing Transformation system is taken into account as a convincing instrument for face distinguishing proof since its invariant to changes scale, way and blockage. At this time, propose to use the YCbCr concealing space for 2 reasons: 1. By using YCbCr concealing space, we are able to abstain from anyway very much like might be normal the assortment of luminance fragment realized by the lighting condition. 2. The YCbCr space is extensively employed in modernized video coding applications. YCbCr could be a concealing space that separates the luminance from the concealing information. Luminance is encoded within the Y and therefore the blueness in Cb and therefore the redness in Cr. it's extraordinarily basic likewise convert from RGB to YCbCr : Examination of YCrCb concealing space on human skin concealing.

Any RGB computerized picture will be changed over into YCrCb shading space utilizing following condition:

$$Y = 0.299R + 0.587G + 0.114B$$
$$Cb = -0.169R - 0.331G + 0.500B$$
$$Cr = 0.500R - 0.419G - 0.081B$$

2.3 Connected Component Labeling

Associated segment naming (on the other hand associated part examination, mass extraction, locale marking, mass disclosure, or area extraction) is an algorithmic use of diagram hypothesis, where subsets of associated segments are remarkably named dependent on a given heuristic. Associated part naming isn't to be mistaken for segmentation. Connected-segment naming is utilized in PC vision to recognize associated areas in parallel advanced pictures, in spite of the fact that shading pictures and information with higher dimensionality can likewise be handled. At the point when coordinated into a picture acknowledgment framework or human-PC collaboration interface, associated part naming can work on an assortment of data.

2.4 Binary Conversion of the Image

A picture that has two potential qualities for every pixel is known as a paired picture. Commonly, the two hues utilized for a twofold picture are high contrast though any two hues can be utilized [6]. The shading used for the object(s) in the picture is the frontal area shading while the rest of the picture is the foundation shading [3].

2.5 Extraction of eye and mouth

The Eye extraction involves the following four steps as shown in figure 2.

i. Morphology-based edge picture.
ii. Beginning rectangular squares to limit the eyes.
iii. Removed eye shapes.
iv. Last milestone focuses for eye shapes.

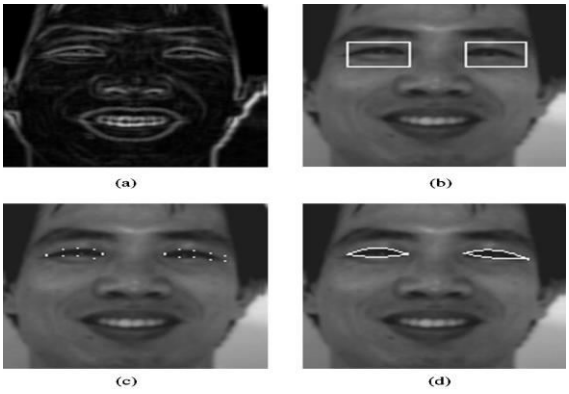

Figure 2: Eye Extraction Steps

The Mouth extraction involves the following four steps as shown in figure 3.

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i. Morphology-based edge picture.
ii. primary rectangular square to keep the mouth.
iii. Final milestone focuses for mouth forms.
iv. Extracted mouth forms.

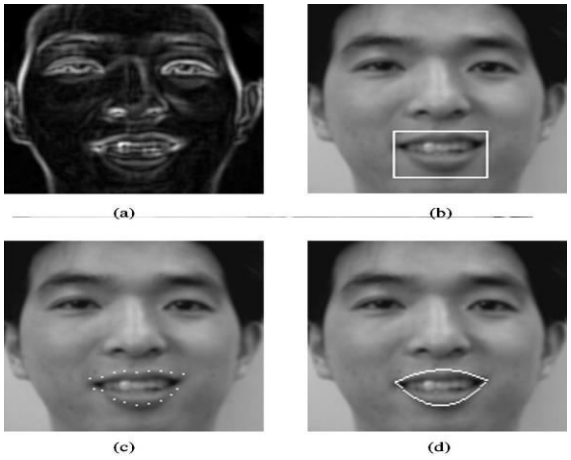

Figure 3: Mouth Extraction Steps

2.6 Bezier Curves Detection [6]

A Bezier twist could be a parametric curve as regularly as conceivable utilized in PC representations and related fields. Moreover Bezier curves are used in the time territory, mostly in animation and interface plan [6]. Bezier curves with their control points is shown in Figure 4.

The recursive formula which are used to decide coordinate locations is obtained by:

$$BEZk,L(t) = (1-t)\cdot BEZk,L-1(t) + t\cdot BEZk,L-1 + t\cdot BEZk-1,L-1(t)$$

where $BEZk,k(t) = t^k$ and $BEZ0,k(t) = (1-t)^k$.

The Bezier curve [6] individual coordinates are characterized by pair of parametric equations given below:

$$x(t) = \sum_{k=0}^{L} xkBEZk,L(t)$$
$$y(t) = \sum_{k=0}^{L} ykBEZk,L(t)$$

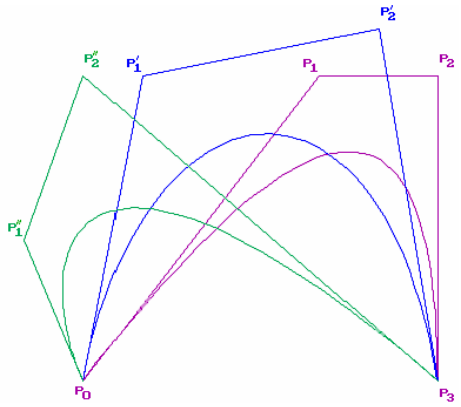

Figure 4: Bezier curves and their control points.

2.7 Facial Emotion with Hausdorff Distance [6]

There are two tables for individual data and files with four emotions of their own twists in the exterior review of appearance in the planning of data bases[7]. To know the face feeling, a synchronization communication between an info-photo and the images in the database has to be processed between each intrigue-area. The Bezier curves are used on the facial expressions. We first standardize moves that change over each width of the Bezier bend to 100 and its tallness according to its width to determine a co-ordination of similarity. We use the Hausdorff separation at this stage to look at the metric structure of them [6].The distance dH(p,q) between two curves p(s),s ∈ [a,b] and q(t),t ∈ [c,d] is given in the following equation.

$dH(p,q) = \max\{ \max_{s\in[a,b]} \min_{t\in[c,d]} |p(s)-q(t)|, \max_{t\in[c,d]} \min_{s\in[a,b]} |p(s)-q(t)|\}$ [6].

The principal lines of subject(FACE) and control points in normal expression and in happy expression are shown in figure 5.

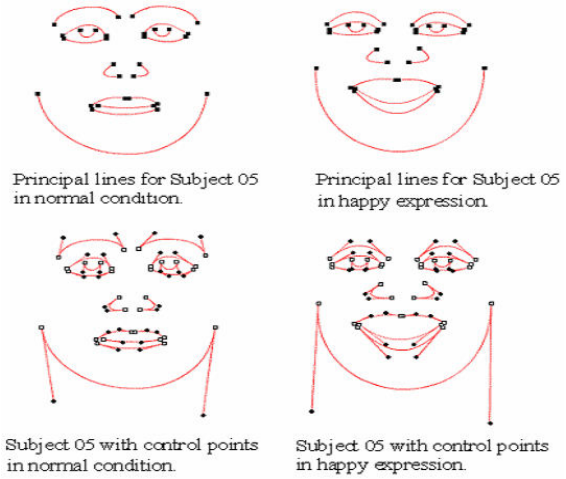

Figure 5: Face Data (Normal and Happy)

3. RESULTS AND DISCUUSION

The algorithm is a two step process. In the first step, skin color segmentation is detected in the facial region, and the feature map is calculated for the eye and mouth regions. In second step Bezier curve and the Hausdorff distance are used to verify the characteristic features of facial emotion. Results were taken by experimenting with 50 (Fifty Samples) for each of the expression Smile, Sad, Surprise, Ambiguous and Neutral respectively and recorded their correctness. The average Accuracy of the algorithm is obtained as 84%. The results are presented in Table 1.

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Table 1: Correctness of Different Expressions

Expression	Correctness	Miss	% of Correctness
Smile	44	6	88.0%
Sad	45	5	90.0%
Surprise	42	8	84.0%
Ambiguous	38	12	76.0%
Neutral	41	9	82.0%
Average Accuracy			**84.0%**

4. CONCLUSIONS

This undertaking proposes another methodology for perceiving the class of outward appearance. We have built the articulation models by utilizing normal Bezier bends from a few subjects. Right now, extraordinary outward appearances of in excess of 50 people pictures have been dissected. Right now, Bezier bend has been used to identify the face blueprints and looks of the submission. The range of the Bezier cubic bends means that only four control focuses are necessary to talk to a bend. For example, by improving the Eye-Lip recognition system, there is a great deal of degree for the assignment to study , and assessing the errand for pictures taken at different focuses and more significant standards. Significant improvement is identified by in the proposed system and promising results are obtained under face registration. As future scope we propose to extend this methodology to videos too.

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