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Emotion Recognition by analysing statistical features of cropped eyebrow portion as a Region of Interest of facial expression image

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Abstract

In this paper, an approach of emotion recognition is carried out by analysing statistical features. In the proposed work firstly on JAFFE standard database ROI considered. Since eyebrow, mouth, nose, left eye, and right eye these portions of facial image plays vital role in finding human emotions. The cropped eyebrow images of different emotions of facial images are considered for calculating statistical feature. In this proposed work unique statistical feathers have been calculated to identify specific emotion of human being. The statistical features like mean, median, mode, standard deviation median Abs. Dev and mean Abs. Dev Calculated for each eyebrow image. By analysing these statistical features human emotions like happy, sad, angry, fear, disgust, surprise and neutral recognizes very accurately.

Keywords: *Emotion Recognition, ROI, Statistical features, JAFFE*

INTRODUCTION:

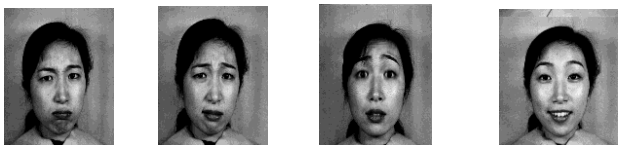
Human communication includes spoken language and non-verbal communication. Facial expression and tone of the voice are used by the human to express their feelings and hence their emotions. The interaction between human and computer will be more natural if computers are able to understand the emotions of human being.

Facial motion and tone of the speech plays a major role in expressing these emotions. Several approaches have been proposed [Ref.2, 3, 4, 5] to recognize human emotion based on facial expression or speech.

Broadly two approaches can be used to identify human emotions those are through verbal and non-verbal communications of human being are useful to find human emotions. Among these two approaches verbal (by using speech); which is not so feasible and strong to justify human emotions. Because Mehrabian [1] indicates that the verbal part (i.e. spoken words) of a message contributes only for a 7% of the effect of the message, the vocal part (i.e. voice information) contributes for 38% while facial expression of the speaker contributes for 55% of the effect of the spoken message. Therefore non verbal (by using facial expression) communication plays major and most effective role in finding exact emotions of human being, the proposed work focuses on this method. Also extraction of facial feature points is very important part in many applications like face recognition, expression recognition, and face detection. In this paper, facial feature like eyebrows, eyes, mouth and nose are extracted using SUSAN edge detection operator, facial geometry, and edge projection analysis. JAFFE facial database has used for experimental work.

ABOUT JAFFE DATABASE:

Facial expression database in six universally recognize basic emotions and neutral one is collected from Japanese female database [6]. Ten expressers posed 3 to 4 examples of each of the six emotions along with neutral one for a total of 219 images of facial expressions. This data was prepared when expresser look into the away 0 expose all expressive zones of the face. Tunggsten lights were positioned to create even illumination on the face. The box enclosed the region between camera and plastic sheet to reduce back reflections. The images were printed in monochrome and digitized using flatbed scanner. Sample images are shown in the fig.1



(Fig.1-1 Sample Database from JAFFE

METHODOLOGY:

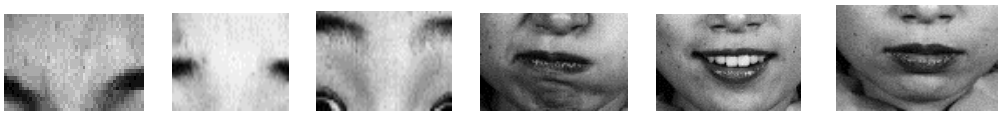
The proposed work focuses on RIO which is responsible for identifying the emotion. The eyebrow, mouth and nose these portions of facial expression image plays very important role in emotion recognition. The proposed work carried out as per the steps given in the following algorithm.

The algorithm for emotion Recognition

1. Read all facial images of different emotions
2. Crop RIO (such as eyebrow, nose, mouth, and eyes)
3. Calculate statistical features like mean, median, standard deviation, mean absolute deviation and median absolute deviation.
4. Stored statistical values in the worksheet (statistical features of eyebrow).
5. By analyzing the statistical values for eyebrow, specific emotion is identified
6. Stop

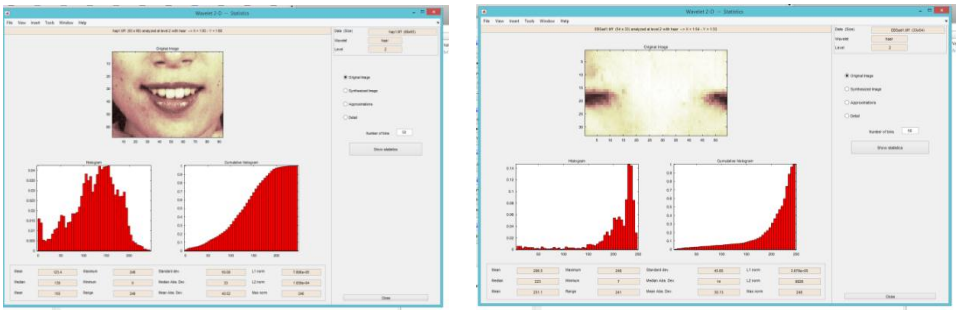
In the proposed work we need to read all facial expression images of different emotions. After reading all images we have cropped the only some facial parts like eyebrow, mouth, nose and eyes of these facial images. These portions are represented in the following fig.2.

Cropped Eyebrow portion facial images Cropped Mouth portion of facial image

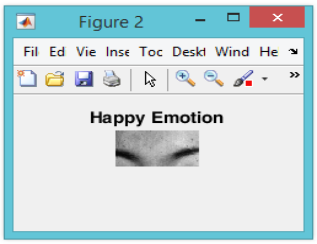


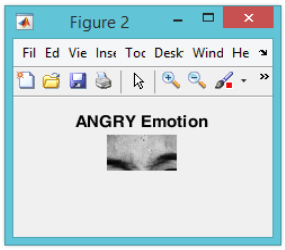
Angry Sad Surprise Angry Happy sad

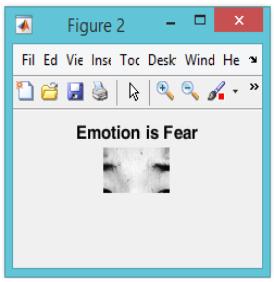
In the next phase of our experiment we have considered all these cropped eyebrow portions of facial images for calculating the statistical features like mean, median, standard deviation, mean absolute deviation and median absolute deviation.

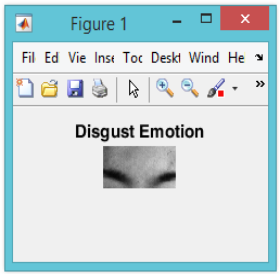


Statistical features using Wavelet toolbox for cropped mouth and eyebrow









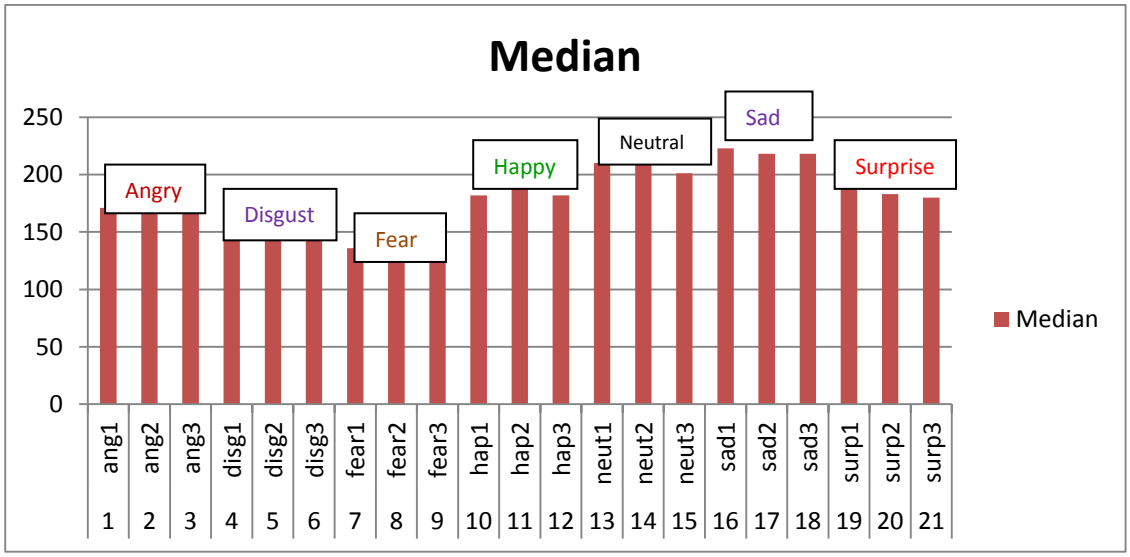
Sr_No	Image file	Mean	Median	Mode	Std.deviation	Median.Abs. deviation	Mean.Abs .Dev
1	ang1	154	171	178	49.84	18	37.38
2	ang2	148.5	170	194.1	56.54	24	44.86
3	ang3	147.7	167	177	53.01	23	41.5
4	disg1	136.3	150	171.9	47.02	25	37.01
5	disg2	136.7	148.5	177	47.05	28.5	37.51
6	disg3	139.4	153	171.9	47.47	26	37.49
7	fear1	130.9	136	123	49.2	28	37.61
8	fear2	132.9	136	122.4	47.99	30	37.32
9	fear3	136.3	142	137	49.1	31	38.13
10	hap1	171.7	182	199	43.81	23	32.48
11	hap2	173.4	189	203	46.1	23	35.58
12	hap3	168.2	182	201.1	46.21	25	35.97
13	neut1	184.4	210	229.9	53.93	16	43.51
14	neut2	184.4	209	219.9	53.97	20	44.14
15	neut3	176.8	201	216.4	53.13	19	43.56
16	sad1	206.5	223	231.1	45.65	14	30.13
17	sad2	100.8	218	230	48.57	16	33.01
18	sad3	198	218	224.7	47.38	13	33.88
19	surp1	160.4	188	218	67.16	30	54.75
20	surp2	158	183	218.4	65.91	32	53.6
21	surp3	155.3	180	205.3	64.71	30	52.36

RESULT

In the above table the statistical features of cropped eyebrow calculated by using wavelet transform tool in matlab. The statistical features like mean, median, mode, standard deviation, mean absolute deviation and mode absolute deviation are shown in the above table. If we focus on median value, we can say these values are very closure for each independent emotion. Following table shows the median values which ranges for specific emotion.

Sr_No	Emotion Type	Median Value Range	Median values mixed with other emotion
1	Angry	167-171	No
2	Disgust	148-153	No
3	Fear	136-142	No
4	Happy	182-189	Yes (overlapping)
5	Neutral	201-210	No
6	Sad	218-223	No
7	Surprise	180-188	Yes (overlapping)

From above table we can say the median values for angry, disgust, fear, neutral, and sad emotions gives 100% accuracy rate. But for Happy and Surprise the median values are mixing with each other. Therefore for happy and surprise emotion, there is a need to consider other statistical features. Then we have focused on the values of standard deviation for happy and surprise. Here we got the unique values for both the emotions. The standard deviation values for happy ranges from 43-47 and for surprise 64-68. By considering standard deviation for happy and surprise emotion, the recognition rate for these two emotions is 100%. Hence we got 100% accuracy rate for all basic emotions i.e. happy, sad, angry, disgust, surprise, fear and neutral. The same results are shown in the following graph.



SCOPE AND FUTURE WORK :

In future we are going to focus on cropped facial portion like eyebrow, mouth, and nose to recognize specific emotions by using neural network.

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