 ISSN: 2321-8169
1575 – 1588

Facial Emotion Identification

Rashmi S. Deshpande[1] Prof. Dr. Mrs. S.D.Apte[2]
E&TC Department, JSPMs Rajarshi Shahu College of Engineering, Pune
rashmi.deshpande19@gmail.com[1] sdapte@rediffmail.com[2]

Abstract: Facial expression recognition plays major role in pattern recognition and image processing. For the facial expression recognition three phases are used. Face detection, feature extraction, classification. In this work we present a method for identification of Facial expressions from facial expression database. Firstly, image is taken from database, sequentially pre processing on every image of database is done. Then from those images features are extracted using Gabor Filters. In this paper, JAFFE database is used. It consists of six basic facial expression emotions. The JAFFE database is used to train and evaluate algorithm. In this work, Global feature based matching method is used that is whole face is used as input to recognition system. The proposed system will developed by local feature based matching method, local features such as eyes, mouth extraction using Gabor filter. The SVM will be used for features classification.

Keywords: *Feature Extraction, Gabor filter, classifier, facial expression*

*****

I. INTRODUCTION

In face to face interaction facial expression with other gestures , convey non-verbal communication . The speaker's facial expression gives about 55 percent of the effect,38 percent of the expression is conveyed by voice intonation and 7 percent by the spoken words. Facial expressions can play an important role wherever humans interact with machines. Automatic facial expression recognition may act as a prime component of natural human machine interfaces. Facial expression can contain a lot of information and extracting this information automatically has been continuously increasing. As there is rapid growth of computer vision and artificial intelligence, facial expression becomes very important technology of human computer interaction. The objective of facial expression is how information can be convey automatically. Facial expression recognition system (automatic) is determined by the facial expression feature. In facial expression detection of facial feature key points is very necessary. There are six basic facial expressions as follows.

Fig.1.Sample of six basic facial expressions.

II. SYSTEM OVERVIEW

Basic block diagram of Facial expression Recognition:

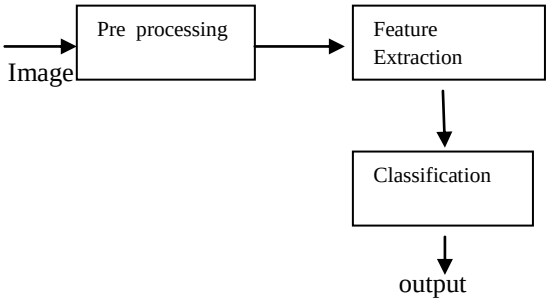


Fig.2Basic block diagram of facial expression recognition

The main approaches in facial expression recognition are given below.

1. Image Acquisition: Image used for facial expression recognition will be static image or sequences of images. Mostly grey scale facial images are most popular type of image used for facial expression recognition system. The images used can be from a standard database of images.

2. Pre-processing (Face detection) : In Image Pre-processing signal conditioning often takes place. It is in the form of noise removal and normalisation against the variation of pixel position and brightness together with segmentation, location or tracking of the face or its parts. Expression representation can be sensitive to translation, scaling and rotation of the head in the image. To solve the effect of these unwanted transformations, the facial image may be geometrically standardised to classification. This normalisation is usually based on references provided by eyes or nostrils. Segmentation is concerned with demarcations of image portions conveying facial information.

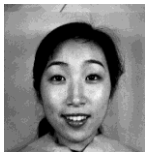
 ISSN: 2321-8169
1585 – 1588

3. Feature Extraction: Feature extraction converts pixel data into higher level representation like shape, motion, colour, texture and spatial configuration of the face or its components. The extracted representation is used for subsequent expression classification. Feature extraction generally reduces dimensions of input image. The feature extraction procedure should retain essential information possessing high discrimination power and high stability. Such dimensionality reduction may mitigate the curse of dimensionality. Geometric, kinetic and statistical or spectral transform based features are often used for classification.

Classification: Expression classification performed by a classifier which often consists of a model of pattern distribution coupled to decision procedure. A wide range of classifiers covering parametric or non parametric techniques has been applied to automatic expression recognition problem.

III. IMAGE PREPROCESSING

Image Pre-processing generally used for noise removal and further processing. Here Median filter of size 5*5 is used for noise removal. Median filter is suitable for the noises such as salt and pepper noise(Black and white spots on image).It is low pass filter which is used for smoothening the image. Median filters are popular because i. They provide excellent noise reduction capability. Ii.Particularly effective in the presence of impulse noise (Salt and Pepper). After application of Median filter, crop the image of the size (160*128).



Original Image

Smoothening of Image

Cropped face image
Fig.3 Image Pre-processing

IV.FEATURE EXTRACTION

The use of Gabor filters in extracting image features are motivated by various factors. These Gabor filters can be considered as orientation and scale tuneable edge and line detectors. Gabor filters are used in several image analysis applications including texture classification, segmentation, image recognition, image registration and motion tracking. Gabor filter can be used for facial recognition system The neighbouring region of a pixel may be described by the response of a group of Gabor filters in different frequencies and directions which have a reference to the specific pixel. In that way feature vector may formed.

Gabor filter is a linear filter. Frequency and orientation representation of Gabor filter are similar to human visual system.2D Gabor filter is Gaussian Kernel function modulated by sinusoidal plane wave. Due to convolution theorem, fourier transform of Gabor filter's impulse response is the convolution of fourier transform of harmonic function and fourier transform of Gaussian function. This filter has real and imaginary component which represents orthogonal direction. Gabor features are calculated by

$$F(x, y)=\exp(-X^2+\Upsilon^2/2\sigma^2) * \cos(2\Pi/\lambda)X$$
$$X=x\cos\Theta+y\sin\Theta,\ Y=-x\sin\Theta+y\cos\Theta$$

Where Υ = Aspect ratio, σ = Effective width
φ = Orientation, λ = Wavelength,Ψ = Phase Shift, X & Y = Pixel values

The Gabor functions for specified values of parameters, wavelength, Phase offset, aspect ratio and bandwidth will be calculated and displayed as an intensity map image in an output window.

λ- Wavelength of cosine factor of Gabor filters. Its value is specified in pixels. The value of λ =2 or greater than 2.

φ -Orientation of normal to parallel stripes of Gabor Function. It is in degrees ranges from 0 to 360.

Ψ- It is argument of cosine factor of Gabor function. Valid values are -180 to + 180.

Υ - Aspect ratio. It specifies the ellipticity of the support of Gabor function.

Υ= 1- support is circular,Υ<1- support is elongated. Vector of features is calculated by taking Euclidean distance between two images of same expression or different expression.

IV. DATABASE

In this paper JAFFE database is used. It is Japanese female facial expressions of 10 Japanese models This Database consists of total 213 grey scale images. It consists of 6 basic expressions (Happy, Angry, Sad, Surprise, Disgust, Fear and Neutral.)

ISSN: 2321-8169
1585 – 1588

V.EXPERIMENTAL ANALYSIS

In this paper first facial expressive image is taken which is of the size of 256*256.Apply low pass filter for noise removal and smoothening. After the smoothening crop the image of the size 160*128. Apply Gabor filter by specifying different parameter ϒ =0.5, ƛ = 4, Ψ = 0 & pi/2 , Orientation ω= 0,10,20,30,……..180 degrees. Now, we get Gabor image. After getting the Gabor image, apply Gabor filter on the image of database and get the Gabor features. Vector of features can be calculated by taking the Euclidean distance between two images of same expression or different expression.

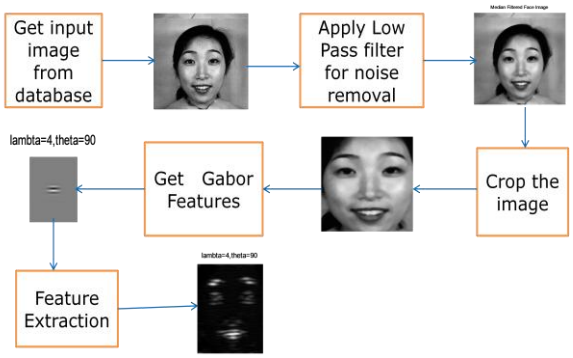


fig.4. Feature Extraction Process

VI .RESULTS

All codes are written in MATLAB. It uses Graphical User Interface.(GUI). In this paper we worked on 121 images of 4 facial expressions (Happy, Sad, Angry and Disgust).we have calculated the Euclidean distances between images of same expressions of same persons, similarly we have calculated the Euclidean distances between the images of same expressions of different persons.

The Results are as follows.

1. Sad emotion of same persons

Table1. Euclidean distance between sad images of same persons.

Name of Person	Euclidean Distance Minimum	Maximum
P1	0.0359	0.0599
P2	0.0582	0.1082
P3	0.0504	0.0182
P4	0.0424	0.0941
P5	0.028	0.0628

2. Sad emotion of different persons

Table 2. Euclidean distance between sad images of persons.

Sad image of different persons(p1 to p5)	Euclidean Distance Minimum	Maximum
Sad image 1	0.063	0.1336
Sad image 2	0.0562	0.1519
Sad image 3	0.0645	0.1782

3. Happy emotion of same persons

Table 3. Euclidean distance between happy images of same persons.

P1	0.0587	0.0709
P2	0.0326	0.0806
P3	0.0357	0.0616
P4	0.0411	0.0767
P5	0.0396	0.0845

4. Happy emotion of different persons

Table4. Euclidean distance between happy images of same persons.

Happy image of different persons(p1 to p5)	Euclidean Distance Minimum	Maximum
Happy image 1	0.0661	0.1598
Happy image 2	0.0554	0.1478
Happy image 3	0.0562	0.1613

5.Angry emotion of same persons

Table5. Euclidean distance between Angry images of same persons.

Name of Person	Euclidean Distance Minimum	Maximum
P1	0.0587	0.0709
P2	0.0326	0.0806
P3	0.0357	0.0616
P4	0.0411	0.0767
P5	0.0396	0.0845

6. Angry emotion of different persons

Table 6. Euclidean distance between Angry images of different persons.

Name of Person	Euclidean Distance Minimum	Maximum
P1	0.0641	0.123
P2	0.0649	0.1233
P3	0.0608	0.1133

7. Three emotions (Sad,Happy and Angry) of different persons

Emotion	Sad	Happy	Angry
Sad	0.1782	0.18761	0.15799
Happy	0.18761	0.1613	0.16518
Angry	0.15799	0.16518	0.1233

Table 7. Euclidean distance among three different emotions(Sad,Happy,Angry) of 5 different persons.

Table 1 to Table 7 are the Euclidean distances for three facial emotions Happy, Sad and Angry. From these minimum and maximum values, threshold value is to be determined for identification of facial expression.

From table 7 it is observed that Euclidean distance between two same emotions are less as compared to the Euclidean distance between different emotions.

VII. CONCLUSION

System operates in two modes. a. Training Mode b. Recognition Mode.

a. Training mode: In this mode, approximately 100 images from database are to be taken. Out of these 100 images, Euclidean distances for 60 images are calculated. Further analysis need to be done and accordingly threshold value will be decided for recognition.

b. Recognition Mode: In this mode remaining images from database approximately 100 images are to be taken for recognition .In this, calculated Euclidean distances from images are to be compared with threshold value in training mode and recognition rate will be determined.

VIII. REFRENCES

[1] Ligang Zhang, student member IEEE and Din Tjondronegoro, “facial expression recognition using facial movement features” IEEE transactions on affective computing, volume II, no.4, pp.219-229 Oct-Dec 2011.

[2] Fie Cheng, Jiangsheng Yu, and Huilin Xiong, “facial expression recognition in JAFFE data set based on Gaussian process classification” IEEE transaction on neural networks, volume 21, no. 10,pp.1685-1690 Oct 2010.

[3] Peter S. Aleksic, member IEEE and Aggelos K. Katsaggelos, fellow IEEE “Automatic facial expression recognition using facial animation parameters and multi stream HMMs” IEEE transactions on information forensics and security, volume I, no. 1,pp.3-11, March 2006.

[4] Mingli Song, member IEEE, Dacheng Tao member IEEE, Zicheng Liu Member IEEE, Xuelong Li Senior member IEEE and Mengchu Zhou fellow IEEE “Image ratio features for facial expression recognition application IEEE transaction on systems, Man and cybernetics, volume 40, no.3,pp.779-788, June 2010.

[5] Yongqiang Li, Shangfei Wang, member IEEE, Yong Ping Zhao and Qiang Ji Senior member IEEE “Simultaneous facial feature tracking and facial expression recognition” IEEE transitions on image processing volume 22, no. 7,pp.2559-2572, July 2013.

[6] Irene Kotsia and Ioannis Pitas Senior member IEEE, “Facial expression recognition in image sequences using geometric deformation features and support vector machines” IEEE transactions on image processing, volume 16, No.1,pp. 172-187, Jan 2007.

[7] Ketaki K Patil, Prof. S. D. Giripunje, Dr. Preeti R. Bajaj , “Facial expression recognition and head tracking in video using Gabor filter” Third international conference on engineering trends in Engineering and Technology DOI 10.1109/ICETET.147 PP.152-157,2010