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AUTOMATIC ANALYSIS OF FACIAL EXPRESSION USING GEOMETRIC PSEUDO FRONTAL VIEW PERCEPTURE ALGORITHMS

Mrs. M . Ayeesha Nasreen
PG Scholar, Department of ECE
C. Abdul Hakeem College of Engineering and Technology
Melvishram- 632 509, Vellore Dist, Tamilnadu, India
ayeeshajailani@gmail.com

Mr. G. Suresh
Professor, Department of ECE
C. Abdul Hakeem College of Engineering and Technology
Melvisharam – 632509, Vellore Dist, Tamilnadu, India

***Abstract*: Human facial expression play an important role in interpersonal relations .This is because human demonstrate and convey a lot of evident information visually rather than verbally Although humans recognize facial expressions virtually without effort or delay ,reliable expression recognition by machine remains a challenge as of today .To automate recognition of emotional state, machine must be taught to understand facial gestures .In this paper we develop an algorithm which is used to identify the person's emotional state through facial expression such as angry ,disgust, happy. This can be done with different age group of people with different situation .We use Fisher's Linear Discriminant analysis(FLD) for feature selection ,Principal Component Analysis(PCA) for dimension reduction ,Support Vector Machine(SVM) for database classification .Hence this method reduces the time taken for recognition. We increase the recognition rate more than 95.2%.**

***Index terms* –Support Vector Machine, Principal Component Analysis, Fisher's Linear Discriminant,** *(keywords)*

I. INTRODUCTION

Human beings express their emotions and feeling s in terms of their facial expressions. Emotions are expressed in terms of body gestures, in voice. Recent Psychological examine tells that most of the feelings are expressed in terms of facial expressions only. The verbal part of a message contributes only 7%, the vocal part contributes 38% and facial expression contribute 55% of information conveyed by a human.

The feeling or responses to particular situation or environment are called emotions. It is an integral part of survival, to show greeting on person should smiles, when a person is in confusion he frowns, when enraged he raises his voice., these can be understand by others.

Computers not have emotions .They are ''emotionally challenged''. They neither recognize other emotions nor possess its own emotion. We have to improve human – computer interface from point-and –click to sense-and- feel, to build up non intrusive sensors, to raise lifelike software agents such as devices, this can express and understand emotion. Computer systems have a wide range of applications in different research, areas including security, law enforcement, clinic, education, psychiatry and Telecommunications. There has been much research on recognizing emotion through facial expressions.

There are two basic emotions in emotion classification are there, Love-fear. Based on emotion classification we classify the emotion into positive and negative emotions. The seven basic emotions are angry, happy, fear, disgust, sad, surprise and neutral.. Other emotions are Embarrassments, interest, pain, shame, shy, anticipation, smile, laugh, sorrow, hunger, curiosity.

Anger can be expressed in different ways like enraged, annoyed, anxious, irritated, resentful, miffed, upset, mad, furious and raging in different situation of emotion. In different ways happy can be expressed in joy, greedy ecstatic ,fulfilled ,contented ,glad, complete, satisfied and pleased .In different way Disgust can be expressed like contempt exhausted ,peeved, upset and bored.

This research describes the emotion classification using support vector machine which uses a kernel function called the radial basis function and extract the feature using fisher's linear discriminant analysis and dimension reduction using principal component analysis.

II .EXISTING WORK

There are several approaches taken in the literature survey for learning classifiers for emotion recognition, The facial action coding system(FACS)[2]quantifying the facial movement in terms of component actions. It is used to find emotion, cognitive states and social interaction. It automatically recognize the facial actions in the sequence of images. It uses optical flow, holistic, spacial analysis such as PCA, LDA. This FACS can't found the invisible

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changes.

The particle filtering[3] used to track the fiducial points in the sequence of images and found the temporal events This method requires independencies between a group of random variables not the sample is evaluated .It overcomes the problem of template based tracking of facial features. The method is geometric based method ,illumination is not constant.

Gabor feature based boosted classifiers [4] based on geometric based features.20 facial feature points in images of expressionless faces is automatically detected .It uses individual feature patch templates to detect the points in the relevant region of interest .Gabor based method needed more number of feature vector.

Detecting facial actions and their temporal segments[5] method handle large range of facial behaviour by recognizing the AU and their temporal segments. This method uses Appearance based features and Hidden Margov Model. Using Particle filtering found 20 facial points, only 27 AU are found. More occulations hair , glasses. It can't found all 47 AU.

Fully automated real time system[6] for recognize the face. The facial motion is used to characterize the frontal view of facial expression. This method recognize the 6 basic emotions, using ratio template tracker algorithm, it founds the averages of facial velocity information over the identified region of the face.

Geometric deformation feature and support vector machine [7] classifier uses the first frame of image sequence place candied grid, track the grid in consecutive videos frames. The geometrical displacement of selected candide grid is found .The difference between first and greatest facial expression intensity is given as input to SVM.

Fully automatic recognition of the temporal phases of facial actions[1] in this paper we detect the face, divide it into left eye ,the right eye and the mouth . Analysing the histogram in these regions and extract features, using sliding window found ROI. It is a geometric based method.

III. PROBLEM DEFINITION

We have to construct a facial expression recognition system, namely face detection, pre-processing, facial feature extraction, database classification and recognition rate for given database. We have to construct emotion analyser despite of gender, age and any ethnicity. We have to construct a system that is invariant to different lightening conditions and distraction as glasses, changes in hair style, facial hair[1], moustache beard, etc and also we have to "fill-in" missing parts of a face and construct a whole face. . It should also perform robust facial expression analysis despite large changes in viewing condition, rigid movement, and also we should reduce the feature used to train the system and hence the emotion classifier can recognize the expression more faster which increases the recognition rate more than 95% for different databases. The system should also recognize the face even when the input is a noise images. Noisy images are mostly obtained from the satellite.

IV. PROPOSED METHOD

The design and implementation of the Emotion classification using facial expression System can be subdivided into three main parts: Face Detection, feature extraction and dimension reduction technique which includes training of the images, Testing phase and then result of classification of database.

A) FACE DETECTION

Input image can be obtained from MIMI database and the complex expressions can be obtained from canon power shot SD 1000-canon digital camera. Images are stored in jpeg format .Images are classified under controlled conditions such as facial hair, glasses, any rigid head movement. Locating a face in a generic image is not an easy task, which continues to challenge researchers. After the image is obtained we have to perform the pre-processing, we have to resize the image the colour image is converted into gray image.

We used real time database images and also download the images from existing databases. This is because of noise free and easy use. We are using Radial basis function network which is capable of handling noisy images also. Its gives better result than back propagation neural network.The radial basis function is used in support vector machine.

B) FEATURE EXTRACTION FOR TRAINING PHASE

The mathematical modelling of face is used to extract the feature vector and the feature vector is fed into a emotion classifier. The recognition rate and the overall performance depends on identification of face or feature vector extracted from the face. After the face is detected, there are two ways to extract the features Holistic and analytic approach. In analytic only some important facial features are detected. In holistic approach we send a raw image as an input without any feature selection .we divide the face into 5*5 blocks on row and coloumnwise. The images are fed into fifty rows and fifty columns.

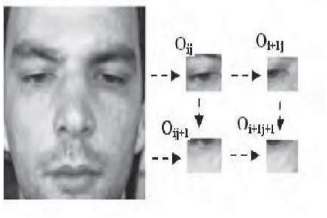

Figure 1 feature extraction

Dimensions $h \times w$ pixels begins scanning each extracted face region from the left top corner sub-dividing the image into a set number of $h \times w$ sized blocks. After dividing into blocks we apply the transformation to extract the features. we observe a particular feature vector for that particular region. The scanning window moves towards right with a step size of n pixels allowing an overlap of pixels, where o=w-n. Again the

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features are extracted from the new block .We have to continue the process until w have to reach the right margin of the image. When the scanning window reaches the right margin for the first row of scanned blocks, it moves back to the left margin and down with m pixels allowing an overlap of pixels vertically. The horizontal scanning process is resumed and a second row of blocks results, and from each of these blocks an observation vector is extracted.

C) STATISTICAL METHOD

After we obtained the image ,the image must be analysed for duplication .We have to find the correlation matrix .The correlation matrix for each image is a square ,we have calculate Eigen value and Eigen vector for each matrix. It is an important feature vector it gives useful information about the data.

D) EIGEN VECTORS AND EIGEN VALUE

In Eigen vectors any vector change in magnitude ,but not in direction is called as Eigen vector .In Eigen values ,the magnitude that the vector is changed is called Eigen value.

$$A x = \lambda x \qquad (1)$$

Where A is nxn matrix . λ is a scalar, .X is the length of n column vector . λ is an Eigen value and x is an Eigen vector .Eigen vectors are unit Eigen vectors their value is 1.It is very important for FLD. In most math packages when asked for Eigen vectors, the unit Eigen vectors are highest Eigen value, it is the linear component of the data set. Using Eigen values we have to calculate the mean values for all the images ,in order to get the highest Eigen values .The Eigen value must contain important feature about the data .We have to select the ten highest Eigen values from all the images.

E) FISHER'S LINEAR DISCRIMINATE ANALYSIS

It can reduce the number Where A is n x n matrix. X is the length of n column vector. λ is a scalar. It's an Eigen value and x is the Eigen vector. It is important to notice that these eigenvectors are both unit eigenvectors that is their lengths are both 1. This is very important for FLD. In math packages, when asked for eigenvectors, will give you unit eigenvectors. It turns out that the eigenvector with the highest Eigen value is the linear Component of the data set After getting the Eigen values we calculate the mean values for all the images, in order to get highest Eigen values highest. The Eigen value must contain important feature about the data. So we select ten highest Eigen values from all the images. The variable in the input by projecting data onto a possibly uncorrelated and low dimensional space. It reduces the number of features in the input to a manageable level. During the projection on low dimensional space we have to exclude some variable that is not related to facial expression,hence the important feature only trained by the classifier. The above property can improve the system performance and generalization. We have to minimize within class variance and maximize between class variance. To reduce the dimensionality we use Principal Component Analysis the data that have largest variance and subsequently project the data.

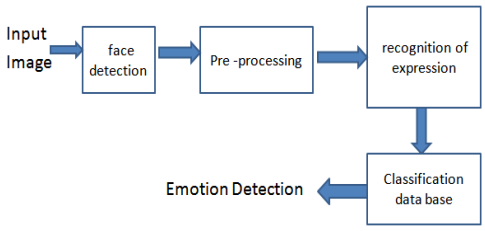

Figure 2 General block diagram

F) SUPPORT VECTOR MACHINE

For applications such as text catergorization,tone recognition, image classification ,micro-array gene expression, protein structure predictions, data classification etc...we have perform classification. In most of the existing method classification when sample size is infinity are based on statistics ,which can provide ideal results .In this paper Support Vector Machine is applied to different (diabetes database ,heart related data ,satellite data ,and shuttle data) .It has two or multiple data. SVM, a powerful machine method developed from statistical learning and has made significant achievement in some field. SVM performs well even limitations of dimensionality and limited samples.SVM is a two layer network The first layer is hybrid feed forward learning network .It is fully connected network. It is very popular network and have wide area of applications. Second layer is radial basis function mainly uses statistical pattern classification techniques. Each hidden neuron has a symmetric radial basis function as an Activation Function. The hidden neurons made the cluster the input data and reduce the dimensionality. In order to minimize the sum of square errors and find the optimal weights between hidden neurons and output nodes. The optimal weights can classify effectively the test data into correct classes.

G) PRINCIPAL COMPONENT ANALYSIS

Principal Components Analysis (PCA) is used to compress data in such a way that the least information is lost. It does so by truncating data and thereby leaving out the data which is of the least importance to the information stored in the data. This PCA process is called dimensionality reduction, because a vector $\bar{x}$ which contains the original data and is N-dimensional is reduced to a compressed vector $\bar{c}$ which is M-dimensional, where M<N. The question that is answered by PCA is: how can we map vector $\bar{x}$ into a vector $\bar{c}$ with a smaller dimension, but where the information contained in $\bar{x}$ is more or less equal to the information stored in $\bar{c}$.

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H) TRAINED IMAGE

The trained system used to found how actual output by making a matching with a desired output. The desired output is produced by changes in the weight of each connection in the network. We give input to the training phase,it is a collection of images showing the human faces. Then we perform the face detection algorithm and then we perform of pre-processing and then perform feature extraction .We have to extract the key attributes of the images and we store the features as a vector called feature vector.

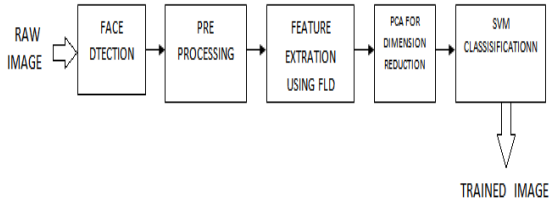

Figure 3 block diagram of trained image

I) TESTING PHASE

In the testing phase we perform the recognition rate. The inputs to the test phase are the trained images that w e obtain from the trained phase and in these phase we have calculate the recognition rate and emotion detection by matching the average probability of the test image with the trained image and we determine to which set of image the extract values matches. The test phase also has the same process of face detection, resizing and colour to gray level conversion.

The first step here again would be a feature extraction phase where the key features from the face image are extracted. The extraction method must be same as the one used in the training phase. The output of this step is the feature vector of the face image that would then be subjected to a testing step. In the testing step the feature vector is tested against the models built during the training phase. The output of the testing step is a score that indicated the emotion that is detected by the model

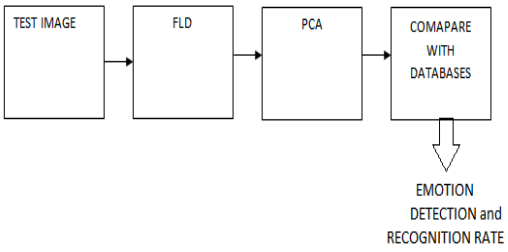

Figure 4 block diagram of test phase

V) EXPERIMENTAL RESULTS

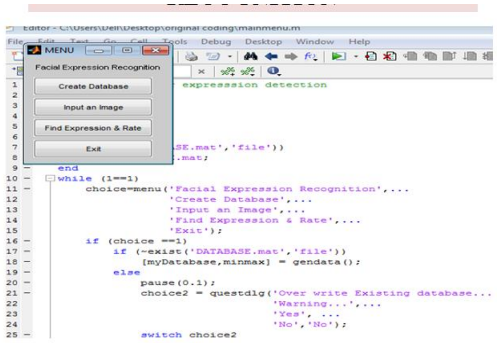

Figure5 GUI of facial expression recognition

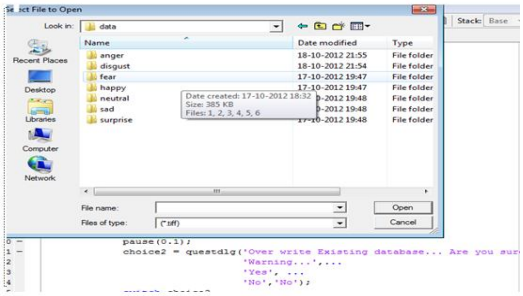

Figure 6 classification of database

GUI is created using matlab in built functions to realize the impact of the proposed face recognition system as shown figure. It is called as Training phase, where we a take a set of different expression images such as anger, happy, disgust, fear, neutral, surprise and sad of two persons, then we perform pre- processing where we divide the faces into 5x5 blocks and find the probability of intensity of each blocks and find the maximum probability of the faces using FLD and reduce the dimension using PCA.

Using the SVM classify the intensity values into zero and non zero values ,by ignoring the zero values taking the non zero values hence each set of images in a database has a unique probability intensity values.

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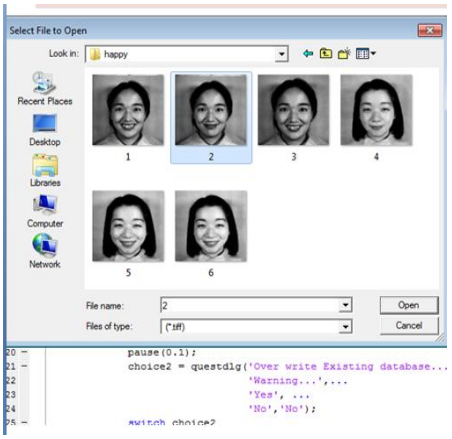

Figure 7 Selection of test image

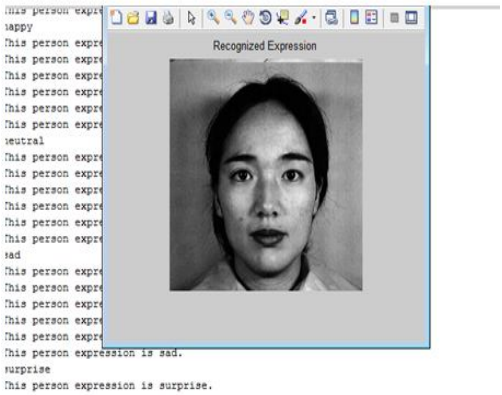

Figure 8 Recognized Expression

TABLE 1 COMPARISON OF RECOGNITION RATE OF ALGORITHMS

ALGORITHMS	RECOGNITION RATE
A geometric pseudo frontal algorithm (FLD, PCA,SVM)	95.2%↑
HMM	95%
Gabor Feature Classifier	93%
Detecting facial actions and their temporal actions	90%
Real time automated analysis	90%
Non rigid registration deformation for facial actions.	94%

VI. CONCLUSION

In this paper we mainly tells about increase the speed of recognition by training the system using feature vector. we have presented an approach to expression recognition in the static images. This emotion analysis system implemented using FLD, PCA and SVM and for feature selection and classification.

This paper is designed to recognize emotional expression in human faces using the average values calculated from the training samples.

We evaluated that the system was able to identify the images and evaluate the expressions accurately from the images. The time taken taken for recognition is less, since we reduce the feature vector used to train the images.

We shall obtain the recognition rate more than 95.2%.From this method using Fisher's Linear Discriminant analysis, Principal Component Analysis and Support Vector Machine.

We recognize and classify 6 basic expressions such as fear, happy, sad, disgust, anger, and surprise, neutral of two different persons and find its recognition rate as more than 95%.

VII . FUTURE WORK:

. In this paper we classify the emotion using seven basic expressions. This gives accurate performance. we may extract the images from moving video and find temporal phase during particular period of time

By find the temporal phases of facial action in the sequence of images from a video; we can detect the neutral, onset, apex and offset of an expression in a face in moving images.

Automatic face expression recognition systems find applications in several interesting areas. With the recent researches advances in robotics, especially humanoid robots, the urgency in the requirement of a robust expression recognition system is evident. As robots begin to interact more and more with humans and start becoming a part of our living spaces and work spaces, they need to become more intelligent in terms of understanding the human's moods and emotions. Expression recognition systems will help in creating this intelligent visual interface between the man and the machine.

Humans communicate effectively and are responsive to each other's emotional states. Computers must also gain this ability. This is precisely what the Human-Computer Interaction research community is focusing on: namely, Affective Computing. Expression recognition plays a significant role in recognizing one's affect and in turn helps in building meaningful and responsive human action interaction interface. Apart from the two main applications, namely robotics and affect sensitive HCI,

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expression recognition systems find uses in a host of other domains like Telecommunications, Behavioural Science, Video Games, Animations, Psychiatry, Automobile Safety, Affect sensitive music juke boxes and televisions, Educational Software, etc. Practical real-time applications have also been demonstrated.

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