Facial Expression Detection By Using Support Vector Machine

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Abstract : In this paper a new algorithm based on a set of images to face emotion recognition has been proposed. Our goal is to categorized the facial expressions given image in to seven basic emotional states Neutral, Happy, Sad, Anger, Fear, Disgust and surprise. The proposed facial expressions recognition system consist of Face Localization, Facial feature extraction, Classifier training and Facial Expression Classification. We propose to use Principle Component Analysis(PCA) for feature extraction and Support Vector Machine(SVM) method for classification stage. A system is capable for processing images rapidly and achieving high detection and recognition rates.

IndexTerms - **Facial Expression, Feature Extraction, Image Processing, Suport Vector Machine(SVM), Principle Component Analysis(PCA).**

I. INTRODUCTION

In the beginning, facial expression analysis was essentially a research topic for psychologists. However, recent progresses in image processing and pattern recognition have motivated significantly research works on automatic facial expression recognition. In the past, a lot of effort was dedicated to recognize emotion in still pictures. For this purpose, many techniques have been applied. They have different algorithm use for feature extraction and classifier. Zhang et al investigated two types of features. They have geometry based features and Gabor wavelets based features, for facial expression recognition[2]. Histogram of Oriented Gradient (HOG), SIFT, Gabbor Fitters, Principal Component Analysis (PCA) and Local Binary Pattern (LBP) are the algorithms used for facial feature representation[4]. For classifier problem we use algorithms like Machine learning, Neural Network, Support Vector Machine, Deep learning, Naive Bayes, Euclidean Distance, k Nearest Neighbor(KNN)[8]. In this project we use Principal Component Analysis for feature extraction of face images and Support Vector Machine for classification of facial expression. Principal component analysis is an algorithm used in pattern recognition and signal processing for dimensionality reduction[6]. As the image pattern most of the time contains redundant information, calculating its feature vector can remove this redundancy and yet preserve most of the important information content of the pattern. The features extracted are used for distinguishing input patterns. SVM builds a hyperplane to separate the high dimensional space. An ideal separation is achieved when the distance between the hyper plane and the training data of any class is the largest. In this project we use images in JAFFE standard database.

II. PROPOSED METHOD

2.1Block Diagram

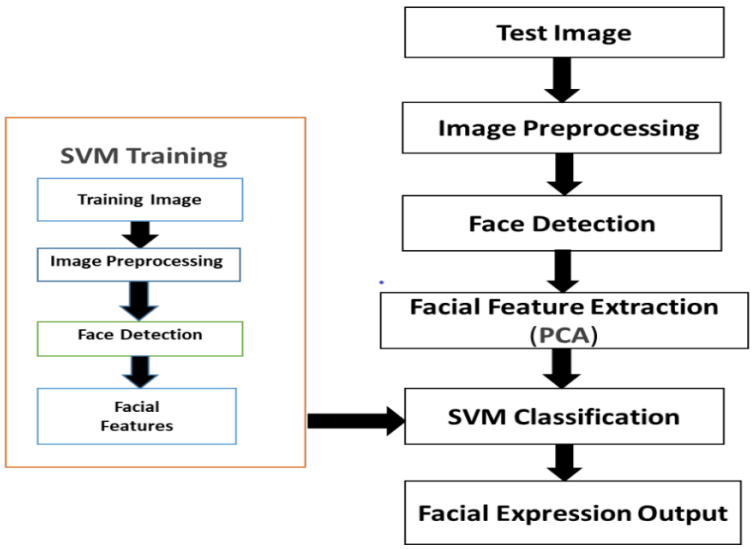


Fig. 1 Block diagram of Facial expression Detection

In the proposed methodology, several steps are carried out like image acquisition, segmentation, feature extraction and classification. In this paper we collect a standard facial expression data base, i.e., JAFEE database. This database contain 213 images of a seven facial expression posed by 10 Japanese female model. Each image is preprocessed in order to enhance, resize and remove the noise from it. Further, the Feature Extraction and Classification are done to recognize the expression.

2.2Image Acquisition

Image acquisition is first step in digital image processing. We use images in standard JAFFE database for further MATLAB operations. In JAFFE database some images are store in training folder for training purpose and some various expressions images in that data base are store in testing folder for testing purpose. Read that images for training and testing for expression classification.

2.3Preprocessing

The data entering into the facial expression system after that preprocessing the images. In emotion recognition system needed important data of face position. In preprocessing images are resized from 256*256 pixel value to 280*180 pixel values. The sobel method is use to identify the face edges.

2.4Feature Extraction

In this project we use Principal component analysis for feature extraction. Principal component analysis or karhunen-loeve transformation could be a customary technique employed in the statistical pattern recognition and signal processing for data reduction. As the pattern often contains redundant info, mapping it to a feature vector can get rid of this redundancy and yet preserve most of the intrinsic information content of pattern. These extracted options have nice role in identifying input patterns. A face image in 2-dimension with size N× N can even be thought-about jointly dimensional vector of dimension $N.^2$ We can retain the maximum information by retaining the coordinate axes that have largest eigenvalues and delete those that have less information. This technique involves

1. Gather xi where i= 1 to p.
2.Compute the mean m and subtract it to obtain xi-m.
3.Compute the covariance matrix Cij = $(x_{i\_}$ m)$(\mathrm{x}_i - \mathrm{m})^T$
4.Determine Eigenvalues and Eigenvectors of covariance matrix C such that
CV=AV
where A = dig$(\lambda 1, \lambda 2, \ldots \lambda p)$
a diagonal matrix is defined by the eigenvalues of the matrix C and V = $(V_1, V_{2,\ldots} V_p)$
5.Sort the eigenvalues and corresponding eigenvectors such that $\lambda 1 \geq \lambda 2 \geq, \ldots, \geq \lambda p$.
6.Select the first l p eigenvectors and discard p-l eigenvectors to find the data in
new directions.
7.If the orthogonal matrix contains the eigenvectors of C, then C can be decomposed
as C= VAV^T where A is diagonal matrix of eigenvalues.

The images are utilized to create a low dimensional face space. This is done by performing Principal Component Analysis in the image set and taking the principal components with greater Eigen. In this method, projected versions of all the train images are also created The test images also projected on face space, all the test images are drawn in terms of the chosen principal parts. The aim of PCA is dimensionality reduction of the feature while still retaining the principle features to minimize loss of information.

2.5Classification

Classification is a main part of facial expression recognition system. The frequently used methods in classification are maximum likelihood classification (MLC) and artificial neural network (ANN). However, there are drawbacks to these classifications; ANN has been associated with over fitting and local minima problems , while MLC needs large training area and assumption that the data are normally distributed. In recent years, there have been an effort to develop better reliable classification methods; support vector machine (SVM) is one among them . SVM is characterised by an efficient hyperplane searching technique that uses minimal training area and therefore consumes less processing time. The method is able to avoid over fitting problem and requires no assumption on data type. Although non-parametric, the method is capable of developing efficient decision boundaries and therefore can minimise misclassification.

Support Vector Machine is linear model for classification problem and regression problems. SVM algorithm can creates line or a hyperplane which separates the data into classes. SVM's do a separating line (or hyperplane) between data of two classes. SVM is a algorithm that takes the data as input and outputs a line that separates those classes if possible. Suppose the dataset as shown below and you need to classify the blue triangle from the yellow ellipses. So the task is to find an ideal line that separate this dataset in two classes (blue and yellow). We have infinite lines that can separate these two classes as shown in fig.2.

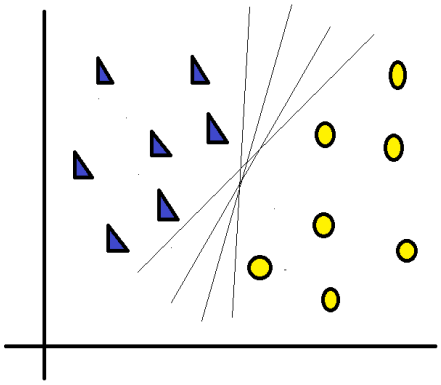


Fig.2 Line/hyperplanes this dataset separates into two classes

According to SVM algorithm find the points closest to the line from both the classes. These point are called as support vectors. Then compute the distance between the line and the support vectors. This distance is called as margin. The hyperplane for the margin is maximum is the optimal hyperplane. This separation as shown in fig.3.

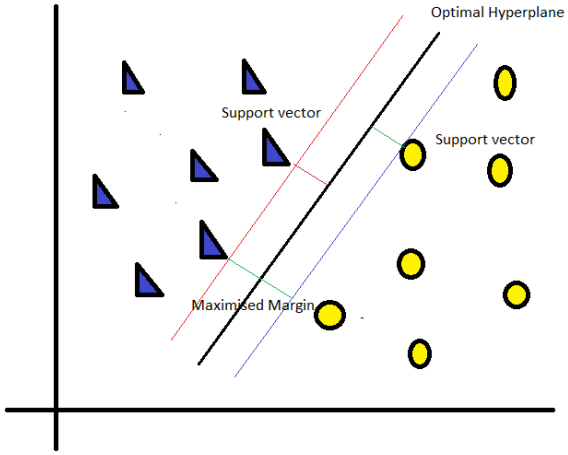


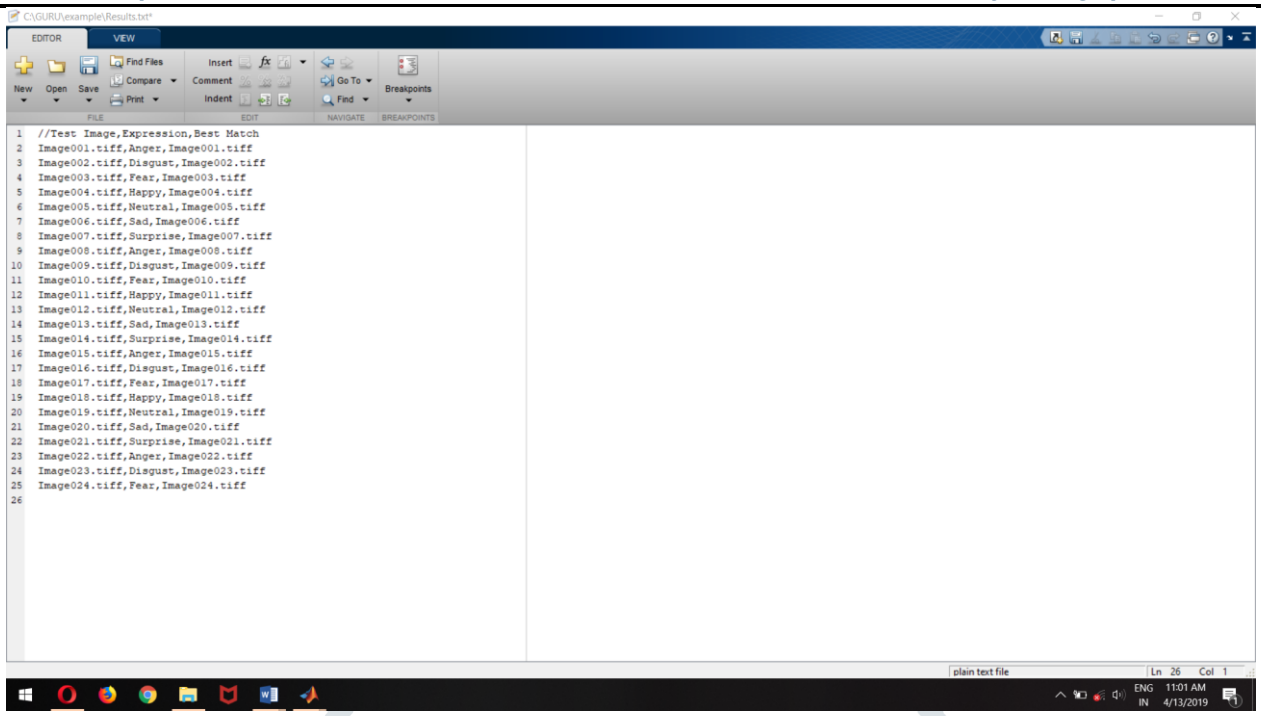
Fig.3 Hyperplane using SVM algorithm

A hyperplane is an n-dimensional Euclidean space is a flat, n-1 dimensional subset of that space that divide the space into two disconnected parts. SVM tries to make a decision boundary in such a way that separation between the two classes is as wide as possible. Similarly, this technique is use in facial expression detection. In this system SVM classify the data in many vs one class. In SVM training store the extracted facial expression images and test image extract the feature and gives to SVM classification. SVM classifier classify with SVM training feature and gives to the facial expression state.

III.RESULT

Facial Expression detection:

Enter Train Folder Name: Train Images
Enter Label File Name: traintext.txt
Enter Test Folder Name: test
Output File = .\Results.txt



IV.CONCLUSION

We have implemented facial expression recognition system using Support vector machine classification method. Support vector machine learning system well correlate with the constraints placed on recognition accuracy and speed. We evaluated our system in terms accuracy for a variety of interaction scenario and compare previous expression approaches to expression recognition.

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