Neural Network For Face Recognition Using Different Classifiers

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Abstract: In this paper I proposed a novel technique for Face Detection and Recognition by Neural Network for Face Recognition using different Classifier. It is advance computer vision of human Face recognition being regarded as a fundamental technology of biometrics has been applied to a variety of areas like college student attendance monitoring, hospitals, Military, and then Banks and along with ATM's also it is very help full to recognise any human face in any lighting and pose rotation conditions. In this paper processing of human faces and extracting facial features then classifying purpose using method are Gabor Wavelet Transform, Back propagation algorithm and corresponding classifying purpose I concentrate PCA algorithm. The main objective of this proposed system is to develop an efficient face recognition system by improving the efficiency of the existing face recognition systems. The proposed system has been developed to provide efficiency in terms of retrieval accuracy and precision. The precision improved by 100 % and average recall rate of up to 97 % for the database of 100 images. The efficiency of the proposed system obtained as 100%.

Keywords: Face recognition, Neural Network, PCA, Gabor Wavelet Transform, BPN, Eigenface, Feature Extraction etc..

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1. INTRODUCTION

Face recognition has traditionally been performed with facial feature extracted from two dimensional images. The features are placed in sets, and decision boundaries are created by which input images may be classified and identified. However, there are two methods face recognition procedure in general, global characteristics and local feature characteristics. A successful face recognition methodology depends heavily on the particular choice of the features used by the (pattern) classifier [4]. Feature selection in pattern recognition involves the derivation of salient features from the raw input data in order to reduce the amount of data used for classification. The most representative recognition techniques frequently used in conjunction with face recognition are principal component analysis (PCA) [1], independent component analysis (ICA) [2], and Fisher's linear discriminant analysis (LDA) [3]. The PCA approach is also known as eigenface method which is a popularly unsupervised statistical technique that supports finding useful image representations. It also exhibits optimality when it comes to dimensionality reduction However, PCA is not ideal for classification purposes mainly because of the fact that it retains unwanted variations occurring due to lighting and facial expression [3]. There are numerous extensions to the standard PCA method [4]–[8]. Meanwhile, the LDA method, also known as Fisher's linear discriminant face method, is a supervised learning approach whose functioning depends on class-specific information. This statistically motivated method maximizes the ratio of between class scatter and within-class scatter and is also an example of a class-specific learning method. Again, there are various enhancements made to the LDA .

On the other hand, while PCA-based and LDA-based approaches depend only on second-order statistical structure between pixels in the face image, ICA method has been used to find statistically independent basis images or coefficient for the face images to deal with the sensitivity to higher order image statistics [2]. In particular, the ICA technique is related to the blind source separation (BSS) problem, where the goal is to decompose an observed signal into a linear combination of several unknown independent signals. This method has demonstrated to be successful in various fields such as speech recognition, three-dimensional (3-D) object recognition, natural images, unsupervised classification [9], bioinformatics, texture segmentation, electroencephalogram (EEG), functional magnetic resonance imaging (f-MRI) signals [9] to name a few representative examples. In the area of face recognition, Bartlett [2] first developed face-recognition system with two different architectures based on the principle of optimal information transfer (InfoMax) proposed by Bell and Sejnowski.

The purpose of these two architectures is to find statistically independent basis images or factorial face code. The results clearly showed that both ICA representations were superior to the representations based on the PCA. Meanwhile, Moghaddam [9] used two different algorithms with the first architecture based on fourth-order cumulates.

Moghaddam [9] found that the ICA is not unique in comparison with the PCA due to the variety of different techniques used to compute the basis and iterative optimization schemes being involved there. In order to analyze such contradictory claims, Draper [9] performed a thorough comparison of the two techniques.

However, the aforementioned techniques unable to recognize the faces with 100% precision but our proposed approach combined with Gabor features with Back propagation neural (BPN) network capable to achieve best results.

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2. PROPOSED SYSTEM

The architecture developed for feature based face recognition is illustrated schematically in Figure1.The face feature extraction and face recognition is the main contribution of the architecture. The query face is processed to compute features, the distance between the two eyes and nose as triangle. There are three main features have been used in our system. The two eyes and nose are feature in our proposed system. The two distances between the two eyes and nose have been computed for query face image. The features are of the computed query face and similar features of the group photo of 59 persons are equal then the face recognized in the group photo.
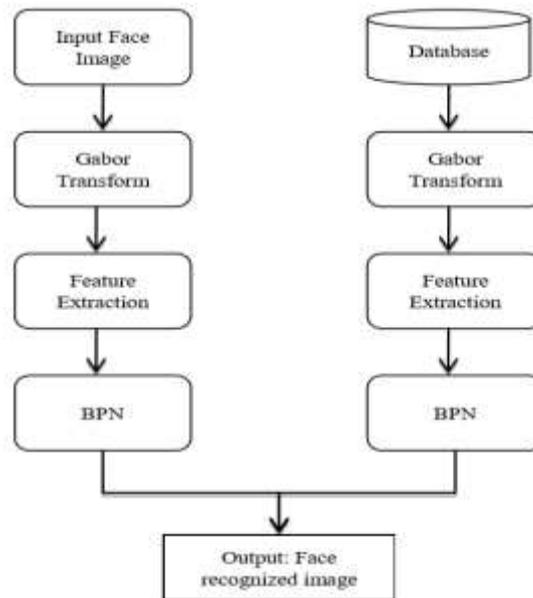
Fig: 1. Proposed Face Recognition System

The output faces are detected similar to the feature values of the query image. The query face input image has been given to Gabor transform and the three features are extracted. These features are trained using BPN. The proposed system able to recognize the same features in the group photo consists of 59 faces. The query face and identified by the face exactly matches. Quadratic distance measure is used for comparison. Similar feature face images are displayed. The exact output face images as relevant to query face image is recognized.

3. GABOR WAVELET TRANSFORM (GWT)

The processing of facial images by Gabor filter is chosen for its biological relevance and technical properties. The Gabor filter kernels have similar shapes as the receptive fields of simple cells in the primary visual cortex have been set.

Wavelet representation shown in equation 1 is especially useful for feature analysis in vision problems because its theory provides powerful properties, such as algorithms for dominant point's detection, and local periodic pattern analysis. In fact wavelet constitutes an efficient mathematical tool for the detection and characterization of signal singularities [3] [6].

$$F(n) = (x * y)[n] \sum_{k=-\infty}^{\infty} x(k) * y(n-k) \qquad (1)$$

Multi-resolution analysis techniques decompose the signal into components at different scales so that the coarsest scale components carry the global approximation information while the finer scale components contain the details information. Additionally some recent psychophysics models suggest that the human visual system processes and analyses image information at different resolutions.

$$y_{low} = \sum_{k=-\infty}^{\infty} x[k]y[2n-k] \qquad (2)$$

$$y_{high} = \sum_{k=-\infty}^{\infty} x[k]h[2n-k] \qquad (3)$$

2D-DWT is a process which decomposes a signal, that is a series of digital samples, by passing it through two filters, a low pass filter L (equation 2) and high pass filter H (equation 3). The low pass sub band represents a down sampled version of the original signal. The high pass sub band represents residual information of the original signal, needed for the perfect reconstruction of the original set from the low resolution.

4. NEURAL NETWORK

Neural network is used as an adaptive retrieval system which incorporates learning capability into the network module where the network weights represent adaptability. This learning approach has several advantages over traditional retrieval approaches.

The proposed system is based on Back propagation neural (BPN) network. There are three layers of BPN network including input layer, hidden layer and output layer shown in Figure 2.The input layer propagates the feature vectors to each node in the middle layer. Middle layer nodes compute output values which given to the output layer. The output layer nodes compute the network output for the particular feature vector is shown in Figure 3.
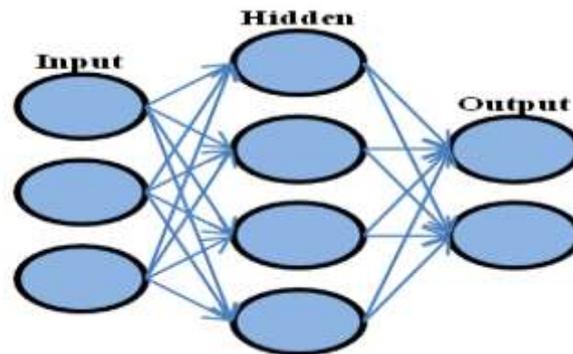
Fig:2 Neural Network Structure

Since the network weights are initialised to random values, it is unlikely that reasonable outputs will result before training. The weights are adjusted to reduce the error by propagating the output error backward through the network. Compute the error values for each node in the output layer. Compute the error for the middle layer nodes. This is done by attributing a portion of the error due to the middle layer node which feed that output node. The amount of error due to middle layer node depends upon size of the weight assigned to the connection between the two nodes. Adjust the weight values to improve network performance using delta rule.
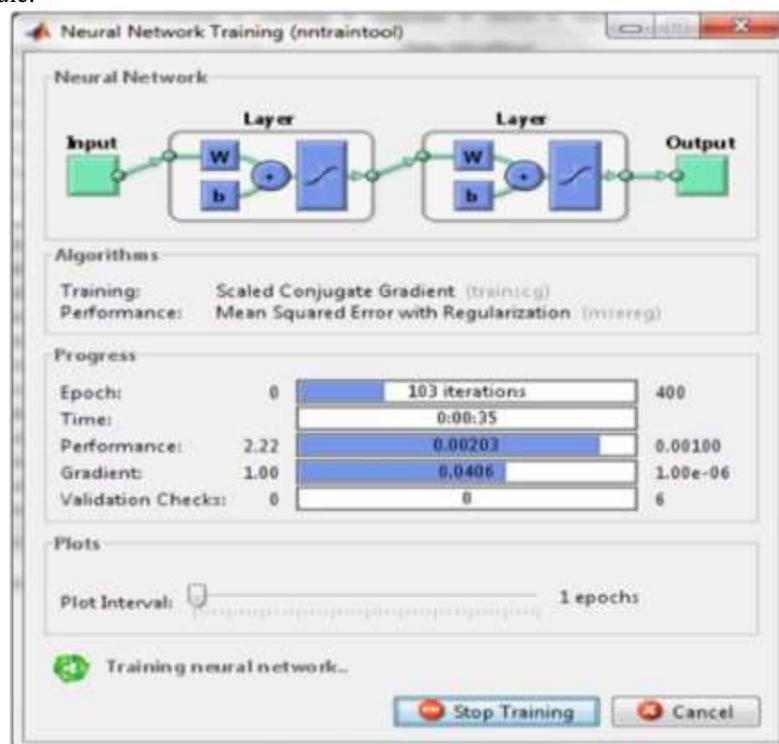
Fig:3 BPN Training

Training Algorithm
 – Training features to the neural network.
 – Compare the network's output to the desired output from that features.
 – Calculate the error in each output neuron.
 – For each neuron, calculate what the output of each feature vector and the output   must be adjusted to match the desired output.
 – Adjust the weights of each neuron to lower the local error.
 – Repeat from step 3 on the neurons at the previous level until the output is obtained.

Neural Network Parameters
The feed-forward neural network is a very powerful classification model in the machine learning content. Since the goodness-of-fit of a neural network is majorly dominated by the model complexity, it is very tempting for a modeler to over-parameterize the neural network by using too many hidden layers or/and hidden units. Neural network used in our proposed approach is BPN for learning the network Fit plot is
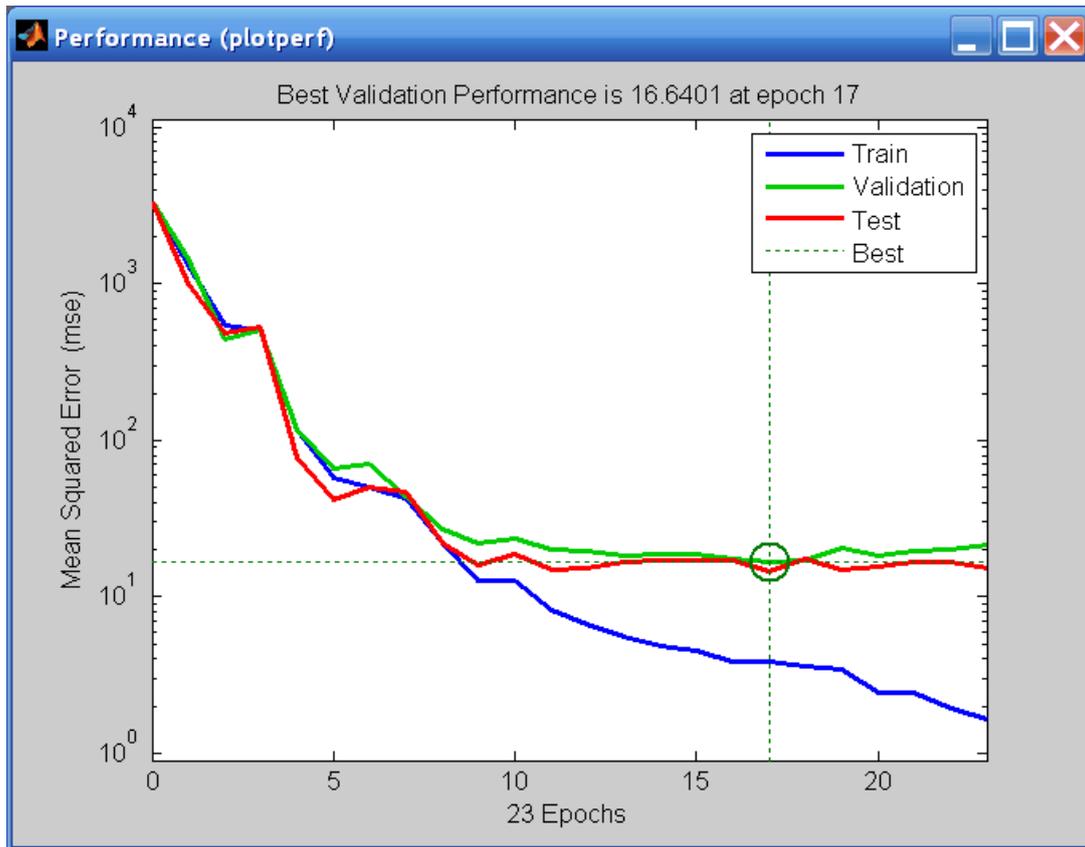
Fig:4. Network Performance Fit data Plot

The function plot perform (TR) plots the training, validation, and test performances given the training record TR returned by the function train as shown in Figure 4
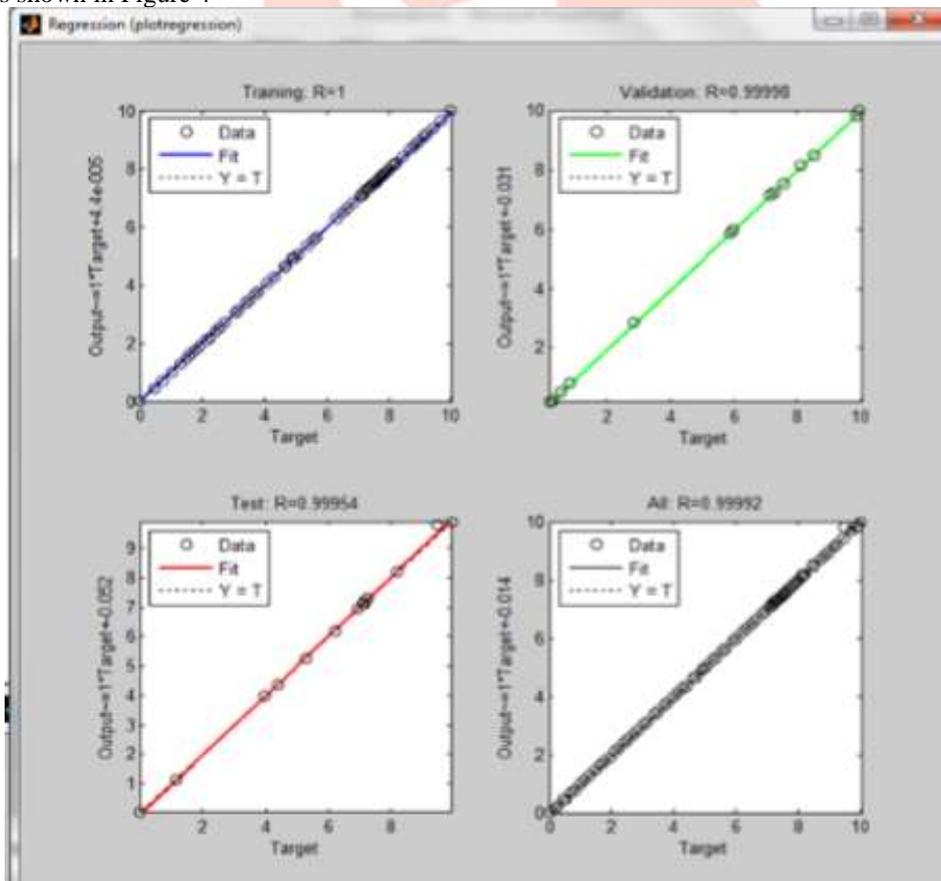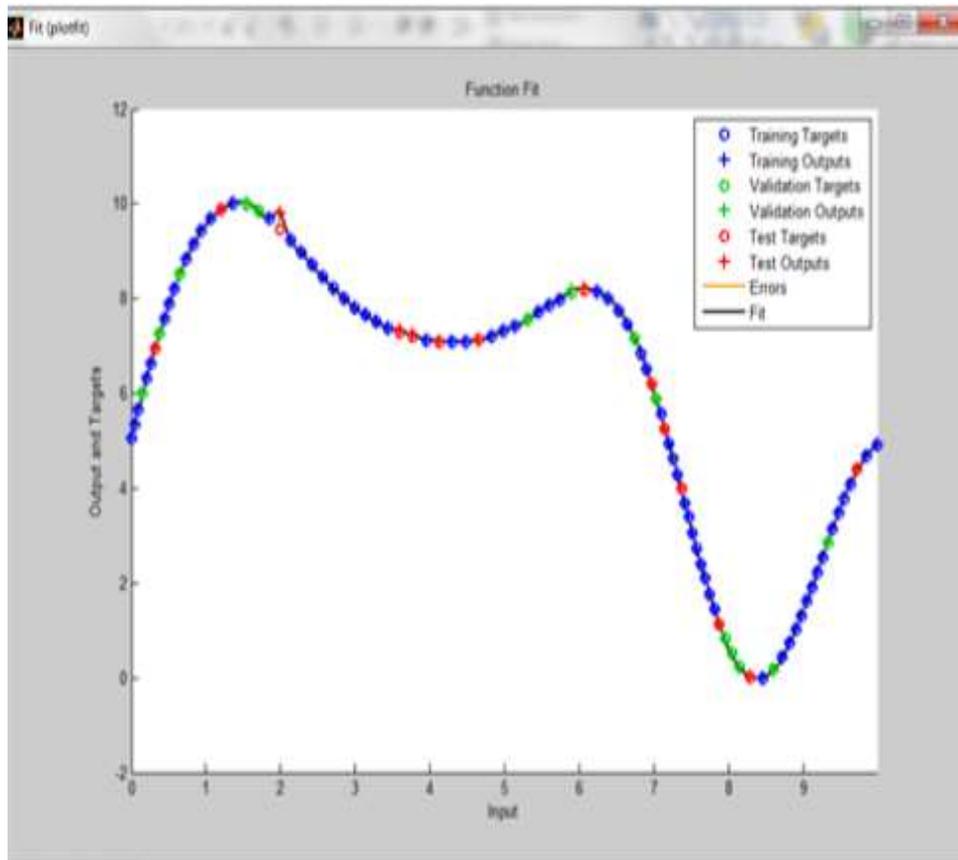

Fig:5. Network Regression plot

Fig:6. Network fit plot

5. EXPERIMENT RESULT

This project is implemented in matlab 2016b and intel i5 core processor used. First I wrote the program for face detection algorithm in viola-jones method and corresponding extracting features purpose Gabor wavelet transform and backpropagation algorithm is used. In current experiment performed on the group photo of with 59 face images from total faces 100 face images, feature extraction with threshold has been simulated. To measure the performance of the proposed system, average recall rate (AVRR), precision are used.
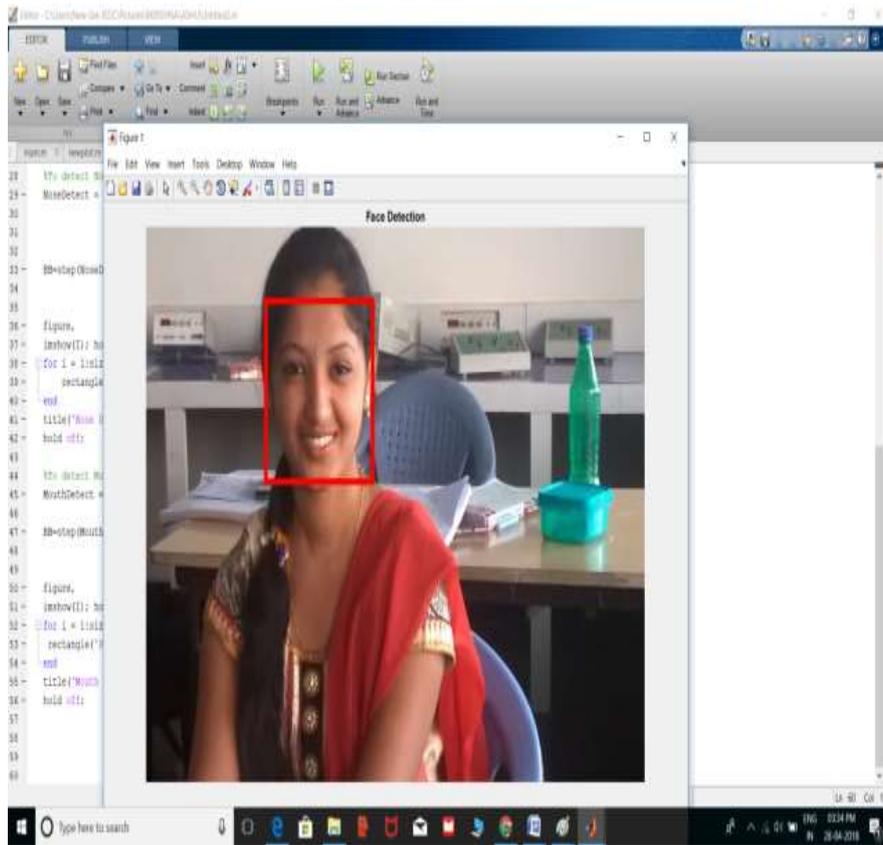
Fig: 7. Face detection
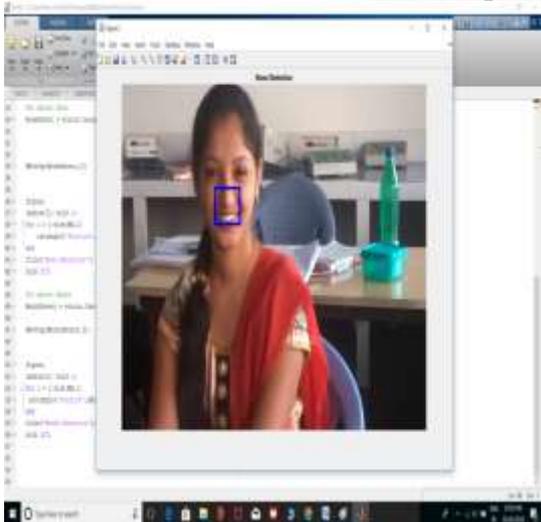
Fig:8. Nose detection
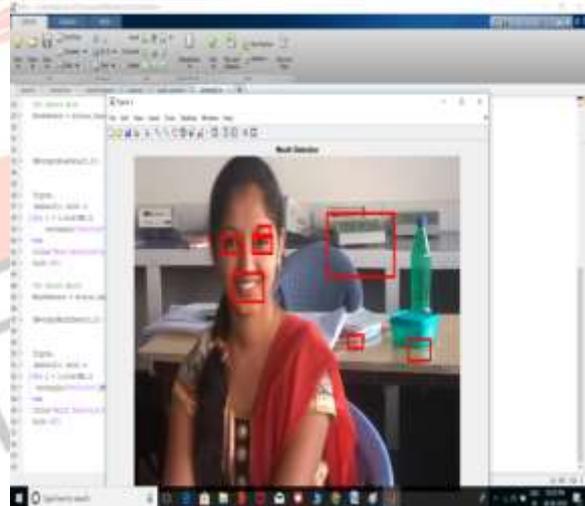
Fig:9. Mouth & Eyes Detection

Fig: 10. Face Tracking

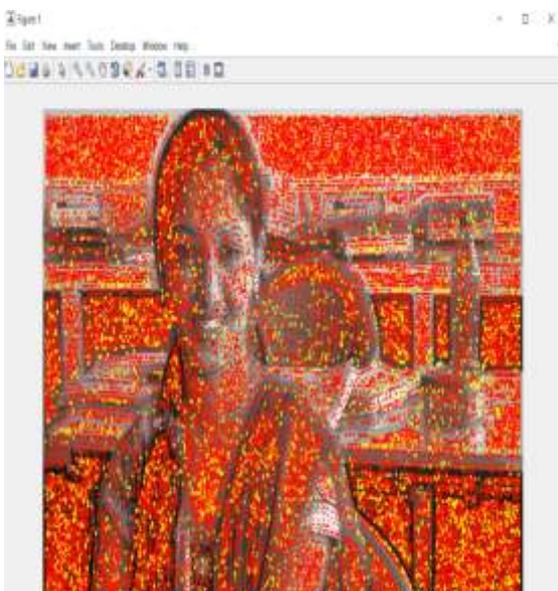
Fig: 11. Features Extraction

Fig:12. Feature Extraction
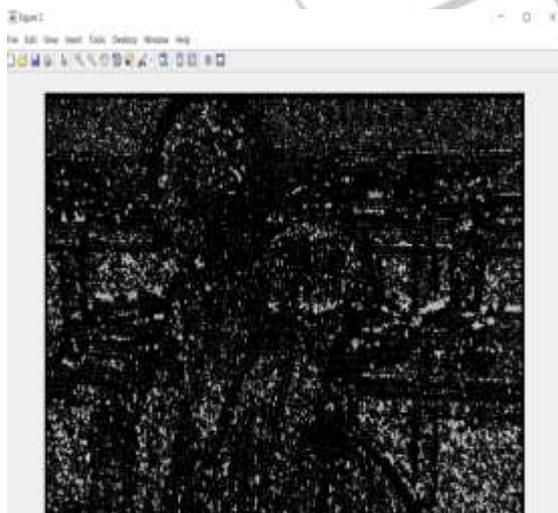

Fig:13. Feature Extractions
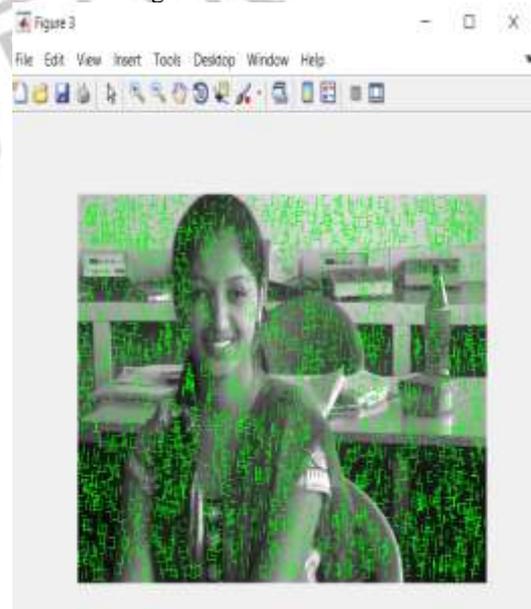

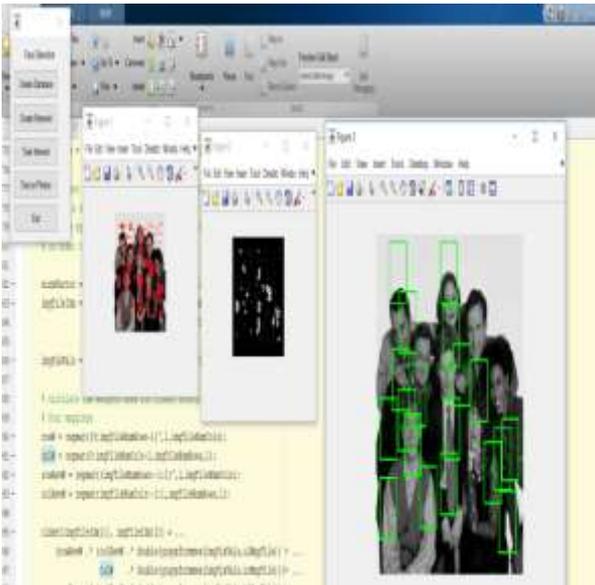Fig1:14.Edge Detection

Fig:15. Face Detection

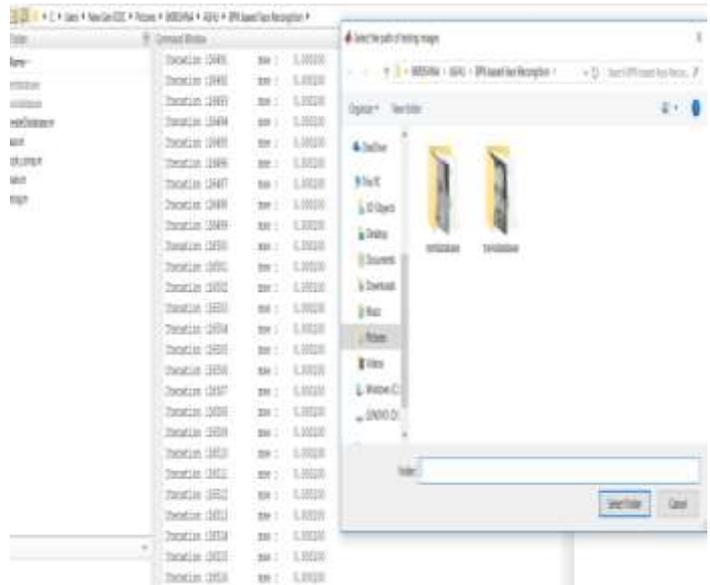Fig:16. Gabor face detection   Fig:17. BPN Training & Testing Images
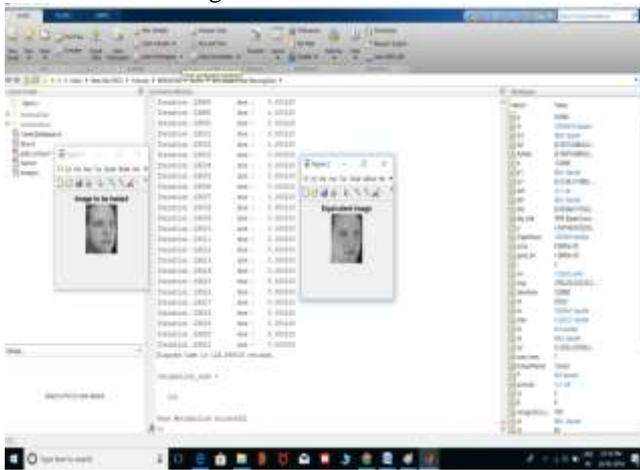

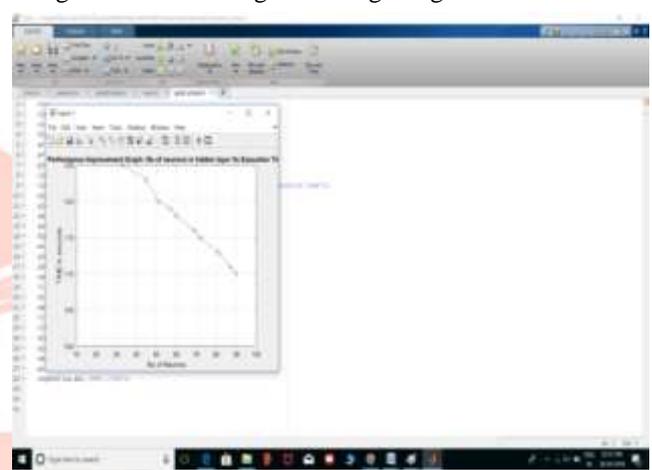Fig:18 BPN Face Detection   Fig:19. No of Neurons vs Time(s)
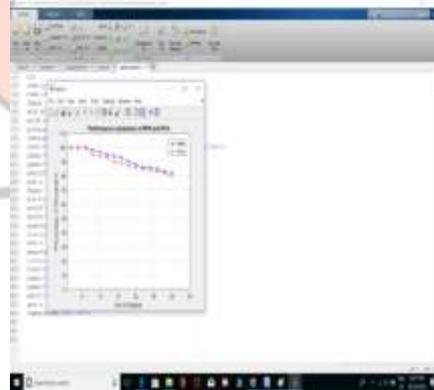

Fig:20. No of Subjects to Percentage of Regression

6. CONCLUSION

In this project may conclude face detection and recognition by using Neural Network with different classifiers. Now a day's Neural Network place a crucial role to detect the any kind of objects and recognise then automatically classifies within the thousand numbers of objects. It is very helping tool for machine learning and brain computer interface. Face recognition falls into the category of biometrics which is using distinguishing traits. Face images from a database are compared with query face images. This proposed approach greatly reduces user's effort and captures the user's information needed more precisely. Furthermore, the effectiveness of the proposed approach has been validated by a large number of experiments yielding 100% overall.

7. REFERENCE

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