

# Recognition of Face Using Neural Network

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**Abstract—** Advancement in Artificial Intelligence has lead to the developments of various “smart” devices. The task of face Recognition has been actively researched in recent years. Wide usage of biometric information for person identity verification purposes, terrorist acts prevention measures and authentication process simplification in computer systems has raised significant attention to reliability and efficiency of biometric systems. Modern biometric systems still face much reliability and efficiency related issues such as database search speed, errors while recognizing of biometric information or automating biometric feature extraction. In face recognition, many methods are used but due to advancement there are some new methods and algorithm used for recognition of face i.e. line edges map, support vector machine etc. for face recognition. A number of current face recognition algorithms use face representations found by supervised and unsupervised statistical methods. In this paper we use a neural network approach for face recognition system. We are creating a supervised multilayer feed forward network model. We will design a neural network for face recognition system which first detect the face and then recognize the face. Specifically some network models use a set of desired outputs to compare with the output and compute an error to make use of in adjusting their weights. Such learning rules are termed as Supervised Learning One such network with supervised learning rule is the Multi-Layer Perceptron (MLP) model. Back propagation algorithm is used to train the network, calculate error and modify weights.

**Keywords—**Artificial Neural Network, Back Propagation Algorithm, Face Recognition, Multi-Layer Perceptron, Supervised Learning

## I. INTRODUCTION

Face recognition is an important research problem spanning numerous fields and disciplines. This because face recognition, in additional to having numerous practical applications such as bankcard identification, access control, Mughots searching, security monitoring, and surveillance system, is a fundamental human behavior that is essential for effective communications and interactions among people. Face recognition is a biometric approach that employs automated methods to verify or recognize the identity of a living person based on his/her physiological characteristics. All face recognition algorithms consistent of two major parts: (1) Face detection and normalization (2) face identification. Algorithms that consist of both parts are referred to as fully automatic algorithms and those that consist of only the second part are called partially automatic algorithms. Partially automatic algorithms are given a facial image and the coordinates of the center of the eyes. Fully automatic algorithms are only given facial images. There are many pose invariance in face. Focusing on the aspect of

pose invariance, face recognition approaches may be divided into two categories: (I) global approach (ii) component-based approach. In global approach, a single feature vector that represents the whole face image is used as input to a classifier. But in component based approach we used different feature vector represents different parts like eyes, nose and mouth as an input to classifier. We used different methods like Generalized Learning Vector Quantization method, template matching method, Fuzzy theory, eigenfaces methods, discriminative[1] common vectors (DCV) and radial basis function for finding the feature of face from image. A new method is multi wavelets transform is used which combines the multi wavelet transform and 2D-Two Activation Function Wavelet Network (2D-TAFWN). There are different methods for 2D images which only work on 2D images when these applied on 3D images or change pose invariance and illumination gives the wrong results. There are methods like 3D morphable model. There are two different methods, which are the contour distance method and a proposed contour angle method were performed on the face contours. Cloud basis function is used for extraction of different feature vectors from face which gives better results than Radial basis function. Because radial basis function can give only the single feature vector. We used neural network approach for face detection and recognition. Some approach work only for face recognition. In 1996 SOM provides a quantization of the image samples into a topological space where inputs that are nearby [2] in the original space are also nearby in the output space, thereby providing dimension reduction and invariance to minor changes in the image sample. Support vector machine, PCA, LDA, ICA, Nearest Neighbor methods, Gabor wavelet methods is also used in the face recognition. There are many face detection and recognition methods which recognize the face. We used supervised and unsupervised learning methods for face recognition purpose.

## II. DESIGN OF MULTILAYER PERCEPTRON NEURAL NETWORK

### A. Multilayer feed forward Model

The MLP network that is implemented is composed of three layers input layer, output layer and hidden layer. Multilayer perceptron [5] feed forward network model with back propagation supervised learning algorithm is used for training of neural network. In our designed neural network number of layer is present input layer, hidden layers and output layer. Number of neuron in the input layer according to size of image.

**B. Input/ Output Parameter**

Multilayer feed forward Neural Network Architecture

- Number of hidden layers =3
- Number of neuron in input layer= 651
- Number of neuron in hidden1 layer=96
- Number of neuron in hidden2 layer=88
- Number of neuron in hidden3 layer=144
- Number of neuron in output layer=7

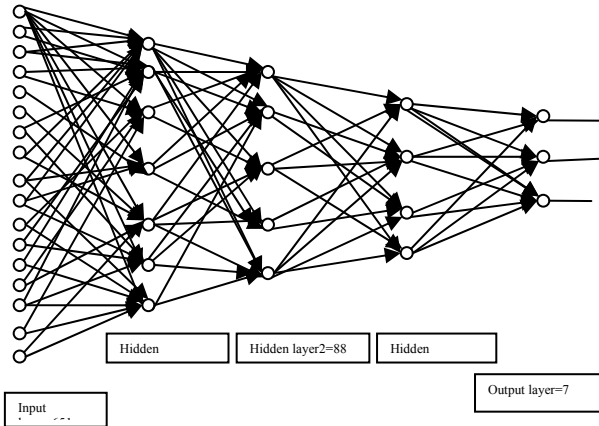


Fig 1 Multilayer Perceptron Neural Network

**III. FACE RECOGNITION PROCEDURE**

**A. Pre-processing**

In this face recognition neural network training process, we use coloured image in neural network training for face recognition process. Convert this coloured image to greyscale image after this pre-processing is done on the greyscale image. Pre-processing is done to reduce the resolution of the image. Then neural network training is done. In between layers some activation function is used for finding out output of the network if any error occurs then readjustment of weight is done. After training of network save this trained neural network file for Face Recognition testing process.

**B. Segmentation**

In this segmenting the image into its sub components and extracting the relevant features to feed to the training and recognition stages. Segmentation is an important stage because the extent one can reach in separation of edges, lines or color directly affects the recognition rate of the script.

**C. Feature Extraction**

After segmenting the image, extraction of feature like height, width, horizontal line, vertical line, and top and bottom detection is done.

**D. Classification**

For classification or recognition back propagation algorithm is used .

**E. Output**

Output is saved in form of grayscale image format.

**IV. TRAINING ALGORITHM**

Training basically involves feeding training samples as input vectors through a neural network, calculating the error of the output layer, and then adjusting the weights of the network to minimize the error. Each "training epoch" involves one exposure of the network to a training sample from the training set, and adjustment of each of the weights of the network once layer by layer. The back propagation training algorithm is an iterative gradient algorithm designed to minimize the mean square error (MSE) between the actual outputs of a multilayer feed forward Perceptron and the desired output. It is supervised learning algorithm. Initialize weights with random values

For a specified number of training iterations do:

- I. For each input and ideal (expected) output pattern
  1. Calculate the actual output from the input
  2. Calculate output neurons error
  3. Calculate hidden neurons error
  4. Calculate weights variations (delta):  $\Delta w_{ij}$
  5. Add the weights variations to the accumulated delta.

Learn by using the accumulated deltas and adding them to the weights.

**V.EXPERIMENTAL RESULT**

The network has been trained and tested for a number of widely used face database. When we change in epochs value then error decrease but this is different for different faces.

Face database \ Learning rate	0.15	0.11	0.09
	Error		
Orl /yale	4.44%	3.33%	1.11%
Bao database	1.11%	0	0
M2VTS	0	0	1.11%
CLV	2.1%	1.11%	0
ID01	3.3%	0.2%	0

Comparison Table

Learning Rate =0.09, sigmoid function is calculated using the formula. Similarly, when we change number of input value and learning value parameter. Increasing the number of iterations has generally a positive proportionality relation to the performance of the network

**VI.CONCLUSION**

The experiments have illustrated that the artificial neural network concept can be applied successfully to solve the face Recognition problem. There are many factors that affect the performance of face recognition system. Increasing the number of iterations has generally a positive proportionality relation to the performance of the network. However in certain cases further increasing the number of epochs has an adverse effect of introducing more number of wrong recognitions. Learning rate parameter variation also affects the network performance for a given limit of iterations.

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