Face and gender Recognition Using Genetic Algorithm and Hopfield Neural Network

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***Abstract*- This paper describes a face recognition system for personal identification and verification using genetic algorithm and Hopfield Neural Network. This FRS system is also being trained for gender identification. Face recognition system consists of three steps. At the initial stage of this system some pre-processing are applied on the input image. Secondly, face features are extracted, which will be taken as the input of the eight parallel Hopfield neural network and genetic algorithm (GA). In the third step, classification is carried out by using Hopfield neural network and GA to identify gender. The proposed approaches can be tested on a number of face images. Sex-recognition in faces is a prototypical pattern recognition task and it appears to follow no simple algorithm. It is modifiable according to fashion (makeup, hair etc).While ambiguous cases exist, for which we must appeal to other cues such as physical build (if visible), voice pattern (if audible) and mannerisms.**

I INTRODUCTION

The literature has some works related to facial expressions recognition, such as Multi-layer Perceptron [1], FRS using Back propagation neural network[2], and also works that apply the Hopfield network to detect face expressions[3,4] and nominal color coding of classified images[5]. Among many recognition subjects, face recognition has drawn considerable interest and attention from many researchers for the last two decades because of its potential applications, such as in the areas of surveillance, secure trading terminals, Closed Circuit Television (CCTV) control, user authentication, HCI Human Computer Interface, intelligent robot and so on. A number of face recognition methods have been proposed [6] [7] and some related face recognition systems have been developed. In this paper we proposed a computational model of face recognition, which is fast, reasonably simple, and accurate in constrained environments such as an office or a household. The proposed approaches have advantages over the other face recognition schemes in its speed and simplicity, learning capacity and relative insensitivity to small or gradual changes in the face image.

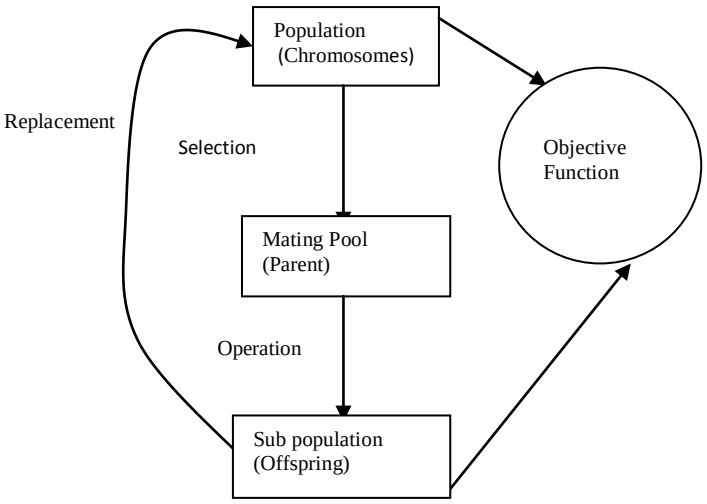
Ma et al. [1] propose facial expression recognition using an MLP architecture allied to image compression techniques, optimization algorithms such as quasi-Newton and pruning methods. In an attempt to simplify this approach, and yet keeping the rate results between 95% and 100% of recognition, a Hopfield neural network can be used for further processing. Ma et al.'s work recognizes the facial expression on each image that is given to the neural network. This FRS system attempts to, beyond recognize, to recover the image of a face without facial expression corresponding to the image of a face with an expression, using Hopfield neural network like associative memory.

II OUTLINE OF THE SYSTEM

The design and implementation of the Face Recognition System (FRS) can be subdivided into two main parts. The first part is *image processing* and the second part is *recognition techniques*. The image processing part consists of Face image acquisition through scanning, Image enhancement, Image clipping, Filtering, Edge detection and Feature extraction. The second part consists of the artificial intelligence which is composed by Genetic Algorithm and Hopfield Neural Network.

The first part of FRS consists of several image processing techniques. Firstly, face's image acquisition then image clipping is performed using start-point and end-point detection algorithm. Then the edges are detected using high-pass filter, high-boost filter, median filter or several edge detection methods. Finally, the features are extracted. These extracted features of image are then fed into Genetic algorithm and Hopfield Neural Network.

In the second part two techniques are used one is based on Genetic algorithm and another one is based on Hopfield neural network. In the first techniques, the extracted features are saved into memory and using genetic algorithm; the recognition of unknown face image is performed by comparing this special pattern to the pattern for which an image module is already built. In the second technique extracted features are given as input to the Hopfield network and it is trained to create a knowledge base for recognition.



III METHODOLOGY

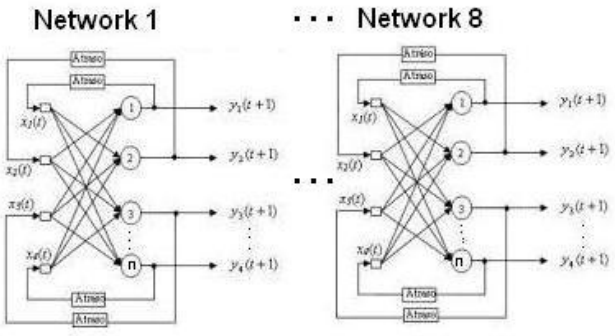
After the acquisition of the image the features are extracted. To extract features of a face at first the image is converted into a binary. From this binary image the centroid of the face image is calculated using the below equations.

$$X = \frac{\sum mx}{\sum m} \qquad Y = \frac{\sum my}{\sum m}$$

Where x, y is the co-ordinate values and m=f(x,y)=0 or1.Then from the centroid, only face has been cropped and converted into the gray level and the features have been collected.

Extracted features of the face images have been fed in to the Genetic algorithm and Hopfield Neural Network for recognition. The unknown input face image has been recognized by Genetic Algorithm and Hopfield Neural Network. The recognized image is compressed and given as input for gender identification.

The face images to be presented to the neural model receive previous processing: first, a dimension reduction, from 350x275 to 32x32 pixels (this do not cause great losses in the image characteristics), and next, the creation of a vector formed by the lines of the reduced image matrix (32x32), lined up in a single vector column with 1024 positions. The initial idea was to use the vector as an input to a single Hopfield network composed by 1024 neurons. This model was tested and proved its inefficiency due to confusion in relation to the gray levels, providing unsatisfactory results. It was necessary to separate the gray levels and to create a network for each level. Thus, the vector with 1024 positions was sliced into 8 bits, one for each gray. Since we now had eight times more data than before, changes on the network topology were needed. Following this idea, we decided to test a model with 8 parallel networks, one for each gray level. Each network works only in one level of the image and retrieves only the same level of the image. The inverse process to the previous processing is then applied to reconstruct the images that were recovered from the neural networks. The model of the Hopfield network is given model.



IV CONCLUSION

In this paper present model of Face Recognition System using the concept of Genetic algorithm and Step Error Tolerance Hopfield Neural Network and digital image processing has been discussed. Here a static Face Recognition system has been developed. The maximum efficiency is 82.61% for Face Recognition System by using Genetic algorithm and the maximum efficiency is 91.30% for Face Recognition System by using 8 parallel Hopfield network is expected. The efficiency can be increased by better technique of scaling, efficient technique of edge detection such as advanced edge detection technique and feature extraction. The same network is trained to identify the gender based on the features extracted.

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