

Face Recognition Based on Self Organizing Map

Ghusoon Idan Arb

Assist Lecturer ,Computer Engineering Dept., College of Engineering, Mustansiriyah University,
Baghdad, Iraq.

Email - eng.computer38@gmail.com

Abstract: *In this paper ,we are built a GUI using neural networks in MATLAB for predicting the face data. We received the measured data for many faces , accordingly we imported the measured data into MATLAB & converted the date to numbers . Second step was plotting the measured data in 2-D graph , then used Time-Series toolbox to plot the daily measurements against the spatial data . Third step was making a neural network (NN) program to learn & adapt itself based on the spatial data history in addition to its ability to be updated & trained again as per the new entered data while the mean squared error (MSE) for the predicted data must be less than %5 . Fourth & last step was using the already trained NN to predict the future data & based on the predicted data , we can judge how to operate the data.*

Key Words: SOM , GUI , Matlab.

1. INTRODUCTION:

A self-organizing map(SOM) or self-organizing feature map (SOFM) is a type of artificial neural network that is trained using unsupervised learning to produce a low-dimensional (typically two-dimensional), discretized representation of the input space of the training samples, called a map. Self-organizing maps are different from other artificial neural networks in the sense that they use a neighborhood function to preserve the topological properties of the input space. Like most artificial neural networks, SOMs operate in two modes: training and mapping. Training builds the map using input examples. It is a competitive process, also called vector quantization. Mapping automatically classifies a new input vector. A self-organizing map consists of components called nodes or neurons. Associated with each node is a weight vector of the same dimension as the input data vectors and a position in the map space. The usual arrangement of nodes is a regular spacing in a hexagonal or rectangular grid. The self-organizing map describes a mapping from a higher dimensional input space to a lower dimensional map space. The procedure for placing a vector from data space onto the map is to first find the node with the closest weight vector to the vector taken from data space. Once the closest node is located it is assigned the values from the vector taken from the data space [1].

2. MATERIALS:

The goal of learning in the self-organizing map is to cause different parts of the network to respond similarly to certain input patterns. This is partly motivated by how visual, auditory or other sensory information is handled in separate parts of the cerebral cortex in the human brain. The weights of the neurons are initialized either to small random values or sampled evenly from the subspace spanned by the two largest principal component eigenvectors. With the latter alternative, learning is much faster because the initial weights already give good approximation of SOM weights [2].

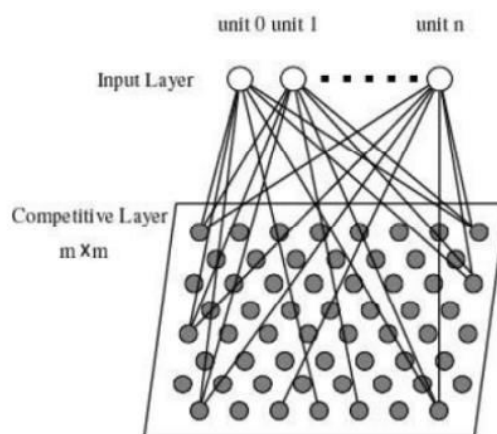


Fig.(1): SOM weights

By exploiting these features of the 2-D SOM, visualization techniques to depict the data structure of the feature space in the form of clustering of neurons in the SOM have been developed. This visualization typically uses a gray scale to illustrate the distance between connection weights. The light shading typically represents a small distance and the dark shading represents a large distance see figure (2):

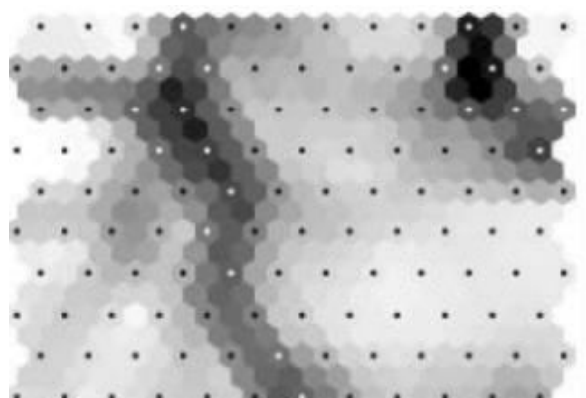


Fig.(2): Gray scale for SOM weights

During mapping, there will be one single winning neuron: the neuron whose weight vector lies closest to the input vector. This can be simply determined by calculating the Euclidean distance between input vector and weight vector.

While representing input data as vectors has been emphasized in this article, it should be noted that any kind of object which can be represented digitally and which has an appropriate distance measure associated with it and in which the necessary operations for training are possible can be used to construct a self-organizing map. This includes matrices, continuous functions or even other self-organizing maps [3].

3. METHODS:

In clustering problems, we want a neural network to group data by similarity. For example: market segmentation done by grouping people according to their buying patterns; data mining can be done by partitioning data into related subsets; or bioinformatic analysis such as grouping genes with related expression patterns. A self-organizing map (selforgmap) consists of a competitive layer which can classify a dataset of vectors with any number of dimensions into as many classes as the layer has neurons. The neurons are arranged in a 2D topology, which allows the layer to form a representation of the distribution and a two-dimensional approximation of the topology of the dataset. After searching many websites & go through MATLAB recommendations, We found that Back-Propagation generally used for prediction problems like weather forecasting & economy in order to predict the stock market while SOM is generally used for pattern recognition or classifying problems, Since our problem (Face Recognition) is classified as classification problem, WE changes our plan to use SOM rather than back-propagation.

4. Face Recognition Using Neural Networks Graphical User Interface (GUI) :

When we completed the face recognition program using MATLABm-file programming language , We decided to rebuild it using MATLAB graphical user interface(GUI) & convert it as stand alone application (.exe) so we can distribute it for any computer has 32-bit system (Microsoft Windows) without installing or purchasing MATLAB environment . Due to limitations in MATLAB compiler , ONLY pre-trained neural networks can be converted into stand alone application (.exe) , Since this is not applicable to our project (Needstraining) , Still we have to run the program under MATLAB environment . After copying our software in MATLAB system folder & typing “Face_Recognition”, The down figure(3) will appear :

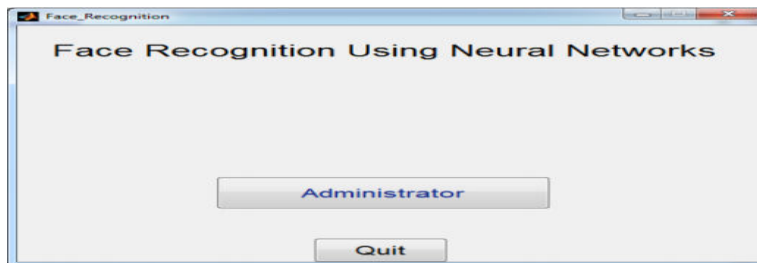


Fig.(3): Home page

As shown above , We have the main window , Showing two options only , Administrator & Quit , By pressing “Quit” button , The program will be terminated (Closing) .

Pressing the “Administrator” Button, The following figure (4) will appear :

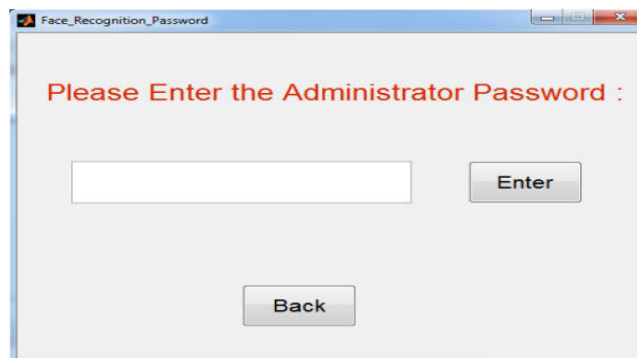


Fig.(4): Login admin

In this window , The user is requested to enter the password in order to make sure that is the “Administrator” of the program . We already programmed our software to have an administrator password “*****” , Lets consider that we entered wrong password like : “saqer” see figure(5):

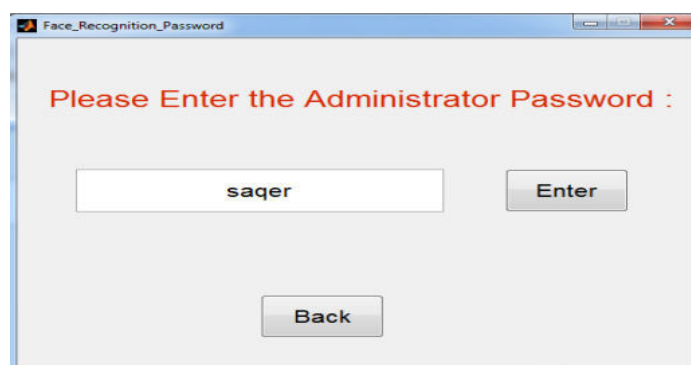


Fig.(5): Login with password

The following window will appear as in figure (6) :



Fig.(6): error message

Now lets consider that we entered the correct password “alotaibi” :

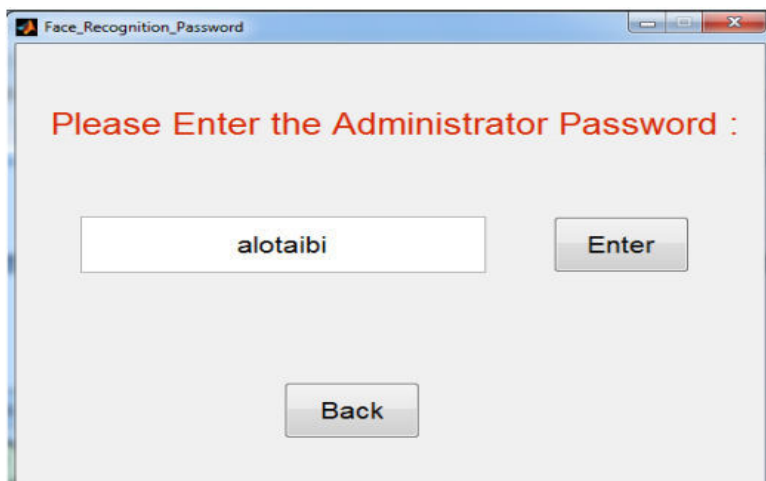


Fig.(7):

The administration window will appear as in figure (8) :

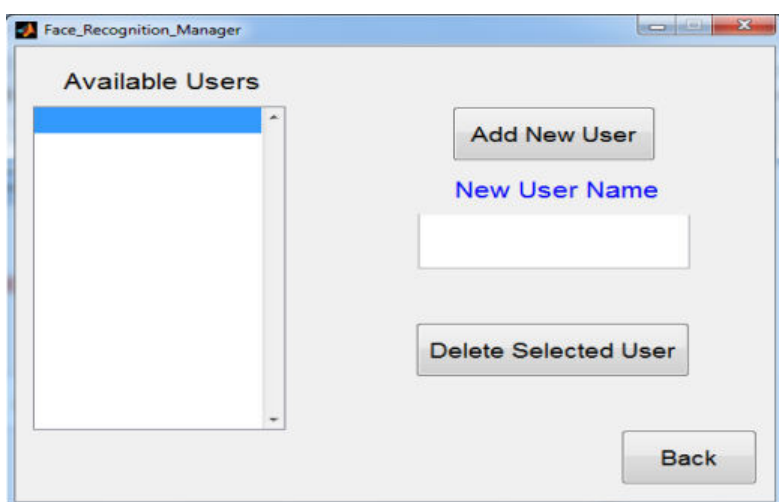


Fig.(8): add new user

In this window , We can add new users or delete available users , Since we are running the program for the first time , we can't see anything in the available users list ,Now lets consider a user name “Khalid” see figure (9):

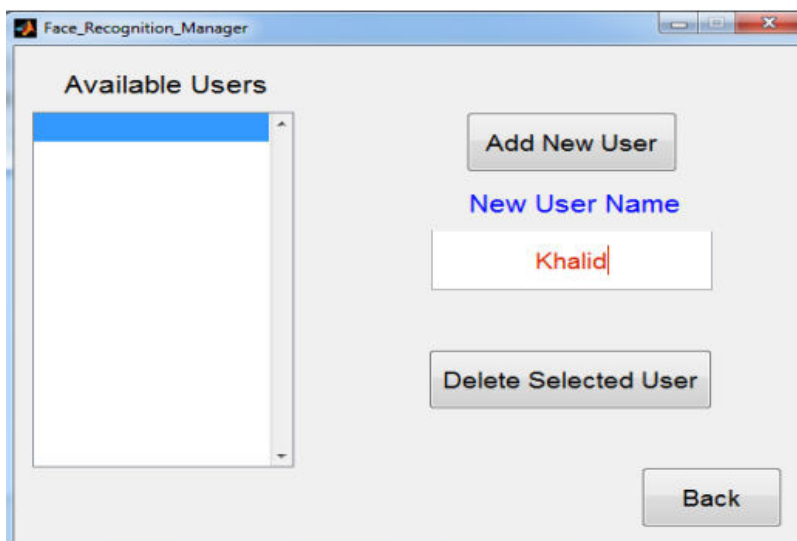


Fig.(9): Face recognition manager

5. CONCLUSION:

Now there is a new option appeared in the main menu “Run Face Recognition Program” , This means the face

recognition software has available users or database which means we can run face recognition process because without available users (Database) we can't train the neural network.

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