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Face Recognition Using Unsupervised Learning Technique

Abhjeet Sekhon[1] and Dr. Pankaj Agarwal[2]

[1]Research Scholar, Mewar University,Chittorgharh, Rajasthan, India
[2]*Department of Computer Science and Engineering,IMS Engineering College,Ghaziabad, U.P, India*

Abstract: This paper presents face recognition errand by using self organizing neural network technique. We dealt with AT&T database which incorporates 400 pictures of 40 people. The face recognition system has been proposed for recognizing the registered faces and some faces which are not parts of the database. The basic objective of this study is to understand the applicability and accuracy of self organizing map for face recognition errand. Some important results and observations of this study have been provided.

Keywords: face recognition, Self organizing neural network, and AT&T database.

I. INTRODUCTION

The security of data and physical property is getting to be vital and troublesome. We find out about the violations of Visa cheats, PC programmers or security ruptures in organization and so on. So to solve this issue we have some biometric systems. Face recognition is one of only a handful few biometric systems which are utilized for security purposes. Biometrics is best characterized as quantifiable physiological or behavioural qualities that can be used to confirm the personality of an individual.

Face recognition is a task in which system consequently distinguishes human appearances in the database. The database is put away in the system which incorporates face images. At whatever point we get another image, it is contrasted and the database of face images as of now put away in the system. Neural system make utilization of new face image and the put away face images to figure out whether there is a match .It is by all accounts a more normal and successful technique to recognize a person since it is the same as the human does and there is no compelling reason to utilize extraordinary types of gear .

A lot of techniques have been proposed for solving this task. In this study we worked on face recognition task by using self organising map. It is an unsupervised learning technique of artificial neural networks.

SOM is [1]:

- Competitive learning artificial neural network
- Each unit of map reduces identical inputs
- Units compete for selection
- Modification of selected node and its neighbours

It is based on dimensionality reduction. In this technique large dimensional input vectors projected down on the two dimensional map in a way that maintains the natural order of the input vectors. Because in the case of high dimensional space SOM not effortlessly figures out which classes of vectors are beside each other.

II. LITERATURE SURVEY

Santaji ghorepade et al[1] had carried out a research on "neural network for face recognition using SOM".They had developed and illustrated a face recognition system for human faces using kohonen self organizing map. Their system was 96.2% accurate for 400 images.[1]

Rohit jain et al[2] had carried out a research on "design of face recognition system by using neural network with discrete cosine transform and principle component analysis". They had compared 2D-DCT for image compression and SOM for face recognition with PCA for image compression and SOM for recognition. They found that PCA with SOM was better technique than 2D-DCT with SOM.[2]

Miss pooja et al[3] had carried out a research on "face recognition using SOM network". They had implemented DCT and DWT for feature extraction along with SOM. They had used 30 face images database containing 6 subjects and each subject having 5 images with different facial expressions. They found their system was 100% accurate for face recognition and DWT feature extraction was better than DCT feature extraction[3].

Shamla mantra et al[4] had carried out a research on "neural network based face recognition using matlab". They had been used AT & T database which includes 400 images. They got 92.40% accuracy of their system. They observed that the complexity of face recognition system decreases dramatically by using SOM[4].

Anderson Rodrigo et al[5] had carried out a research on "face recognition based on LDA and SOM neural nets".the purpose of this research was to classify/identify one face with its respective representative on the database connecting to the particular individual.(one -to -many application).A computational system to face recognition was implemented based on results showed by recent techniques using the LDA subspace algorithm to codify the images and many SOM neural networks together to classify the faces set. The tests were performed with many training groups and the results showed that there was no need to use all the PCA eigenvectors to reach high recognition rates.[5]

Que chin at al [6] had carried out a research on "face recognition using self organizing map". They found that the system play role of dimension reduction and feature extraction because it can provide partial invariance to translation, rotation, scale and deformation in the image sample [6].

III. PROPOSED WORK

Self organizing map is implemented in this proposed work. [2], the principle goal of self organizing map is transform an incoming pattern of arbitrary dimension into a one or two dimensional discrete map and to perform this transformation adaptively in a topologically ordered fashion.SOM learn to recognize group of similar input vectors in such a way that neurons physically near each other in the neuron layer respond to similar input vectors. They provide quantization of image sample into a topological space where inputs that are nearby in the original space are also nearby in the output space, thereby providing dimensionality reduction and invariance to minor changes in the image sample.

- Database

In this proposed work, a face image database was created for the purpose of benchmarking the face recognition system. AT & T database is used for face recognition task. It has complete 400 images, 10 unique images of each of 40 people with varieties in face points, outward appearances and so on are considered. The image database is divided into two subsets, for separate training and testing purposes. Fig 1 shows the example of few face images in the database.

fig1 Few face images in database

A. *Algorithm*

The algorithm summarised as follows:

1. The learning rate parameter and weight values for the network were initialized.
2. Squared Euclidean distance was calculated.

$D(j) = \sum(wij - xi)\text{^}2$ (1)

Here i= 1 to n and j=1 to m

D for squared Euclidean distance.

w for weight values and *x* for inputs.

3. Then winning unit was found.
4. Weights were updated.

$Wij(new) = Wij(old) + \propto [xi - Wij(old)]$ (2)

5. Learning rate was also updated.
6. Until the system found its stopping condition we have to update the weights and again perform the previous steps.

B. *Network topology of SOM*

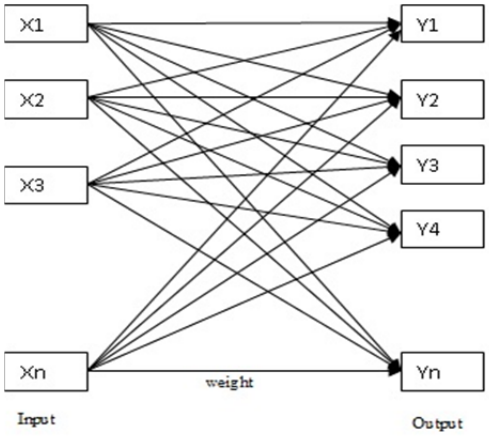

fig2 Network topology of SOM

In fig1, there are X values and Y values. X for inputs and Y for outputs of the network. In the network all input nodes are directly connected to the output nodes because there are only two layers (input layer and output layer) in the SOM network. Input layer accepts input in the form of face feature values. The system processed these values and generates output of the network in form of face values. In the process of SOM, the winner unit was calculated by Euclidean distance method. In this method the system calculates squared Euclidean distance between input vector and weight vector and chooses the unit whose weight vector has smallest Euclidean distance from the input vector. Then the winning and neighbouring units updated their weights.

We can increase or decrease the number of nodes in the network according to system's requirement.

In fig2, there is architecture of SOM.

There are:

- input unit
- weight values
- Nodes
- Output unit.

It is an unsupervised learning, so there is no any desired Output vector. The training of the network starts from input layer to output layers of the network. When the training of the system is completed then our system is ready to recognising the faces.

C. *Architecture of self organising map*

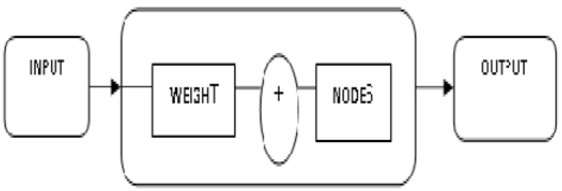

fig3 Architecture of SOM.

IV. RESULTS AND OBSERVATIONS

In this proposed work, we observed that:

- The self organising map is precise for face recognition task but in instance of huge database of face images the system is more exact as contrast with little database of images.
- As we increase the number of nodes in the network the complexity of system output also increased which directly affect the recognition task of the system.
- On account of extensive size of the network the system has taken more time in training process of face recognition task.

Table I, represents the effects of training length in the network. We have 900 nodes in the layer and 200 numbers of epochs. The execution time and accuracy of the system has been calculated. When we have 10 numbers of faces in the database for training then the execution time was 0:11:16 and system was 82.06% accurate. When training length increased to 30 then the execution time was 0:25:38 and accuracy increased to 87.42%. It means when the training length increased then the system was slow in its execution but the accuracy of the system was increased.

We can calculate the performance of system by increasing the number of nodes in the network. In table II When we have 100 nodes in the network that time our system is 89.62% accurate but training time is 0:03:11 but when we increase the nodes in the network from 100 to 900 then our system is 93.30% accurate and system takes 0:33:10 in training process. It means when we increase the number of nodes in the network then the accuracy of the system increases but system takes lot of time in execution. We can see this effect in fig4 and fig5.In fig4 there are 100 nodes in the network and in fig5 there are 900 nodes in the network. In fig4 the execution time is 0:03:11 and in fig5 the execution time is 0:33:10. So we can say number of nodes in the network also affects the performance of the system.

TABLEI EFFECTS OF TRAINING LENGTH

Number of epochs	Training length	Number of nodes	Execution time	Accuracy (recognition rate)
200	50	100	0:03:11	89.62%
		400	0:13:08	91.90%
		900	0:33:10	93.30%

TABLEII EFFECTS OF NODES IN NETWORK

Number of epochs	Nodes in layer	Training length	Execution time	Accuracy (recognition rate)
200	900	10	0:11:16	82.06%
		20	0:21:26	84.27%
		30	0:25:38	87.42%
		40	0:28:37	90.10%
		50	0:33:10	93.30%

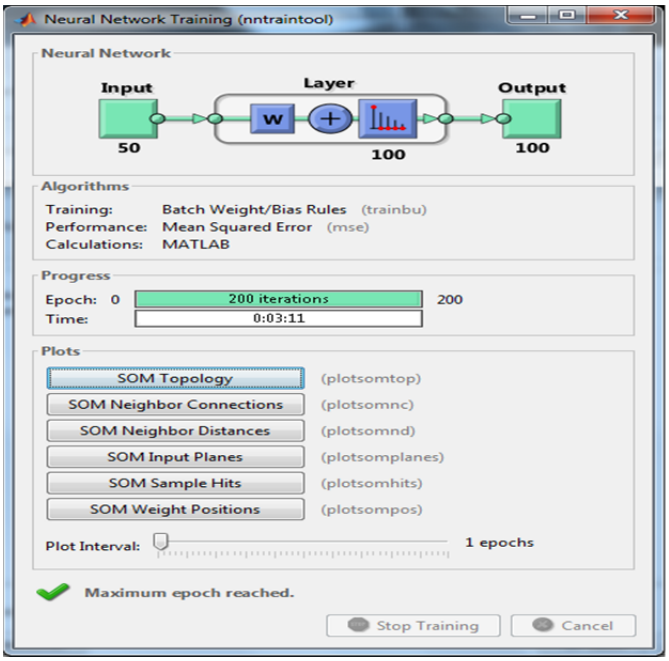

fig1 Represents performance of the system

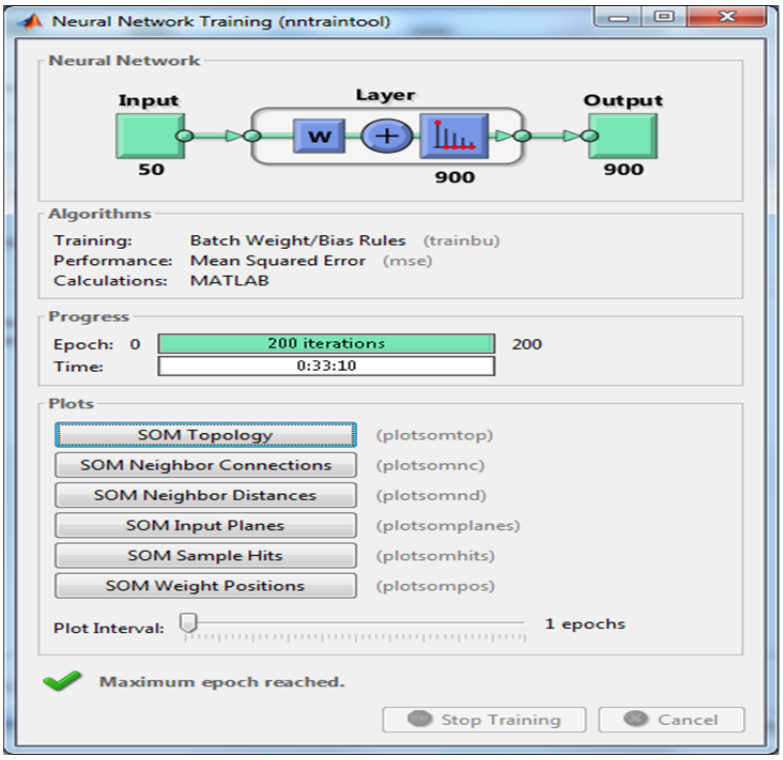

fig2 Represents performance of the system When nodes are 900

V. CONCLUSION

In this proposed work the self organising map for face recognition errand is reviewed. On the premise of this study, we have been validating an accuracy of SOM technique in face recognition system. It is precise for this errand however if there should arise an occurrence of vast databases of images system takes heaps of time in the training process of the system but the accuracy of the system also increases. The system is consummately well on still pictures.

REFERENCES

[1] Santaji ghorpade et al, "*neural networks for face recognition using SOM*," IJCST vol 1issue 2,December 2010.

[2] Rohit jain et al," *Design of face recognition system by using neural network with discrete cosine transform and principal component analysis*,"International journal of advanced computer research , vol 2,No.4,December 2012.

[3] Miss pooja et al, " *face recognition using SOM network*," International journal on recent and innovation trends in computing and communication, vol 3,issue 9,September 2015.

[4] Shamla mantra et al," *neural network based face recognition using matlab*," IJCSETvol 1, issue 1, feb 2011

[5] Anderson Rodrigo," *face recognition based on LDA and SOM neural nets*" September 2012.

[6] Qiu Chen, et al "*Face Recognition Using Self-Organizing Maps*" ,Intech, ISBN: 978-953-307-074-2,2010.