Neural Network Based Face Recognition Using Matlab

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Abstract

In this paper, we propose to label a Self-Organizing Map (SOM) to measure image similarity. To manage this goal, we feed Facial images associated to the regions of interest into the neural network. At the end of the learning step, each neural unit is tuned to a particular Facial image prototype. Facial recognition is then performed by a probabilistic decision rule. This scheme offers very promising results for face identification dealing with illumination variation and facial poses and expressions. This paper presents a novel Self-Organizing Map (SOM) for face recognition. The SOM method is trained on images from one database. The novelty of this work comes from the integration of Images from input database, Training and Mapping. Face Recognition using unsupervised mode in neural network by SOM. Among the architectures and algorithms suggested for artificial neural network, the Self-Organizing Map has special property of effectively creating spatially organized "internal representation' of various features of input signals and their abstractions. After supervised fine tuning of its weight vectors, the Self-Organizing Map has been particularly successful in various pattern recognition tasks involving very noisy signal. One develops realistic cortical structures when given approximations of visual environment as input, and is effective way to model the development of face recognition capability.

Here, we have developed and illustrated a recognition system for human faces using a novel Kohonen self-organizing map (SOM) based retrieval system. SOM has good feature extracting property due to its topological ordering. The Facial Analytics results for the 400 images of AT&T database reflects that the face recognition rate using one of the neural network algorithm SOM is 92.40% for 40 persons.

Keywords

SOM (Self Organizing Mapping), PCA (Principal Component Analysis), ICA (Independent Component Analysis).

I. INTRODUCTION

In today's networked world, the need to maintain the security of information or physical property is becoming both increasingly important and increasingly difficult. From time to time we hear about the crimes of credit card fraud, computer breaking's by hackers, or security breaches in a company or government building. . It goes without saying that if someone steals duplicates. Recently, technology became available to allow verification of "true" individual identity. This technology is based in a field called "biometrics "as shown in Fig. 1 and Fig. 2. Face recognition is one of the few biometric methods [5] that possess the merits of both high accuracy and low intrusiveness. It has the accuracy of a physiological approach without being intrusive. For this reason, since the early 70's (Kelly, 1970), face recognition has drawn the attention of researchers in fields from security, psychology, and image processing, to computer vision. Numerous algorithms have been proposed for face recognition such as PCA, ICA [1][2].

What is SOM

SOM [3] is a

- Competitive learning ANN
- Each unit of map reduces identical inputs.
- Units competes for selection
- Modification of selected node and its neighbors.

The human capacity to recognize particular individuals solely by observing the human face is quite remarkable. This capacity persists even through the passage of time, changes in appearance and partial occlusion. Because of this remarkable ability to generate near-perfect positive identifications, considerable attention has been paid to methods by which effective face recognition can be replicated on an electronic level. Certainly, if such a complicated process as the identification of a human individual based on a method as non-invasive as face recognition could be electronically achieved then fields such as bank and airport security could be vastly improved, identity theft could be further reduced and private sector security could be enhanced.

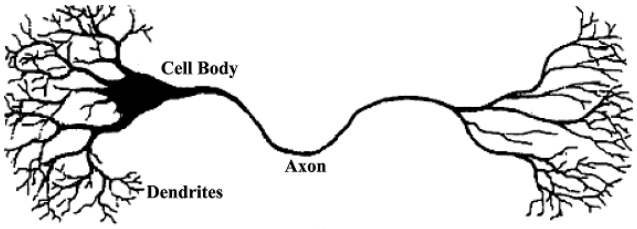

Fig.1 Neuron Cell

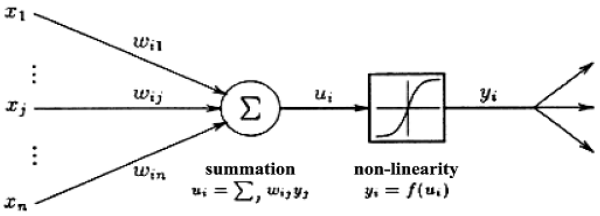

Fig.2 Neuron Model

II. CHALLENGES IN FACE RECOGNITION

Pose, Illumination, Facial expression, Image condition, Face size.

A. Classification of Face Recognition

Face recognition scenarios can be classified into two types Fig. 3, Face verification (or authentication) and Face identification (or recognition).

1) Face verification: It is a one-to-one match that compares a query face image against a template face image whose identity is being claimed. To evaluate the verification performance, the verification rate (the rate, at which legitimate users are granted access) vs. false accepts rate (the rate at which imposters are granted access) is plotted, called ROC curve. A good verification system should balance these two rates based on operational needs.

2) *Face identification:* It is a one-to-many matching process that compares a query face image against all the template images in a face database to determine the identity of the query face. The identification of the test image is done by locating the image in the database that has the highest similarity with the test image[4].

The identification process is a "closed" test, which means the sensor takes an observation of an individual that is known to be in the database. The test subject's (normalized) features are compared to the other features in the system's database and a similarity score is found for each comparison. These similarity scores are then numerically ranked in a descending order. The percentage of times that the highest similarity score is the correct match for all individuals is referred to as the "top match score".

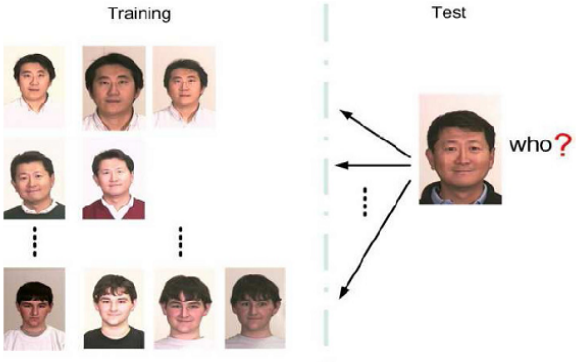

Fig. 3 Comparing a new image with the database

III. REQUIREMENT ANALYSIS

A. Hardware Requirements

1) *P-4 Computer System:* Intel CPU @ 2.93 GHz Core 2 Dual/D2C, 2GB DDR2 RAM,G41 Gigabit Motherboard, On Board Soundcard Card & AGP Card, 60GB HDD, Cabinet with SMPS loaded with OS Windows XP / Vista / Windows 7.

2) Webcam, Scanner

B. Software Requirements

1) Matlab 7.8, Matlab 2008, Image Processing Toolbox
2) Outsourced Database
3) AT&T Image Database

IV. SOM ALGORITHM AND FLOWCHART

A. Algorithm Steps

Step 1 - Initializing the Weights
Step 2 - Obtain Best Matching Unit
Step 3 - Scale Neighbors:
    a) Determining Neighbors
    b) Training
Step 4 - Mapping: Determining the Quality of SOMs.

B. Flow Chart

Flow chart consistence of two steps A) Training B) Testing

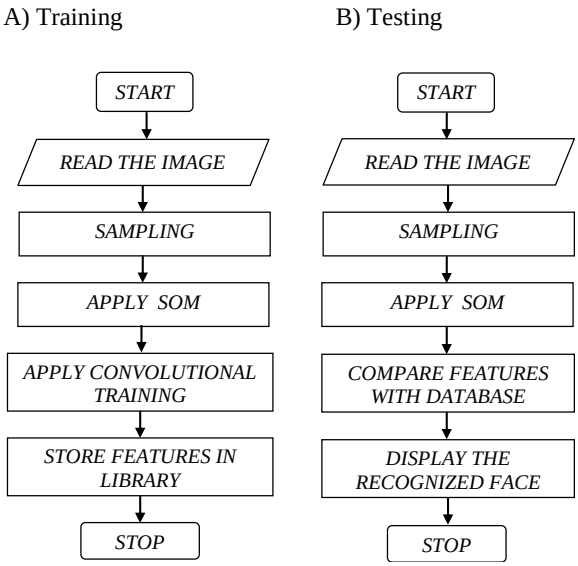

Fig. 4 Flow Chart for Face Recognition

V. INTRODUCTION TO THE SOFTWARE USED

A. Overview of the Matlab Environment

The name MATLAB stands for matrix laboratory, originally written to provide easy access to matrix software developed by the LINPACK and EISPACK projects. Today, MATLAB engines incorporate the LAPACK and BLAS libraries, embedding the state of the art in software for matrix computation Fig. 5.

MATLAB is an interactive, matrix based system for scientific and engineering numeric computation and visualization. Its basic data element is an array that does not require dimensioning. It is used to solve many technical computing problems, especially those with matrix and vector formulation, in a fraction of the time it would take to write a program in a scalar non interactive language such as C or FORTRON

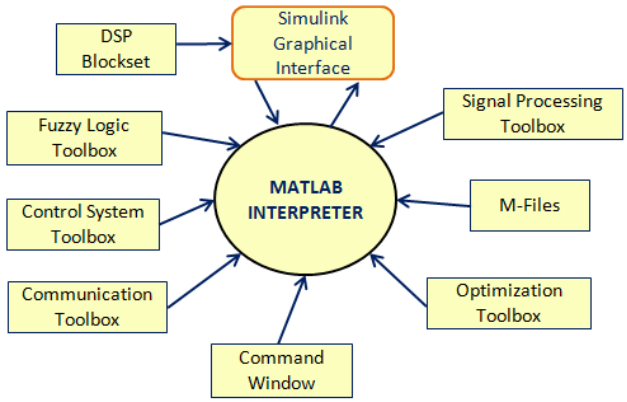

Fig. 5 Matlab Environment

VI. EXPERIMENTAL DATASET

Publicly available AT&T database [6] is used for recognition experiments. In the database, 10 different images of each of 40 persons (total 400 images) with variations in face angles, facial expressions and facial details are considered. A preview image of the Database of Faces is as shown in Figure 6.

Fig. 6 AT&T Dataset

VII. RESULTS

Computational Efficiency of the SOM Method is as shown in Table 1 and Fig. 7.

TABLE I
RESULT OF SOM ON ORL DATABASE

SRN	DB Image	Accuracy (Recognition Rate)
1	3	81.80%
2	4	83.70%
3	5	86.00%
4	6	92.00%
5	7	92.40%

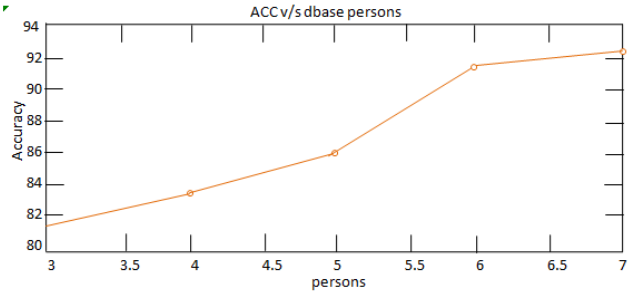

Fig.7 Accuracy Vs Database Persons

VIII. APPLICATIONS

The advantage of face recognition is that it is a non-intrusive technique that can be effective without participant's cooperation or knowledge; this makes it especially suitable for surveillance purposes. Systems, for example ATR (automatic target recognition), Human traffic census security & Criminal identification uses face recognition techniques.

IX. CONCLUSION

We have seen a Self Organizing Map (SOM) method for face recognition. The novelty of this paper comes from integration of input image, Feature extraction, Training and Mapping. SOM is sheet-like artificial neural network, the cells of which become specially tuned to various input signal patterns or classes through an unsupervised learning process. Each cell or local cell group acts like separate decoder for the same input it is thus the presence or absence of an active response at the location and not much the exact input-output signal transformation or magnitude of the response, that

provides an interpretation of the input information. SOM reduce dimensions and display similarities.

Self-Organizing Maps are topologically ordered, which leads to good extracting feature ability.

The highest average recognition rate achieved using **SINGLE ALGORITHEM SOM is of 92.40%**, obtained for 40 persons' 400 images of AT&T database. Thus our experimental results conclude that the complexity of face recognition system decreases dramatically by using SOM.

REFERENCES

[1] Santaji Ghorpade**,** Jayshree G**.,** Shamla Mantri. (Dec 2010): Pattern Recognition using Neural Networks.IJCSIT, ISSN- 0975-9646, vol 2, No. 6, pp92-98.

[2] Santaji Ghorpade**,** Jayshree G**.,** Shamla Mantri, Dhanaji G. (Dec 2010): Neural Networks for Face Recognition using SOM.IJCST, ISSN-0976-8491, vol 1, issue 2.

[3] Teuvo Kohonen.(1990), Self-Organizing Map, vol. 78, No.9.

[4] Dinesh Kumar Dimensionality.(May 2008),Reduction using SOM based on Technique for Face Recognition, Journal of Multimedia, Vol.3, No.1.

[5] F, Nazish Jamil, Fatima Jinnah Women University. Rewalpindi, Pakistan ace Recognition using Neural Networks.

[6] AT&T Laboratories Cambridge, The database of faces at http://www.cl.cam.ac.uk/research/dtg/attarchive/facesataglance .html..