Neural Network Based Face Recognition Using MatLab

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Abstract

In this study, we suggest labeling a Self-Organizing Map (SOM) to detect how similar human face images are. To be more specific, we used the training mode in the SOM, which is training using an input data set . We feed the neural network with facial photos and random objects related to the regions of interest to manage this goal. Neural units are tailored to facial features at the conclusion of the learning phase. A probabilistic decision rule then performs facial recognition. This method for face identification takes into account variations in facial features that are common in all human faces, which shows highly encouraging results. Images from one database are used to train the SOM algorithm. The Self-Organizing Map, one of the suggested architectures and techniques for artificial neural networks, has the unique ability to efficiently create spatially structured "internal representations" of diverse input signal elements and associated abstractions. The Self-Organizing Map has proven extremely effective in a variety of pattern recognition applications involving very noisy signals after supervised fine setting its weight vectors. It is a useful technique to understand how the capacity to recognize faces emerges when given approximate representations of the visual environment as input. Here, we present and demonstrate a self-organizing map (SOM) results for 50 photos from the Kaggle database, which shows a 93.3% face recognition rate for 30 images that were properly identified by neural network technique

I. Introduction

The necessity to ensure the security of data or physical assets is becoming both more crucial and more challenging in today's networked society. We occasionally learn about crimes like financial fraud, computer hacking, and security lapses at business and government buildings. Nowadays, by using face recognition, a facial recognition system can identify and verify the person's true identity which improves the security of the systems. In this paper, we present and demonstrate how neural networks recognize whether it is a face or an object, which motivates the use of Neural Networks to classify and recognize one human face from another in a more advanced approach.

II. Methodology And The Structure Of The System

The system's initial phase is to identify faces in an image. The original image is first read into a ".m" format by MatLab before being transformed to grayscale to reduce the original image's three-dimensionality to two dimensions. The backpropagation neural network's input layer is then fed the pixel matrix. Because we were seeking a pattern in the human face so the network could detect any human face with the same pattern, pattern recognition app was utilized in the Neural Network. The network has a 10 neuron input layer. For the purpose of differentiating faces from objects, two output neurons were utilized. The structure of the design system is shown in Figure 1.

2.1. Training Set

The training set includes 30 photographs of various people's faces and 15 images of other objects, for a total of 15 images that will be used to train the neural network. Examples of the training set data are shown in Figure 2.

2.2. Testing Sets

The testing set also includes 20 photographs of various people's faces and 10 images of various items, a total of 10 images, which is 30% of the overall data set. This testing is done to see if the Neural Network can distinguish a face from an object

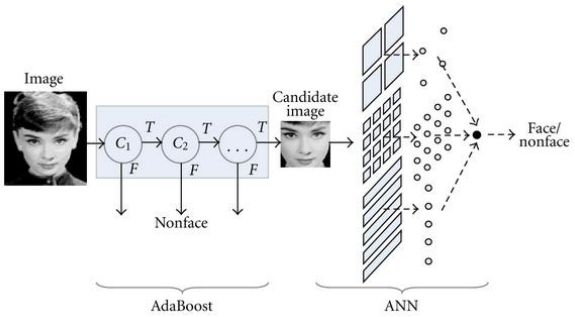


Figure 1

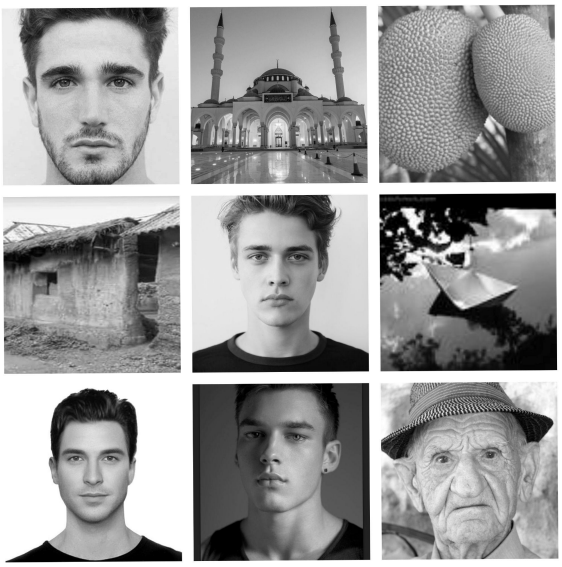


Figure 2

III. REQUIREMENT ANALYSIS

A. Hardware Requirements

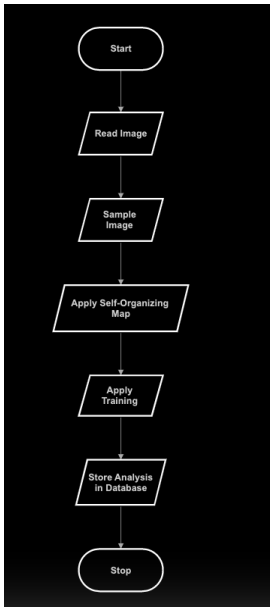
1) Computer System with 64-bit and 2GHz compatible processors that support AVX2.
2) 512MB of free RAM.
3) Internet Connectivity

B. Software Requirements

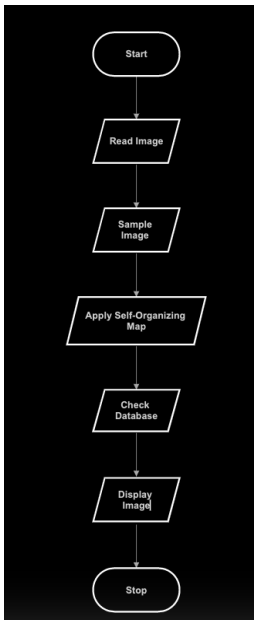
1) MATLAB R2022a
2) Image processing toolkit
3) Database

IV. SOM Flow Chart

1) Training Flowchart



2) Testing Flowchart



V. Introduction To The Software Used

MATLAB is a programming platform that is used to design systems and analyze functions and data. It allows for implementations of algorithms, computations, and visualizations.

VI. Experiments And Results

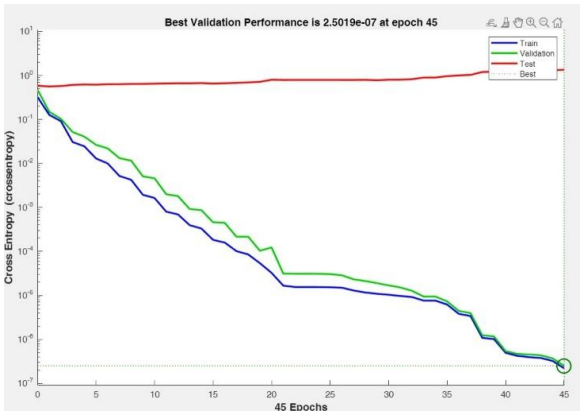
The sets of photographs were subjected to numerous experiments until optimal parameters for the neural network's training process were found. Ten photos were used during the neural network training procedure. The initial collection of pictures featured human faces. The second set of pictures featured various items including a chair, table, keyboard, or even a mouse. The training parameters of the neural network are shown in Table 1.

During the training, a 100% identification ratio was attained and no images were incorrectly identified as was expected. The trained network's capacity to recognize images other than the training images was tested using a single repetition test after the training was complete. The test was run on 20 photos, including 10 different items and 10 human faces.

Parameters	Value
Number of input neurons	363000
Number of output neurons	2
Training time	56 seconds
Max. epochs	45
Target error	9.89e-07

Table 1

Performance Plot



Model Summary

Model Summary

Train a neural network to classify predictors into a set of classes.

Data
Predictors: Train - [30x363000 double]
Responses: data - [30x2 double]
Train: double array of 30 observations with 363000 features.
data: double array of 30 observations with 2 classes.

Algorithm
Data division: Random
Training algorithm: Scaled conjugate gradient
Performance: Cross-entropy error

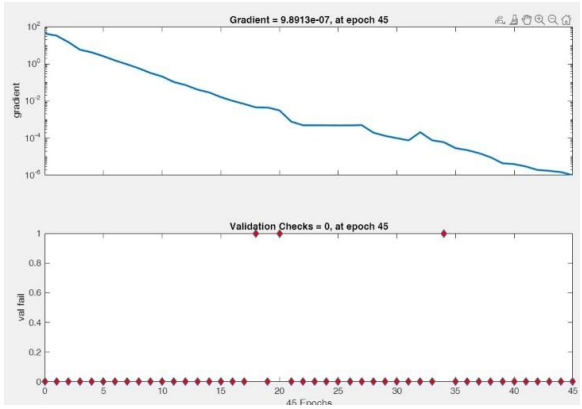
Training Results
Training start time: 03-Dec-2022 17:13:12
Layer size: 10

	Observations	Cross-entropy	Error
Training	18	0.0000	0
Validation	6	0.0000	0
Test	6	1.3529	0.3333

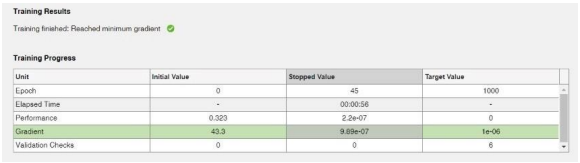
Additional Test Results
Predictors: Test - [363000x20 double]
Responses: data - [2x20 double]
Test: double array of 20 observations with 363000 features.
data: double array of 20 observations with 2 classes.

	Observations	Cross-entropy	Error
Additional test	20	0.5451	0.1500

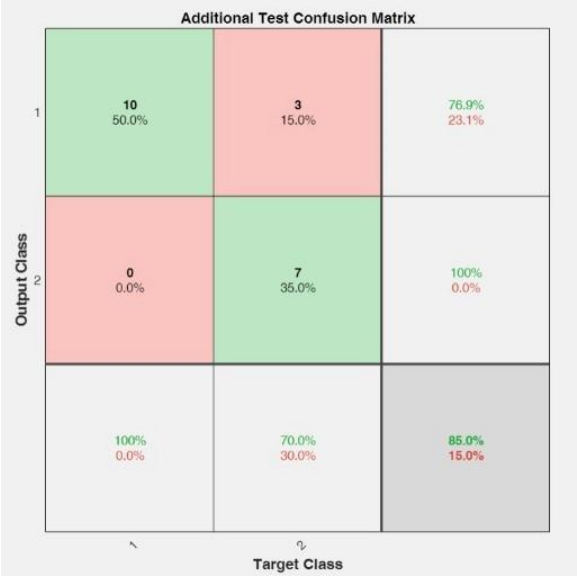
Training State



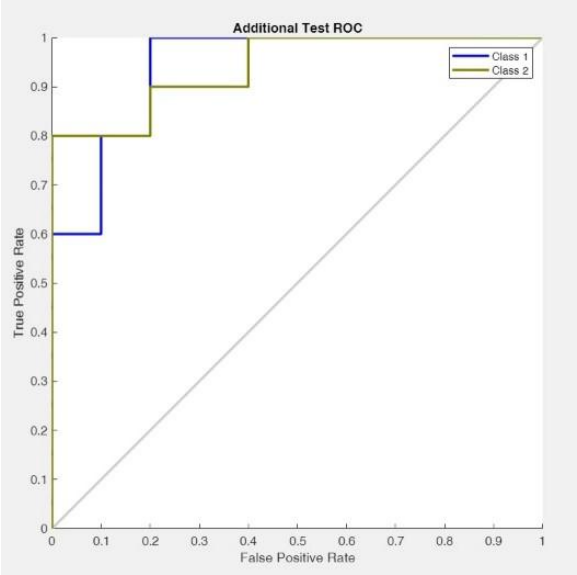
Training Results



Confusion Matrix



Test ROC Curve



Class 1 is face & = 1
Class 2 is not & = 2

VII. Conclusion

Numerous academic publications and studies have covered face recognition. It has a lot to provide in the fields of biometrics and classification science. With the use of ANNs, this effort aims to introduce face detection or categorization from other objects. Neural networks have demonstrated that they can provide great efficiency in a variety of applications. The core of the most significant unique traits of the human face and the differentiation of faces from other random objects must be covered in a facial recognition procedure. Without conducting any mathematical or statistical analyses, neural networks attempt to categorize groups of photos based on their features.

We draw the conclusion that the usage of the neural network for face recognition and classification was effective based on the tests conducted in this research and the data obtained. In this study, many experiments have been conducted, including network training and testing. A series of photos were created and fed to the neural network during the training phase. Up until an acceptable mistake was reached, the backpropagation procedure was initiated. A different collection of photos with human faces and various objects were produced in order to evaluate the effectiveness of the developed network with different images from the training sets. These photographs were sent to the network, which produced the desired results. Out of the 30 training photos, 93.3% were properly identified. In this trial, the recognition ratio was considered exceptionally high. The findings of this study demonstrated that using ANN to separate faces from objects is a good approach. It is demonstrating how neural networks may be used for classification problems including machine vision, facial recognition, and also biometric science.

VIII. References

[1] (n.d.). *BIOMETRIC IDENTITY AUTHENTICATION FOR SECURE MOBILE AND WEB APPLICATIONS*. Neurotechnology.com https://www.neurotechnology.com/face-verification-system-requirements.html

[2] Face Detection in Images." *Face Detection in Images | Kaggle*, /datasets/dataturks/face-detection-in-images. https://www.kaggle.com/datasets/dataturks/face-detection-in-images

[3] Hindawi, and Thai Hoang Le. "Applying Artificial Neural Networks for Face Recognition https://www.hindawi.com/journals/aans/2011/673016/

IX. Individual Contribution

Name	**Tasks Assigned**
Samia Abu Theeb	Abstract, Introduction
Sumaya Almomen	Requirement Analysis, SOM Algorithm and Flowchart, Introduction to the software used.
Fahda Bin Muqrin	Methodology and Structure of the System, Experiments and Results, Conclusion