International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 -0056
Volume: 02 Issue: 03 | June-2015 www.irjet.net p-ISSN: 2395-0072

COMPARISION BETWEEN NEURAL NETWORK AND ADAPTIVE NEURO-FUZZY INFERENCE SYSTEM(ANFIS) RESULTS IN DETERMINATION OF GENDER USING FINGERPRINTS

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Abstract - *This research represents a novel identification of gender by using different features of fingerprints. Fingerprints are the biometric system provides an automatic recognition of an individual based on some unique features of an individual. Gender classification using fingerprints can be done by using spatial domain approach or frequency domain approach or it can be also done using the combination of both spatial domain and frequency approaches both. The identification and classification of fingerprints are based on feature extraction. In a fingerprint pattern , it consists of a number of Ridges and valleys presents in it. These makes different kind of structures on a fingerprint pattern, which are used for the identification of an individual. Cause each and every fingerprints are unique in the world. For the identification and classification, different algorithms are presented earlier. These algorithms are able to produce different recognition rates. However proposed results have usually been produced under fanamable conditions and technology.In this paper we have proposed the gender classification by using two methods NN and ANFIS and compare their results.*

Key Words: Fingerprints, Gender determination, Discrete Wavelet transform (DWT),Ridges, Valleys, minutea, NN, ANFIS

1. INTRODUCTION

A fingerprint is a pattern of feature of a finger as shown in fig1 given below. As per with the strong evidences, it is believed that each fingerprint in this world are unique and so each person of this world has a unique fingerprint With a permanent unique characteristics over it. That's why fingerprints are being used for various forensic investigation and identification from a long period of time. Nowadays, we also fingerprints for many purposes like to note down daily attendance and to get an automatic database retrieval system.

Fig1. An original fingerprint Image

The fingerprint surface is made up of a system of ridges and valleys that serve as friction surface when we are gripping the objects. The surface exhibits very rich structural information when examined as an image. The fingerprint images can be represented by both global as well as local features. The global features include the ridge orientation, ridge spacing and singular points such as core and delta. The singular points are very useful from the classification perspective (See Fig2). However, verification usually relies exclusively on minutiae features. Minutiae are local features marked by ridge discontinuities. There are about 18 distinct types of minutiae features that include ridge endings, bifurcations, crossovers and islands. Among these, *ridge endings* and *bifurcation* are the commonly used features.

Abruptly terminates and a ridge bifurcation is marked by a fork in the ridge flow. Most matching algorithms do not even differentiate between these two types since they can easily get exchanged under different pressures during acquisition. Global features do not have sufficient discriminative power on their own and are therefore used for binning or classification before the extraction of the local minutiae features.

2. METHODOLOGY

The proposed method can be classified into as follows.

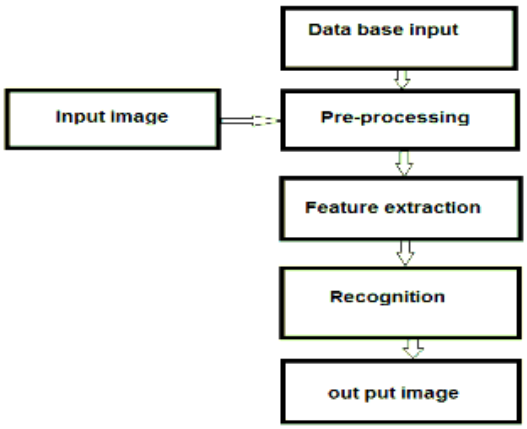

Fig.2 Block diagram of proposed system

2.1 Fingerprint Image Acquisition

The fingerprint images of internal database were collected from a scanner manufactured by nitgen biometric solution.

2.2 Pre processing

The biometric data is captured and pre-processed by enhancing the input from the sensor, removing any background noise or any piece of input that is not required. Normalization is done on the input stream to enhance quality and correct any deformity in the input stream in order to attain the desired format for efficient feature extraction.

2.3 Feature Extraction

The feature extraction extracts the features of importance for image recognition. The feature extracted gives the property of the text character, which can be used for training in the database. The obtained trained feature is compared with the test sample feature obtained and classified as one of the extracted character. Here we are using both spatial domain and frequency domain analysis for the feature extraction. Spatial domain features extracted with the help of Ridge to Valley area ration(RVA). And for the DWT is used.

Discrete Wavelet Transform

Discrete wavelet transform (DWT) is used to decompose the fingerprint image into a multi-resolution representation in order to keep the least coefficients possible without losing useful image information. 2-D wavelet decomposition of an image is results in four decomposed sub-band images referred to as low–low (LL), low–high (LH), high–low (HL), and high–high (HH). Each of these sub-bands represents different image properties.

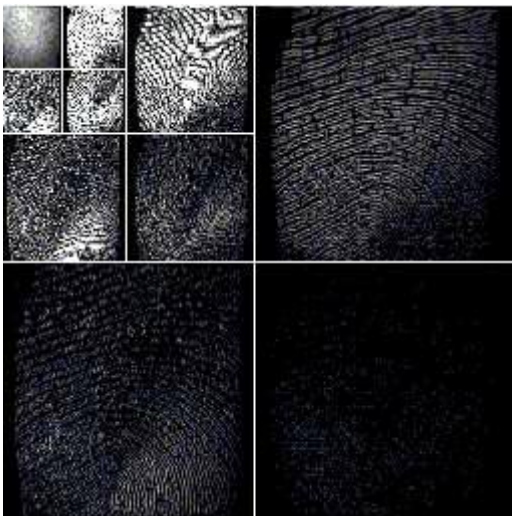

Fig 3. 3-level of 2-D DWT

2.4 Classification

For the classification there are two methods applied one is Neural Network and second is ANFIS.

Neural Network

Artificial Neural Network (ANN) or neural networks are a kind of information processing paradigm. These are inspired by the working of biological nervous systems such as brain. ANN process information in the same manner as biological nervous systems do. Neural networks are composed of highly interconnected processing elements called neurons. These neurons operate in parallel to solve a specific problem. Patterns to be analyzed are presented to the network via the 'input layer'. Getting a specific target output from a particular input requires neural networks to be adjusted, or trained.

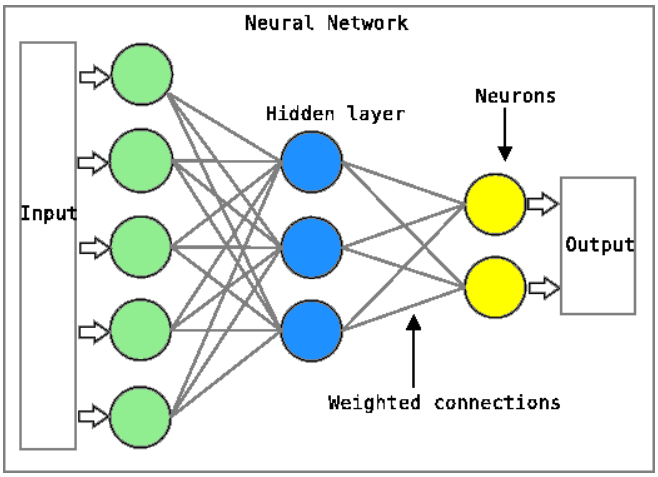

Fig4 . Structure of Neural Network

ANFIS

Neuro-fuzzy systems use the combined power of two methods: fuzzy logic and artificial neural network (ANN).

This type of hybrid system called as ANFIS ensures for the classification of the gender in the input Fingerprints images .

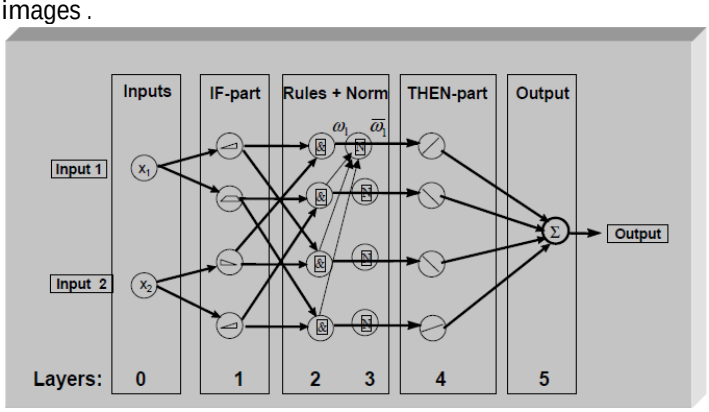

Fig5. Architecture of ANFIS Network

3. SIMULATION RESULTS

Fig 9 shows the GUI neural network toolbox. Fig shows the Fig 10 shows Performance Plot mean square error dynamics for all the datasets in logarithmic scale. Training Mean Square Error is always decreasing with increasing in number of epochs. Fig11 shows the GUI ANFIS training data sets and fig 12 shows the average training error.

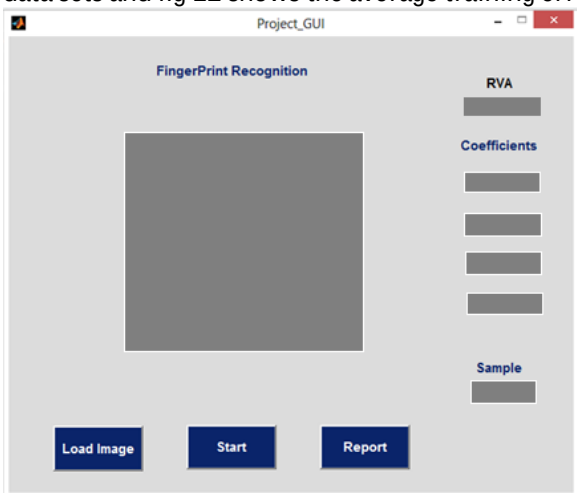

Fig6 Screenshot of GUI

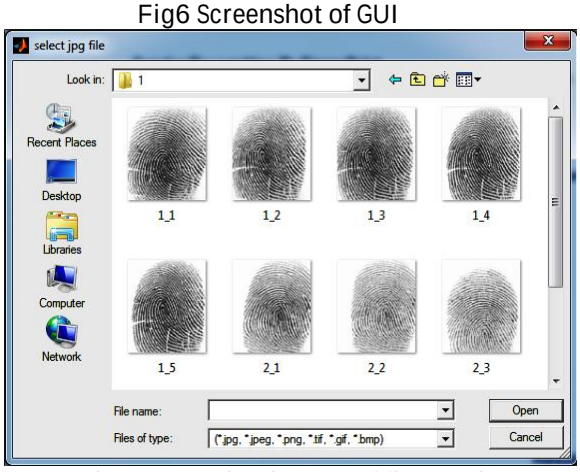

Fig7 Screenshot images of fingerprints

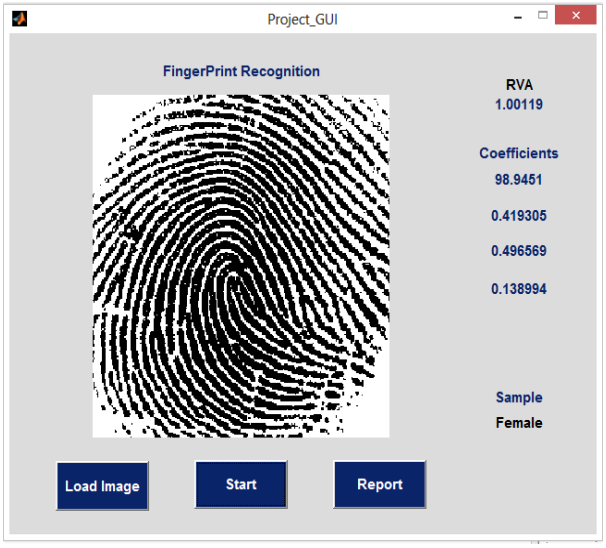

Fig 8 Screenshot showing determination of gender

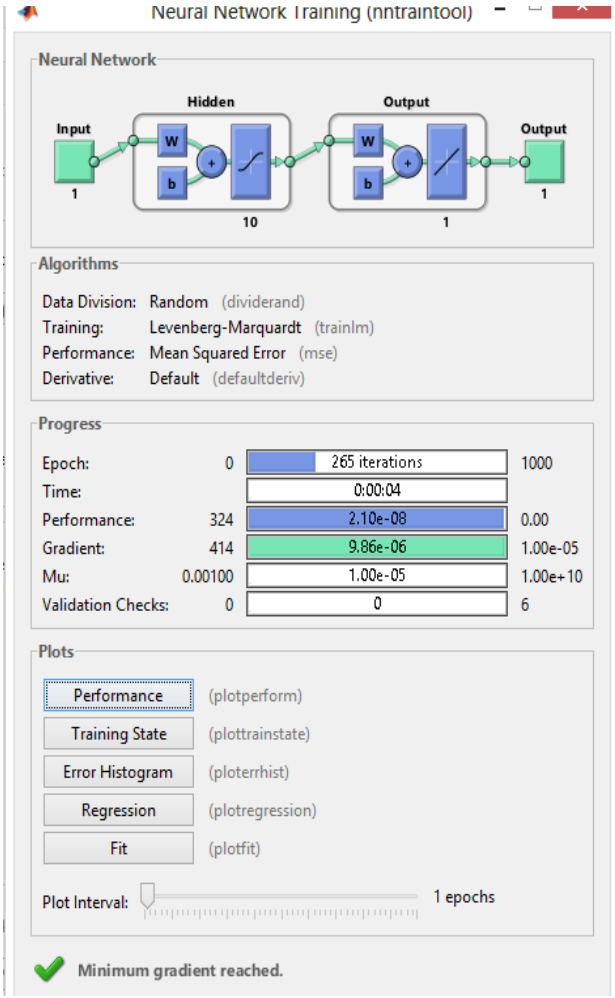

Fig 9 Screenshot of GUI neural network training phase.

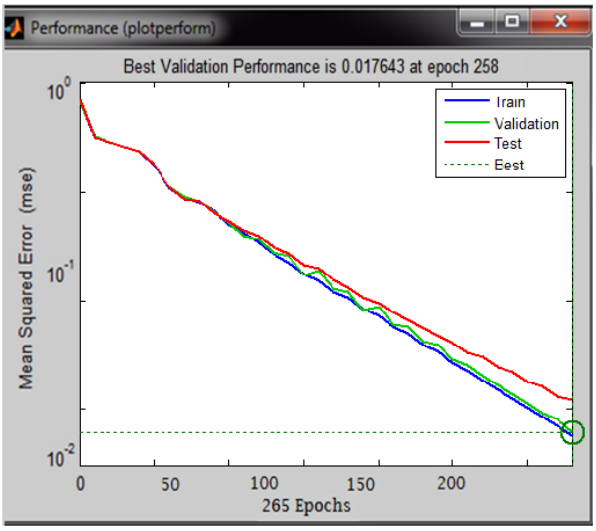

Fig 10 Screenshot of GUI NN Performance of Mean square error

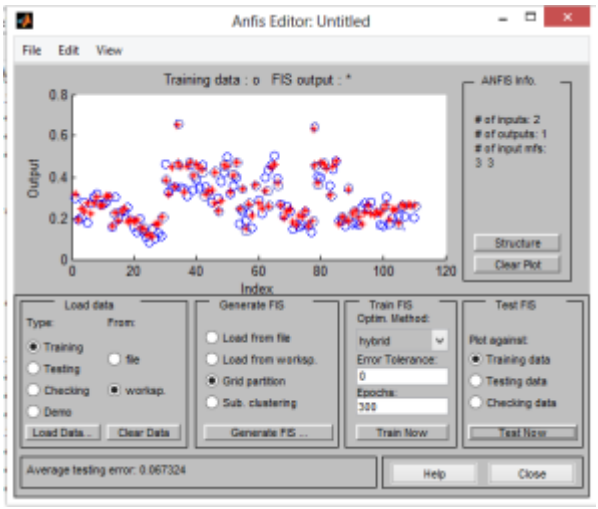

Fig 11 Screenshot of GUI ANFIS training phase.

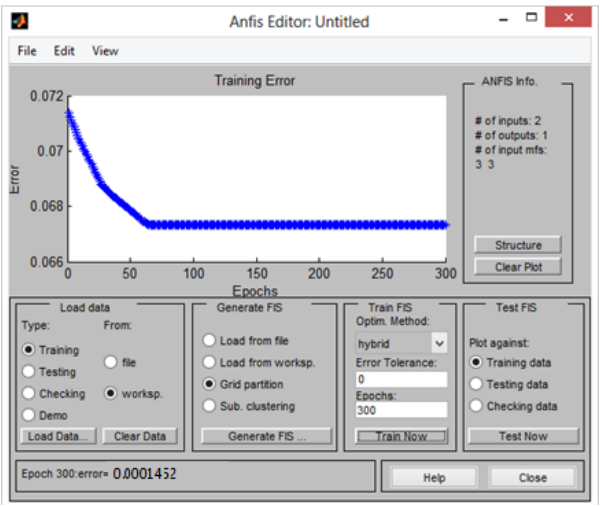

Fig 12 Screenshot of GUI ANFIS training error

4. CONCLUSIONS

This paper presents grnder determination from the fingerprints image using the adaptive neuro fuzzy inference system and neural network. It is observed that the system result in better classification during the classification process. The considerable recognition time and the accuracy level is found to be about 60-70% improved in determination by using ANFIS as compared to the existing neural network. It is observed that if the training data sets are tested by using NN and ANFIS, the root mean square error is lower by training ANFIS than NN, which is almost negligible.

ACKNOWLEDGEMENT

I wish to thank my superviser Prof. A. Prabhakar Rao & my co- superviser Mr. Saurabh Tarun Mishra for their invaluable advice and support throughout the research. Without which it was impossible to complete my paper. Once again I would like to thank you all staff members (E &TC dept.) for their timely support.

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