www.ijecs.in
International Journal Of Engineering And Computer Science ISSN:2319-7242
Volume 2 Issue 6 June , 2013 Page No. 2041-2044

"FINGERPRINT MATCHING USING NEURAL NETWORK TRAINING"

Kalpna Kashyap[1], Meenakshi Yadav[2]

[1] Department of Computer Science and Engineering,
Krishna Institute of Engineering and Technology, Ghaziabad (U.P.), India.
Kalpna.kashyap@gmail.com

[2] Department of Computer Science and Engineering,
Krishna Institute of Engineering and Technology, Ghaziabad (U.P.), India.
meenakshiyadav2309@gmail.com

Abstract

Fingerprint is widely accepted for personnel identification. In this paper Levenberg-Marquardt back propagation (LMBP) algorithm is used for training purpose because LMBP is fastest technique for complex data sets and gives better performance in such situation. Input image is trained by trainlm function for producing different result sets like performance plot, regression values, simulation network of input image , histogram graph etc

.

Introduction

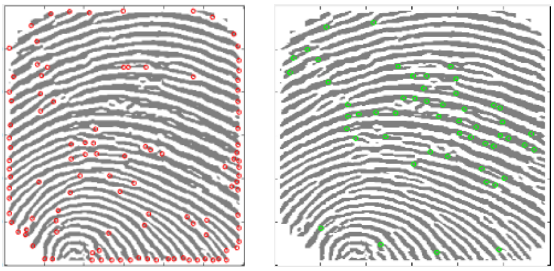
Biometrics is broadly used for recognition in various areas including person's behaviour as Gait, typing rhythm, voice, speech, Gesture, pattern recognition etc. Behavioural features and physiological characteristics are two core types of biometric identification.[1] A physiological characteristic consists of Palm Prints, Fingerprint, Retinal, Iris, Ear, Face and DNA.[2] Among different biometric fingerprint identification is widely accepted and commonly used method for person's verification and validation. Finger consists of different global and local features for matching purposes. Global features include Basic Ridge Pattern Area, Delta, Type Lines, and Ridge Count etc. And local features include minutiae points. These points show immutable and distinct characteristic fingerprint image. Table1 shows different minutiae points.

Key Terms: ANN, Minutiae, LMBP

Table 1: Description of Minutia [9]

Minutiae type	Description	Appearance
Ridge Ending	The terminal of a ridge is abrupt end	
Ridge Bifurcation	A single ridge that divides into two ridges or one ridge is branch with two ridges.	
Short ridge	A ridge that commences, travel a short distance and then ends	
Island	A small ridge inside a short ridge or ridge end that is not connected to all other ridges	
Spur	A bifurcation with a short ridge branching off a longer ridges	
Crossover	A short ridge that runs between two parallel ridges	
Delta	A Y-shaped ridge meeting	
Core	A U-turn in the ridge pattern	

Among these minutiae points ridge ending and ridge bifurcations are mostly used for verification. Figure 1 gives an idea about terminations and bifurcations.



Termination points Bifurcations

Figure 1

According to Ross *et* al. it is very difficult to increase the accuracy of the system in a relevant way by using only one form of representation or only one matching algorithm [3]. There are different techniques present for a matching fingerprint such as artificial neural network, fuzzy logic, latent fingerprint matching technique, Neuro fuzzy method etc. Artificial neural network method has several significances. First, fingerprints form patterns with unusual characteristics and statistical features. In such a case neural network provides rational success[4]. Second, neural networks try to remove the shortcomings of traditional methods. Third, neural networks can be trained from examples and provides Input Output Mapping, Nonlinearity, Adaptivity, Neurobiological Analogy and robustness [5].

2. Artificial Neural Network (ANN)

Artificial neural networks can be defined as a group of interconnected neurons used for information processing as a computation model. It is an adaptive system capable of transforming its arrangement according to input and output sequence that flows in the network. Feed forward back propagation (FFBP) algorithm is commonly used ANN learning technique [6-7].

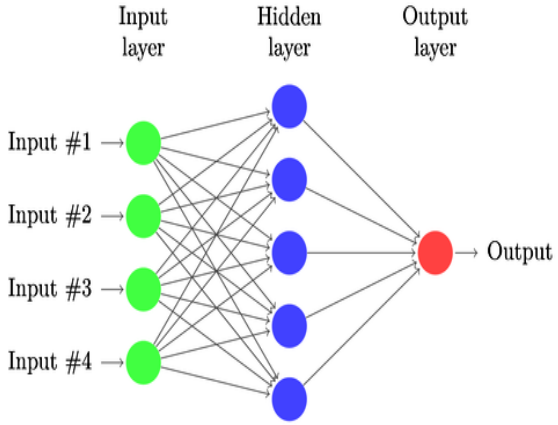


Figure 2

Figure2 shows the architecture of artificial neural network with input layer, hidden layers in the middle and output layer. Multi-layer networks also used by ANN networks with one or more hidden layers.

3. Learning in ANN:

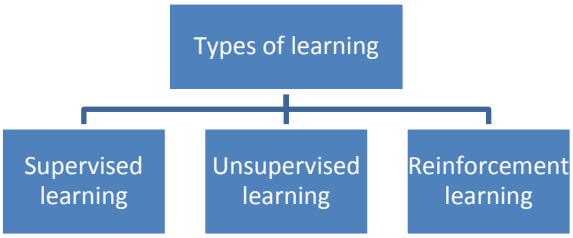


Figure 3

3.1 Supervised learning: This machine learning technique takes inference from function on training data. Training data consists of input data set and output data and applying different learning algorithms and provide inference functions for mapping purpose.

3.2 Unsupervised learning: This machine learning technique focuses on finding hidden arrangement of data. Here, the modification of network's weights and biases are without interference of external teacher.

3.3 Reinforcement learning: It is similar to supervised learning. This learning technique keeps less information about target output corresponding to given input i.e. only critical information is given not accurate [6-7].

4. Training technique:

In this paper we are using LMBP (Levenberg-Marquardt back propagation algorithm). This method trained arbitrary-sized data set and seems fastest technique for feedforward neural networks (up to several hundred weights).

Levenberg-Marquardt algorithm with no computation of Hessian matrix is a second order training technique. If performance functions having a form of a sum of squares, then Hessian matrix can be estimated as:

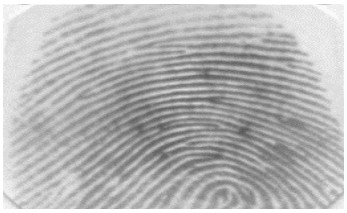
$H = JTJ$

And the calculation of gradient is as

$g = JTe$

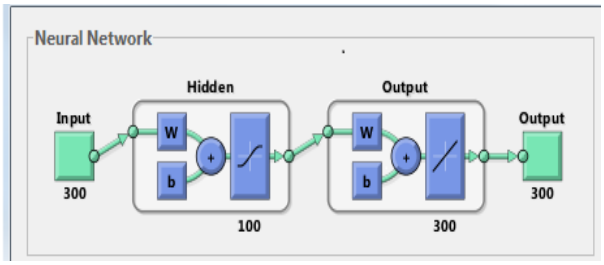
vector of network errors is denoted by e, where J denotes Jacobian matrix that includes first derivates of network errors with respect to biases and weights. The standard back propagation method is used for estimation of Jacobian matrix, it is less difficult than the Hessian matrix estimation [8].

5. Experimental Results:



Taking image 101.tif as an input applying neural network training and performing different results as shown below:

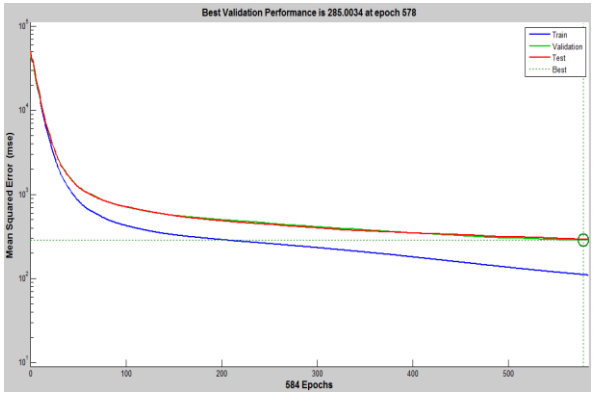
The figure shows the neural network of an input image.



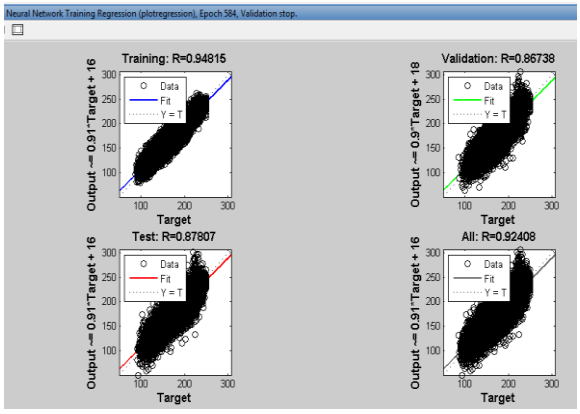
Input image having mean squared error and regression value.

	Samples	MSE	R
Training:	210	111.09720e-0	9.48154e-1
Validation:	45	285.00343e-0	8.67382e-1
Testing:	45	292.80630e-0	8.78070e-1

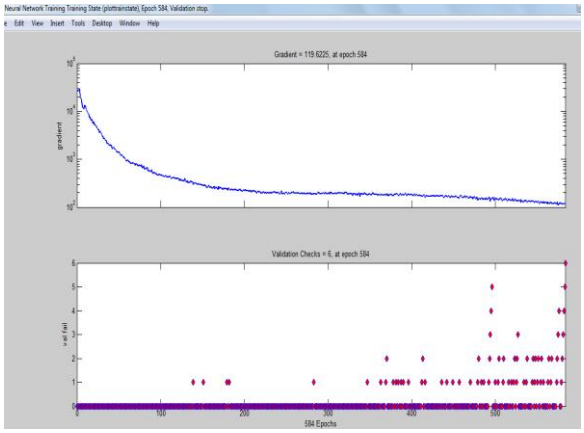
Performance graph with best validation at 578 epochs.



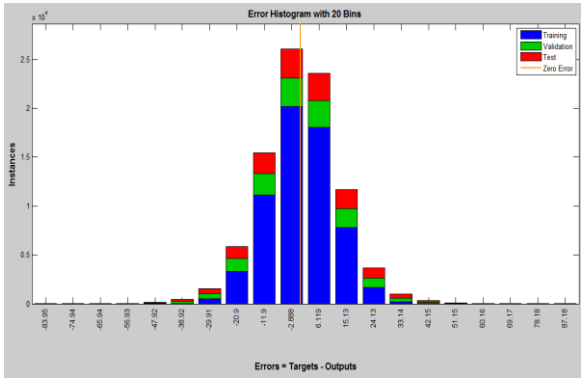
Training Regression with 584 epochs.



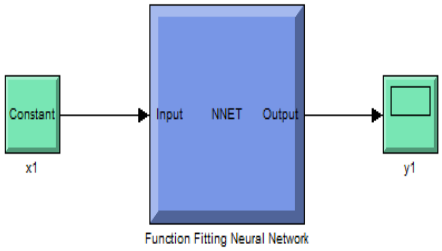
Training state graph with Gradient =119. 6225 and Validation Checks =6.



Error histogram of input images



Simulation Network of a given input figure.



Conclusion:

Artificial neural network is broadly used for training large data set because it provides good results in complicated conditions. Neural networks have many advantages over other methods like adaptive learning, self organization, real-time operation, fault tolerance. It has several applications such as hand writing and type writing recognition, fraud detection, criminal sentencing, optimization, pattern recognition etc. Here, trainlm function is applied for training network so that it can produce different result sets.

References:

[1] Anil K. Jain, Yi chen, Melten Demirkus, "Pores and ridges: High resolution fingerprint matching using Level 3 features,"IEEE Transactions on Pattern Analysis and Machine Intelligence, vol. 29, no.1, pp. 1-13, Jan 2007.

[2] Jain, A.K., and et al, 2004, "An Introduction to Biometric Recognition",IEEE Tran. On Circuits and Systems for Video Technology, vol.14 No.1, PP. 4-20.

[3] Arun Ross, Anil Jain, James Reisman, "A hybrid fingerprint matcher," Pattern Recognition, vol. 36, pp. 1661-1673, 2003.

[4] L.e Cun, V.,et.al.. "Handwritten digit recognition with a back propagation network", Neural Information Processing Systems, Vol. 2, pp. 396-404.

[5]. Moenssens, Fingerprint Techniques,Chilton Book Company, Radnor.

[6] Haykin, S., Neural Networks: "A Comprehensive Foundation", 2nd ed. (Englewood Cliffs, NJ: Prentice-Hall), 1999.

[7] Vijaya Sathiaraj, "A Study on the Neural Network Model for Finger Print Recognition" International Journal Of Computational Engineering Research (ijceronline.com) Vol. 2 Issue. 5, oct 2012

[8]http://www.mathworks.in/help/nnet/ref/trainlm.html

[9] Anil Jain, Sharath Pankanti, "Automated Fingerprint Identification and Imaging Systems". Technical Report 500-89, National Bureau of Standards, 1988.