Implementation Of Hand Gesture Recognition Using Artificial Neural Network

Poorva Arya[1], Dr. Uma Shankar Modani[2]

[1] *Govt. engineering college, Ajmer*
[2]*Govt. engineering college , Ajmer*

Abstract

Hand gesture recognition system can be used in different area for example HCI (human-computer interaction), remote control, robot control, computer generated reality and so forth. Hand gesture recognition system is for the most part the investigation of identification and acknowledgment of different hand gestures like American Sign Language hand gestures, Danish Sign Language hand motions and so on by a computer system. This work is centered on three fundamental issues in building up a motion acknowledgment framework. Human Computer Interaction (HCI) requires using various modalities (for example body position, speech, hand motions, Lip development, Facial articulations, and so on.) and coordinating them together for an increasingly vivid client experience. Hand signals are a natural yet ground-breaking correspondence methodology which has not been completely investigated for Human Computer Interaction (HCI). The most recent computer vision, image processing methods make vision based hand gesture recognition plausible for Human Computer Interaction (HCI).In this thesis sign language recognition system is presented in which a Hand gesture detection system is proposed based on shape context matching with ANN algorithm .The proposed work was implemented on MATLAB. To indicate the potency and effectiveness of the proposed system results performance are compared with existing work with 90% and it's been analyzed that the proposed algorithm had achieved highest accuracy with 95%.

Keywords: *Human Computer Interaction, Gesture Recognition System, ANN, Hand Gesture Recognition System, Feature Extraction*

1. Introduction

Computer system and interfaces are the emerging technologies and are dispersed in various fields rapidly. Human ability in adopting computer and information system is an expanding research topic. This interdisciplinary domain relating the human attitude and computer is termed as Human Computer Interaction (HCI). Hence a primary objective of HCI is generating methods that amalgamate the attitude of the human and the computer to produce interactive system, shifting the technology from computer centric user computer-interface to human-centred multimedia, multi-mode interactive technology, incorporating lip reading, tracking of head movements, recognition of hand gestures,

facial recognition, body interaction recognition etc. Lacking dedicated devices for tracking, amongst the biggest concerns for the system becomes accurate assessment and validation of hand movement through vision detecting sensors and hardware. A tracking procedure utilizing vision-based input requires only an appropriate vision sensor, essentially a camera. Generally, the overall framework of this approach should ideally be simpler and lighter as compared to the Data Glove procedure, and should facilitate interaction without requiring any complementary hardware. This sort of interaction can be difficult in the context of computer pattern and vision analysis, given its natural associated complexities with algorithmic issues, i.e. segmentation of images, extraction of features, and calibration of the camera device etcetera. The HCI is generally dependent over the finger point detection or depending on the finger point position which confines the normal means of manipulation using hands and results in complicating the easy task.

In this research work we have worked for our own data set which are representing
various signs to show numbers from one to five using one hand.Our main focus is on recognition and classification of these signs.

2. Proposed methodology

The designed system is based on the basic image processing and supervised training of neural network. Some basic image processing steps are done on data set feature vector matrix is created to train a neural network to give as an input in neural network for its training.As this work is running around Artificial neural network training so first we must go through with artificial neural network.

2.1. Artificial neural network

The neural network approach is based on the elementary processors called neurons. Each neuron takes many inputs and generates one output. Each input is associated with a weight and the output is the weighted sum of inputs. The output function may be discrete or continuous. The inputs are represented as v1 , v2, v3.....and the weights are represented by w1, w2, w3 ..... The sum of all inputs to a neuron is given by

$$x = \sum vi\ n\ i{=}1\ wi$$

Where is the threshold of a neuron. A transfer function f(x) is defined with a neuron which gives an output. These neurons are interconnected such that they take number of external inputs and deliver some number of outputs. The applications of these networks are classification, auto association and general association.

$$E = \sum \sum (yj\ i - dj\ i\ )\ 2$$

Where $yj\ i$ is the actual output of the output node and $dj\ i$ is the desired output of the same output node of the network Steepest gradient descent technique is applied to update the weights of the network

$$wi,j\ (k + 1) = wi,j\ (k) - \eta\ \partial E(n)/\ \partial wi,j$$

2.1.1.Feed-forward networks: A neural network without feedback loops is termed as feed forward neural networks or perceptrons. The previous perceptions training algorithm converges if a solution to a problem exists. This limitation showed to be uncertain necessitating that the classification has to be linearly distinguishable. This drawback was surmounted by Back propagation algorithm. This algorithm trains layered networks. In layer network, one layer exists between input and output. A feed forward network is shown in Figure 1, where data are applied at the input nodes and proceeds toward the output node. Here in Figure 1. Nodes 1, 2 and 3 are input nodes, nodes 4 and 5 are hidden nodes and nodes 5 and 6 are output nodes.

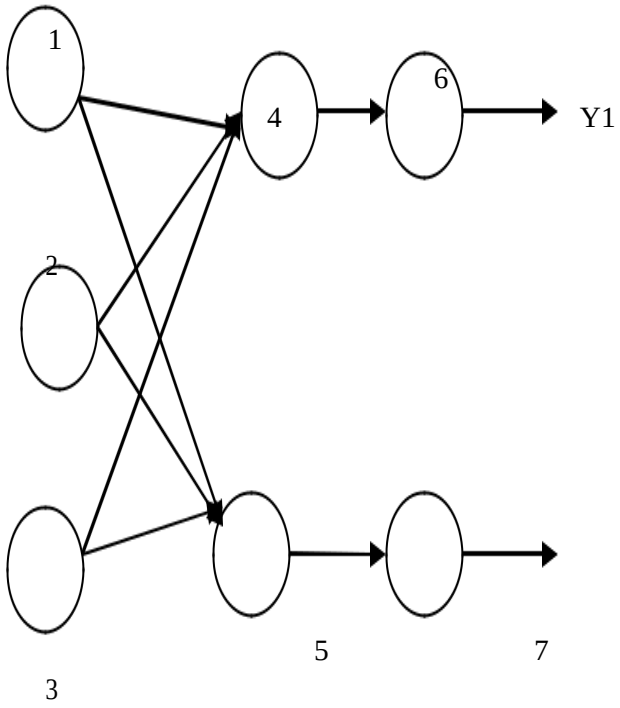


Figure 1. One layered neural network structure

Back Propagation Algorithm (Steepest Gradient Technique) is the most common Neural Net algorithm which is a multilayer network. The algorithm applies a weight modification based on the sigmoid function. Back propagation is a supervised learning where excepted output is known.The Back propagation algorithm is an evolution of Windrow-Hoff algorithm. It employs the gradient descent technique to reduce the minimum square error. The minimum square error is mainly due to the difference between the actual and trained output from the network. In the Back propagation algorithm, the input is applied to the input nodes of the network. The input propagates through the hidden nodes towards the output nodes of the network. The response of the each input node is thus obtained at the output node. The actual output of each output node is then compared with the trained or the desired output. If there is no difference the training of the network stops else the iterative process of changing the weights of the nodes are performed until the difference between the actual and the trained outputs is minimized.

2.2. Proposed module

The flow diagram of the proposed system is shown in Figure 2 and proposed module is mentioned below.

2.2.1. Module : Input Image
Pre Processing
Feature Extraction
Classification & ANN training

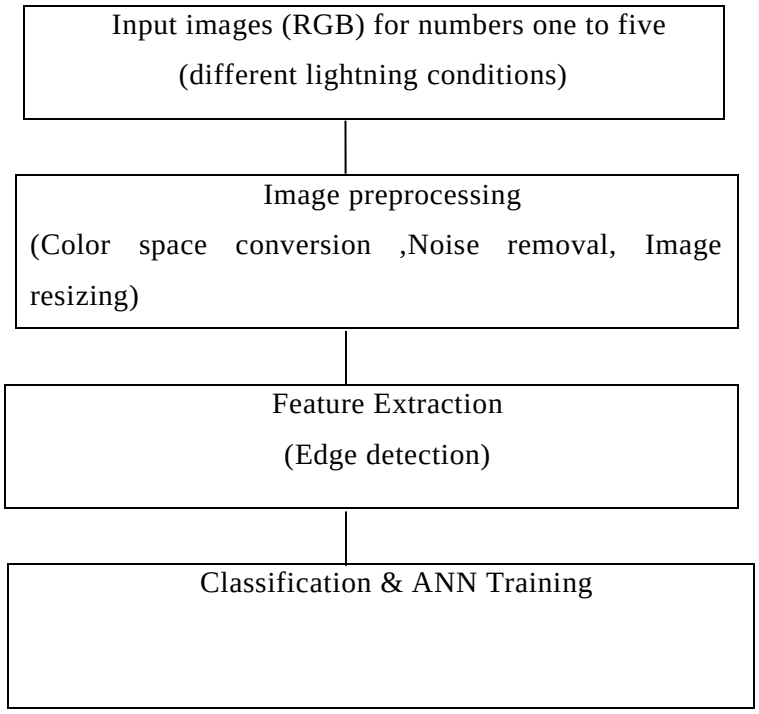


Figure 2. Proposed flow chart

3. Result

In this result section we are showing step wise results through images. Figure 3 shows screenshots of various steps of proposed module loading input image, adding salt and pepper noise then edge detection feature extracted image and Figure 4 is representing ANN classification training process. Table 1 shows feature extracted images of some of our dataset after doing basic image processing steps as well as counting number of figures image also and Table 2 shows detailed accuracy measurement of images.

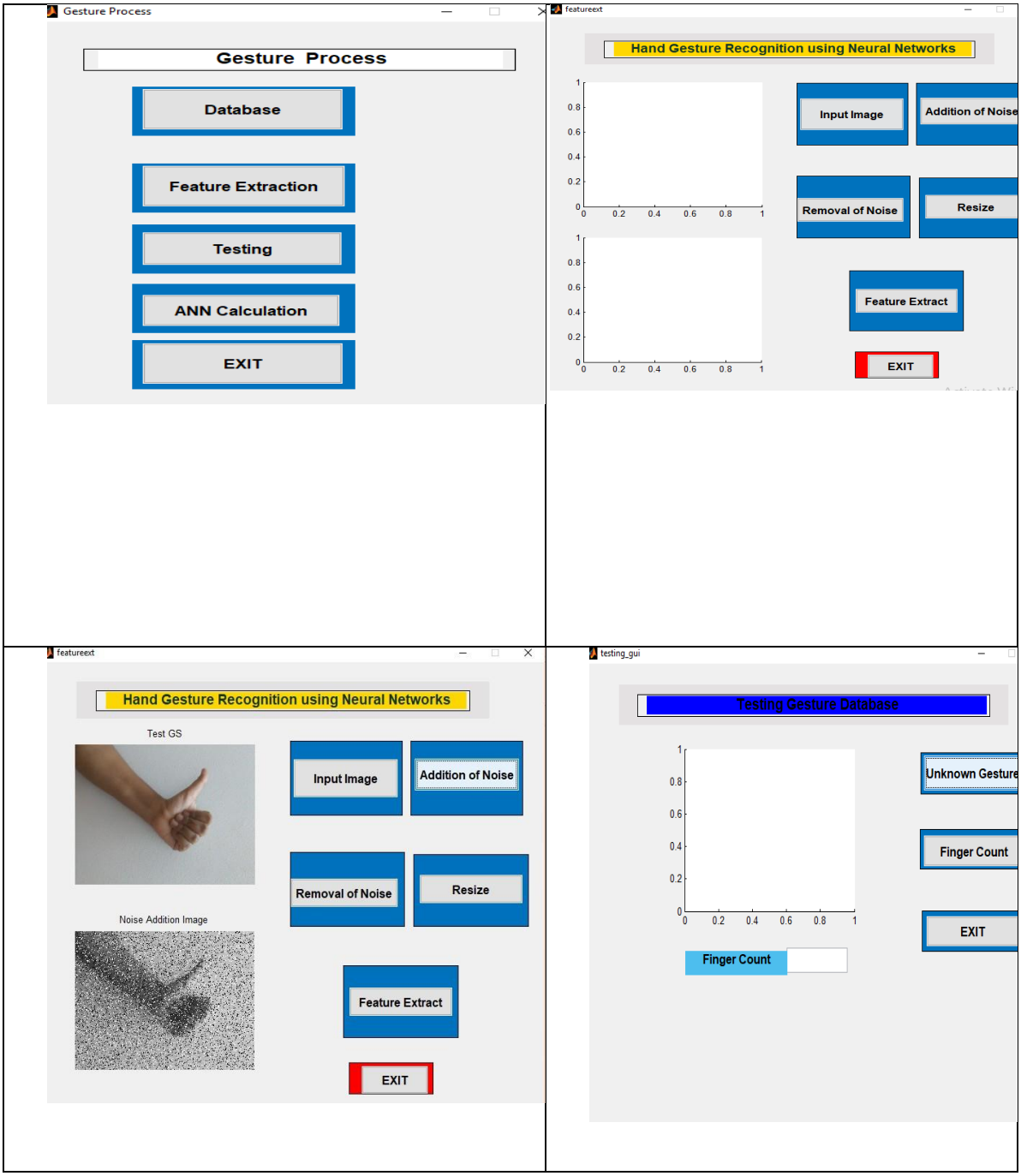
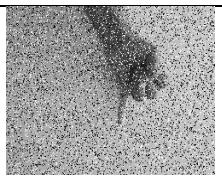
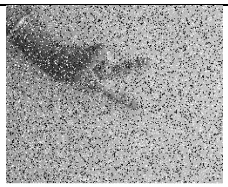
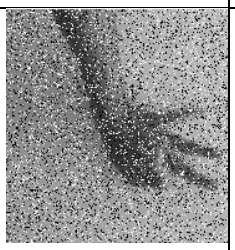
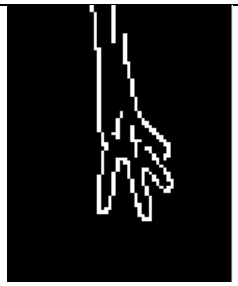


Figure 3. Hand gesture recognition process

There are 22 sets of images in our database which are showing numbers one to five with different signs using one hand only. Our main task is to recognize and classify them in their classes. Here as we are representing five numbers so basically there are five classes. There can be two types of training for neural network here in this work supervised training is done where we already know the output.

Table 1 Image processing steps

S. No.	Input image	Addition of Noise	Feature extracted image	Fingers counting
1				
2				
3				
4				
5				

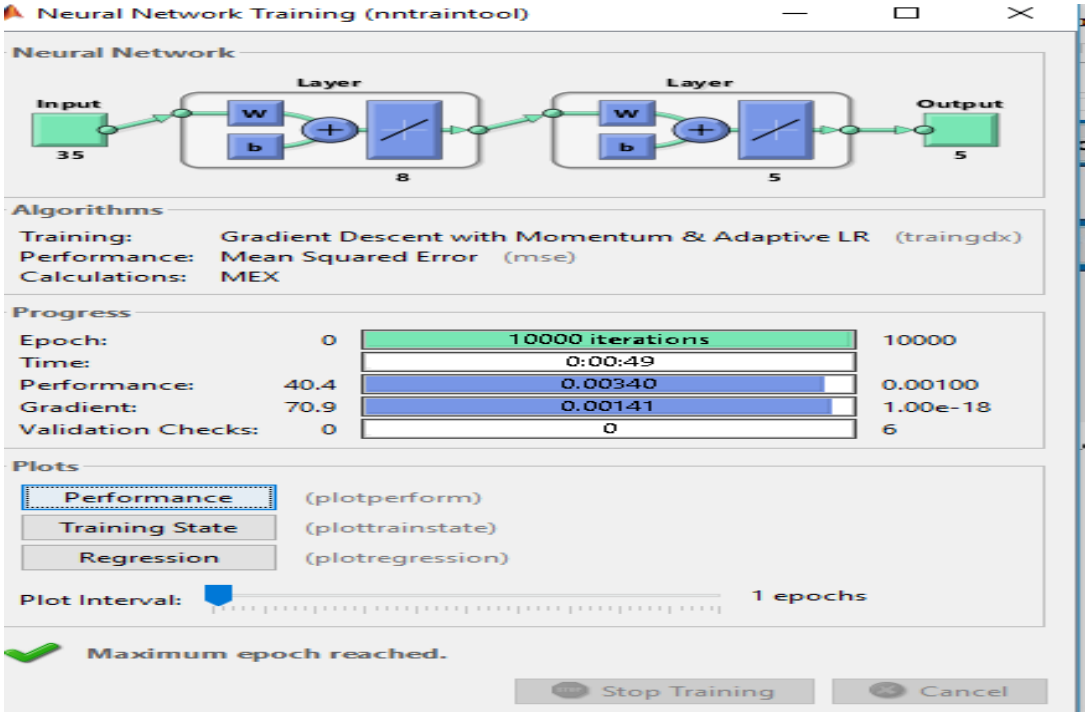


Figure 4. Hand gestures classification process

The following Table 3.2 will show the accuracy of gestures recognition.

Table 2 Detailed accuracy measure for gestures

Gesture	No. of image	Correctly classified image	Incorrectly classified image
One Finger	4	4	-
Two Finger	5	5	-
Three Finger	4	3	-
Four Finger	5	4	1
Five Finger	4	4	-
TOTAL	22	21	1

Accuracy = (22-1)/22*100 = 95%.

4. Conclusion

In this Research work, propose a strategy for arranging static hand gestures utilizing hand picture form where the main highlights are that of low-level calculation.The significant objective of this examination is to build up a framework that will help in the cooperation among human and PC using hand gestures as a control directions. Hand signal acknowledgment based man-machine interface is being grown vivaciously as of late. Signal acknowledgment is likewise significant for creating elective human PC communication modalities. It empowers human to interface with machine in a progressively common manner. MATLAB gives the better answer for hand signal acknowledgment. Sign Gesture Recognition has been effectively done in MATLAB. In view of the proposed strategy the normal acknowledgment rate is high contrasted with the current strategies .Hand gestures acknowledgment was performed for 22 subjects by fixing the camera at fixed tallness. Great lighting was furnished utilizing a blaze light with an unmistakable white foundation for both the picture handling techniques. Subjects were told to indicate fingers looking like the check of 1,2,3,4 and 5. The hand gestures were perceived productively with least mistake rate by the picture preparing strategy , utilizing ANN calculation. To indicate the potency and effectiveness of the proposed system results performance are compared with existing work with 90% and it's been analyzed that the proposed algorithm had achieved highest accuracy with 95%.

References

1. G. R. S. Murthy, R. S. Jadon , “A Review of Vision Based Hand Gestures Recognition”, International Journal of Information Technology and Knowledge Management, vol. 2(2), pp. 405-410.

2. P. Garg, N. Aggarwal and S. Sofat , “Vision Based Hand Gesture Recognition”, World Academy of Science, Engineering and Technology, vol. 49, pp. 972-977.

3. Fakhreddine Karray, Milad Alemzadeh, Jamil Abou Saleh, Mo Nours Arab, “Human Computer Interaction: Overview on State of the Art”, International Journal on Smart Sensing and Intelligent Systems, Vol. 1(1).

4. Simei G. Wysoski, Marcus V. Lamar, Susumu Kuroyanagi, Akira Iwata, “A Rotation Invariant Approach On Static-Gesture Recognition Using Boundary Histograms And Neural Networks”, International Journal of Artificial Intelligence & Applications (IJAIA), vol.3(4)

5. Rafiqul Z. Khan, Noor A. Ibraheem, “Survey on Gesture Recognition for Hand Image Postures”, International Journal of Computer And Information Science, vol. 5(3), 2012.

6. Thomas B. Moeslund and Erik Granum, “A Survey of Computer Vision-Based Human Motion Capture,” Elsevier, Computer Vision and Image Understanding, vol. 81, pp. 231–268, 2001.

7. Bhumika Gupta , Pushkar Shukla, Ankush Mittal,(2016) “K-Nearest Correlated Neighbor Classification for Indian Sign Language Gesture Recognition using Feature Fusion” IEEE,2016.

8. E. Stergiopoulou, N. Papamarkos , “Hand gesture recognition using a neural network shape fitting technique,” Elsevier Engineering Applications of Artificial Intelligence, vol. 22(8), pp. 1141–1158, 2009.

.