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Hand Gesture Recognition Using Backpropogation Algorithm Based on Neural Network

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***Abstract*—**The proposed system is design for physically challenged people to communicate among common people without an intermediate human translator. The system based on hand gesture recognition using neural network. We used back propogation algorithm for the recognition of image. Some of the systems are used for the purpose of communication are costly and bulky that the common man can not afford but system we are going to used is affordable so it is possible to minimize the distance between hearing and speech impaired people with normal human being. The image is captured with the help of inbuilt camera of laptop comparing with the existing database using matlab and further it will process in neural network accordingly gives the output in the form of text along with the accuracy in percentage. Firstly the prepocessing steps are completed. The steps going to perfom are image aquisiton, image processing, feature extraction, gesture identification and finally output translated in text. We calculate the centroid of the hand image called as vectorization which will futher train our neural network and after processing we get output.

Keywords*-component,matlab tool,Hand Gesture Recognition, Neural Network.*

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I. INTRODUCTION

The difficulties faced by hearing and speech impaired people or physically challenged people in communicating with others. Hand gesture recognition based man-machine interface is being developed vigorously in recent years. I am designing real time communication system enables differently impaired people or physically challenged people to communicate among themselves without an intermediate human translator. The aim of this work is to evaluate different segmentation processes specific to hand gesture recognition**.** Recently, there has been a surge in interest in recognizing human hand gestures. The gestures in the system belongs to sign language. In sign language, every gesture has an assigned meaning for the pupose of recognision.

One of the major challenges in hand gesture recognition is to give the output for the different hand image effectively in varying the background and changing lighting condition [1][4] Different applications which make use of hand gesture, may involve significant motion of the hands or simple undynamic pose depending on the choice of the system.

The first stage, as displayed in the figure, is mostly related to the hardware of the system and the way data for the recognition process is gathered.

Preprocessing is the second stage. In this stage filtering processes for smoothing the image, edge-detection are occured.

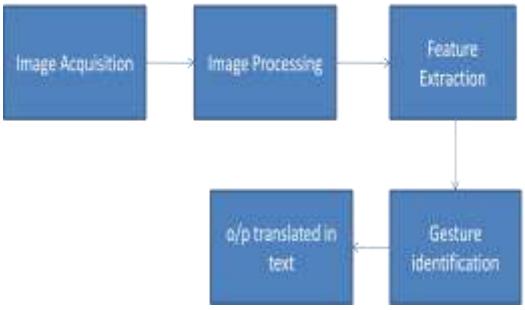

Figure 1: A general gesture recognition system

Feature extraction is part of the data reduction process and is followed by feature analysis.That is, techniques should find shapes reliably and robustly whatever the value of any parameter. The most important parameter is position, its rotation ,size it appears. The features of the input are then measured in one of the possible way to make a decision about which gesture the system is most likely subjected to in the fourth stage, also known as evaluation stage. Explicitly specifying features is not easy. Therefore, transformed images are taken as input, and features are selected implicitly and automatically by the classifier (Wu & Huang, 1999).

II. GESTURE RECOGNITION

"A gesture is a bodily motion that conveys some information." [2].The general gesture recognition process in any kind of system can be broken down into the components [1]. Krueger (1991) was the first who proposed Gesture recognition as a new form of interaction between human and computer in the mid-seventies.

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Gestures can be static or dynamic elements, as in sign languages. Moreover, gestures are often language- and culture-specific[6]. Gestures can be of the following types: 1) hand gestures: recognition of hand poses, sign languages, and entertainment applications (allowing children to play and interact in virtual environments); 2) face and head gestures: some examples are:; a) direction of eye gaze; b) raising the eyebrows; c) looks of happiness, sadness, surprise, fear, anger, etc.; d) flaring the nostrils; e) winking and f) nodding or shaking of head 3) body gestures: involvement of full body motion, as in: a) tracking movements of two people interacting outdoors; and b) analyzing movements of a dancer for generating matching music and graphics.[6] The several types of contained information in any gesure may be Spatial information means where it occurs, locations a gesture refers to ; Pathic information means the path that a gesture takes; Symbolic information means the sign that a gesture makes. Affective information means the emotional quality of a gesture. In order to infer all these aspects of gesture, human position, movement and configuration must be sensed.

Gesture is a movement of part of the body, especially, a hand or the head to express an idea or meaning" (Gesture). Gesture recognition is the process by which gestures made by the user are made known to the system. [13] Gesture recognition is also important for developing alternative human computer interaction modalities [14]. It enables human to interface with machine in a more natural way.

III. PROPOSED WORK

The work starts with training process which involves selection of alphanumeric characters which ranges from A-Z and 0-9. The database comprises of real images captured using inbuilt camera of laptop. The training set consists of number of images. A set of feature vector is used to train the neural network. In neural network we are using backpropogation algorithm.

Testing set consists of no. of images. Then images are converted into gray scale to binary image after which dilation process is carried out[2]. Then image segmentation is done using morphological operations. In testing process feature extraction is carried out using features like centroid and orientation. Using threshold rule the feature comparison is done between testing image and training images. After that the feature sets of trained images and testing images are compared and then the relevant results are displayed showing the output image with accuracy[3].

IV. NEURAL NETWORKS

Neural networks are adjusted, or trained, so that a particular input leads to a specific target output as shown in Figure 2 below.

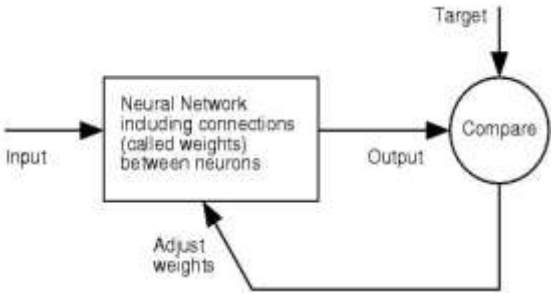

Figure 2: Neural Net block diagram

Today neural networks can be trained to solve problems that are difficult for conventional computers or human beings. A neural network has to be configured such that the application of a set of inputs produces either direct or via a relaxation process the desired set of outputs. Various methods to set the strengths of the connections exist. One way is to set the weights explicitly using a priori knowledge Another way is to train the neural network by feeding it teaching patterns and letting it change its weights according to some learning rule.

Paradigms of learning we can categorise the learning situations in two distinct sorts. These are supervised learning or Associative learning in which the network is trained by providing it with input and matching output patterns. These inputoutput pairs can be provided by an external teacher or by the system which contains the network self supervised. Unsupervised learning or Self organisation in which an output unit is trained to respond to clusters of pattern within the input. In this paradigm the system is supposed to discover statistically salient features of the input population. Unlike the supervised learning paradigm there is no a priori set of categories into which the patterns are to be classified rather the system must develop its own representation of the input stimuli.

NN have the Ability to produce reasonable outputs for inputs it has not been taught how to deal with. So ,the output of a neuron is a function of the weighted sum of the inputs plus a bias.

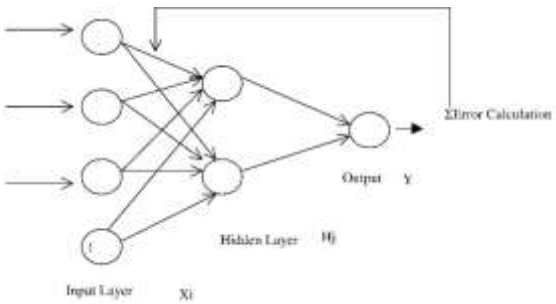

Figure 3: Working of Neural Network

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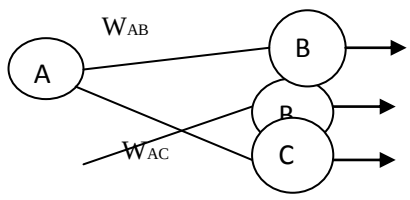
Deep learning models for image classification have been studied in a vast number of experiments in the past few years [8]. Among deep learning techniques, Convolutional Neural Networks [5] have shown good results in the classification of static images [4]. The use of convolutional models focuses on how the human brain enhances and extracts features of an image in an implicit way using a set of local and global features.

V. BACK PROPOGATION

One of the most popular NN algorithms is back propagation algorithm. Rojas [2005] claimed that BP algorithm could be broken down to four main steps[11]. After choosing the weights of the network randomly, the back propagation algorithm is used to compute the necessary corrections. The algorithm can be decomposed in the following four steps: i) Feed-forward computation ii) Back propagation to the output layer iii) Back propagation to the hidden layer iv) Weight updates The algorithm is stopped when the value of the error function has become sufficiently small.

The network is first initialised by setting up all its weights to be small random numbers – say between –1 and +1. Next, the input pattern is applied and the output calculated (this is called the forward pass)[11]. The calculation gives an output which is completely different to what you want (the Target), since all the weights are random. We then calculate the Error of each neuron, which is essentially: Target - Actual Output (i.e. What you want – What you actually get). This error is then used mathematically to change the weights in such a way that the error will get smaller. In other words, the Output of each neuron will get closer to its Target (this part is called the reverse pass). The process is repeated again and again until the error is minimal. Let's do an example with an actual network to see how the process works. We'll just look at one connection initially, between a neuron in the output layer and one in the hidden layer, figure 3.3. Figure 3.3, a single connection learning in a Back Propagation network.[12]



The algorithm is as follows:

1. First apply the inputs to the network and work out the output – remember this initial output could be anything, as the initial weights were random numbers.

2. Next work out the error for neuron B. The error is What you want – What you actually get, in other words: $Error_B = Output_B (1-Output_B)(Target_B – Output_B)$

The "Output(1-Output)" term is necessary in the equation because of the Sigmoid Function – if we were only using a threshold neuron it would just be (Target – Output).

3. Change the weight. Let $W+_{AB}$ be the new (trained) weight and W_{AB} be the initial weight.

$W+_{AB} = W_{AB} + (Error_B * Output_A)$ Notice that it is the output of the connecting neuron (neuron A) we use (not B). We update all the weights in the output layer in this way. 4. Calculate the Errors for the hidden layer neurons. Unlike the output layer we can't calculate these directly (because we don't have a Target), so we Back Propagate them from the output layer (hence the name of the algorithm). This is done by taking the Errors from the output neurons and running them back through the weights to get the hidden layer errors.

For example if neuron A is connected as shown to B and C then we take the errors from B and C to generate an error for A. $Error_A = Output_A (1 - Output_A)(Error_B W_{AB} + Error_C W_{AC})$ Again, the factor "Output (1 - Output)" is present because of the sigmoid squashing function.

5. Having obtained the Error for the hidden layer neurons now proceed as in stage 3 to change the hidden layer weights. By repeating this method we can train a network of any number of layers.[12]

VI. CONCLUSION

Results that are achieved by using NN are encouraging, especially in some fields like pattern recognition. A proposed system is used to indentify the gesture from the input image as well as it calculates the accuracy of the character at the output. The recognition system accuracy is found to be lies above 90%. So we conclude that back propogation neural network has better accuracy. The proposed system is designed for static images.future work can be done using dyanamic images.

Sr.no.	Letters	Back propogation accuracy
1	A	91.8796
2	H	91.8391
3	O	91.9173
4	C	91.8152
5	K	91.8506
6	F	91.9482

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