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Hand Gesture Recognition Using Neural Networks & Image Processing

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Abstract: Gestures are the basic mode of communication. The main aim is to recognise these gestures through modern day technology such as Image processing and Neural networks.
In a laboratory or in homes user need to control various activities like lighting, air conditioning, ventilation, security and many house-hold appliances. To ease with these things we can use our hand gestures to switch automatically as per user convenience. Firstly there is a need to train the Neural Networks to recognise various hand gestures. As many as samples are given to inputs and outputs to train the neural networks. Images are captured by the camera are complex even if they are in greyscale the pixels will take wide range. There is a need convert the image into binary image. After image processing and training of Neural network we can recognise the HAND GESTURE.
Keywords: Neural Networks, Image Processing, Smart Homes, Hand gesture.

Introduction

Artificial neural networks are computational models used in the concepts of machine learning. In our method we propose a different a technique to use the concepts of machine learning to implement in hand gesture recognition. Hand gesture recognition possesses extensive applications in virtual reality sign language recognition' and computer games. The direct interface of hand gestures provides us a new way for communicating with the virtual environment. In this paper a novel and real-time approach for hand gesture recognition system is presented. At first we take several sample images from the camera .Later we train the neural network to recognise the images The images and hence recognised by the camera by using the set interval of time and then displayed on screen

The concepts of machine learning and neural networks has always fascinated us in many ways .In today's fast developing world the way in which artificial intelligence (AI)has been in the verge of doing things automatically has always left us in splits! Machine learning concepts provide computers the ability to learn without being explicitly programmed by this it can automatically learn things depending on human preferences .This factor has always been a huge motivation for us. In the above script we have made a brief effort to enter into the world of machine learning and artificial intelligence by using concepts of machine learning and image processing.

The present existing methods are

Wired gloves. These can provide input to the computer about the position and rotation of the hands using magnetic or inertial tracking devices. Furthermore, some gloves can detect finger bending with a high degree of accuracy (5-10 degrees), or even provide haptic feedback to the user, which is a simulation of the sense of touch.

Depth-aware cameras. Using specialized cameras such as structured light or time-of-flight cameras, one can generate a depth map of what is being seen through the camera at a short range, and use this data to approximate a 3d representation of what is being seen. These can be effective for detection of hand gestures due to their short range capabilities.

Stereo cameras. Using two cameras whose relations to one another are known, a 3d representation can be approximated by the output of the cameras. To get the cameras' relations, one can use a positioning reference such as a lexian-stripe or infrared emitters. In combination with direct motion measurement (6D-Vision) gestures can directly be detected.

Gesture-based controllers. These controllers act as an extension of the body so that when gestures are performed, some of their motion can be conveniently captured by software. An example of emerging gesture-based motion capture is through skeletal hand tracking, which is being developed for virtual reality and augmented reality applications.

The above proposed methods takes into consideration of moving hand gesture in real time and perform actions depending on the performed gesture. While our proposed technique captures still images and process it based on position and condition of the gesture.

Proposed Methodology

Get training images of hand gestures Perform Background subtraction and Colour normalization on the images.

Apply Back propagation algorithm to train a network. The input layer will be the pixels intensities of the images.

The trained network can now be used to recognize hand gestures. The image is fed a input to the network and its output is found using Forward Propagation.

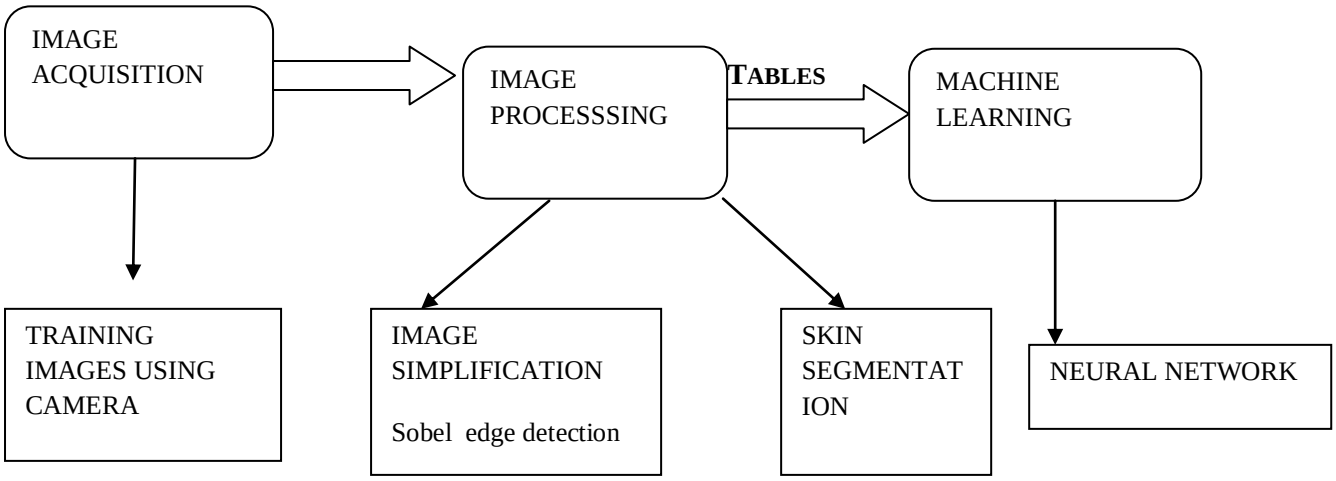


Fig 1: Training the Neural Network

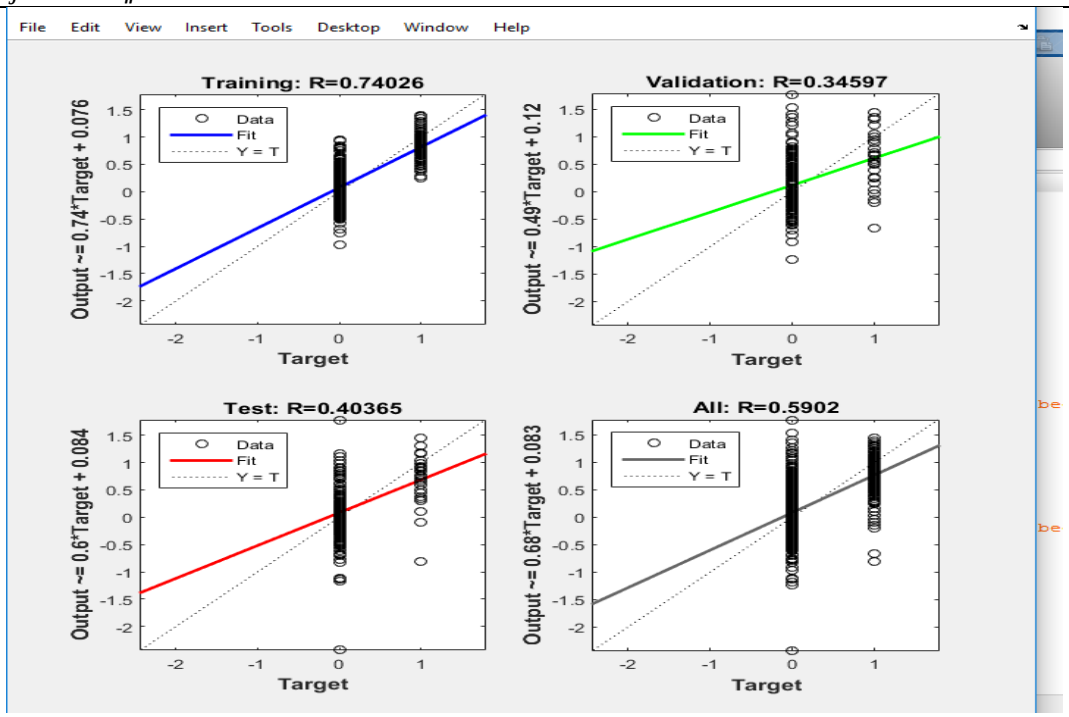


Figure2: Various Plots

Software Tools

- MATLAB (Version R2015 a)
- Relevance – Simulation of the algorithm

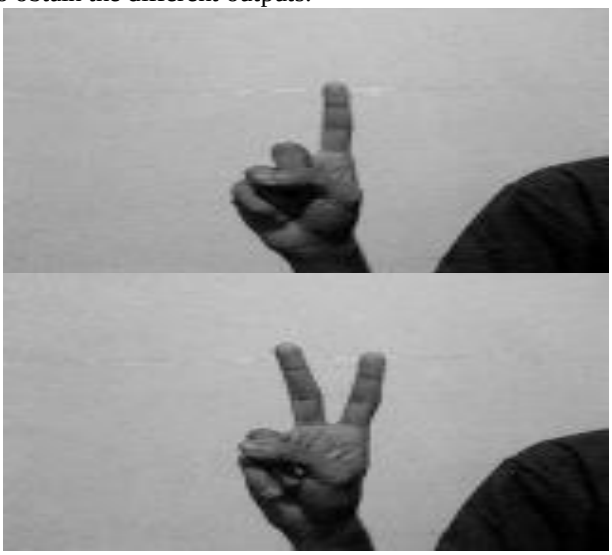
Hardware Tools

- Logitech Quick Cam 300
- Capturing images and implementation of the idea

Proposed Method

In our method we use neural networks to recognise different hand gestures' neural network is a connection of interconnected nodes with 3 layers, input layer, hidden layer and output layer. The given input propagates through the network to provide the required output.

First we have to train the neural network to recognise different hand gestures. So we give 100's of sample images as different inputs to obtain the different outputs.



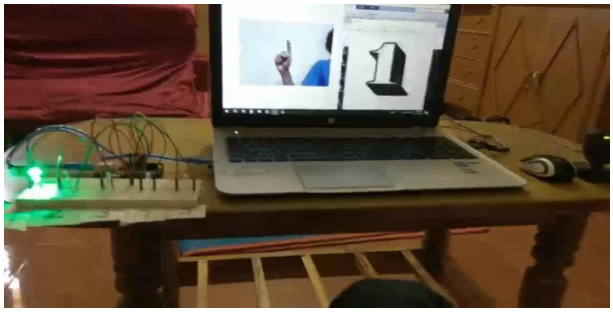
The images of hand gestures are complex even though they are in grey scale. So the images are converted into binary image, hence the resolution also reduced to 20x30.so the no of input given to network is only 600 .

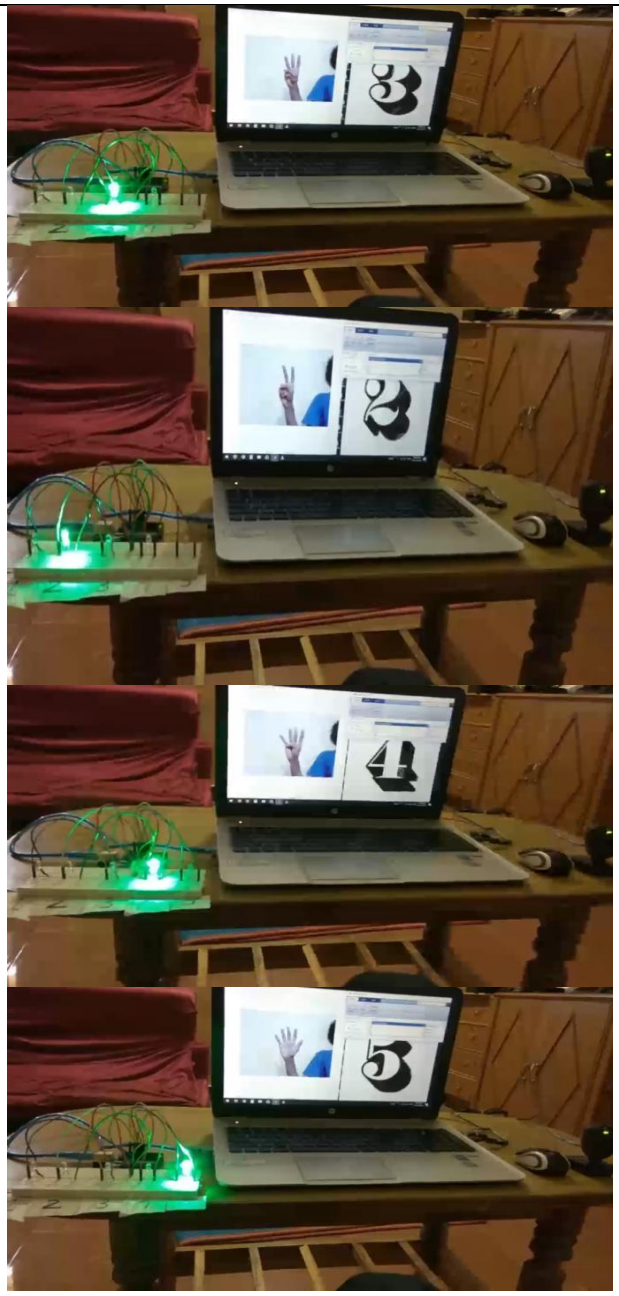
Database Description

Our approach for hand gesture recognition is based on static mode so; our first problem is to gather a good quality of data since our classifier will classify characters according to it only.We had created our own database for each character of ASL' which can includes 50 images ie. 10 images for each gestures. During creating a database images captured should have uniform white color background that can be a white color rubber glove on hand as in contrast. We had done this in order to minimize noise and unwanted data so that we can easily do segmentation process

Result, Conclusion & Future Scope

Our obtained results of image processing has about 90% efficiency and the obtained results were quite promising.



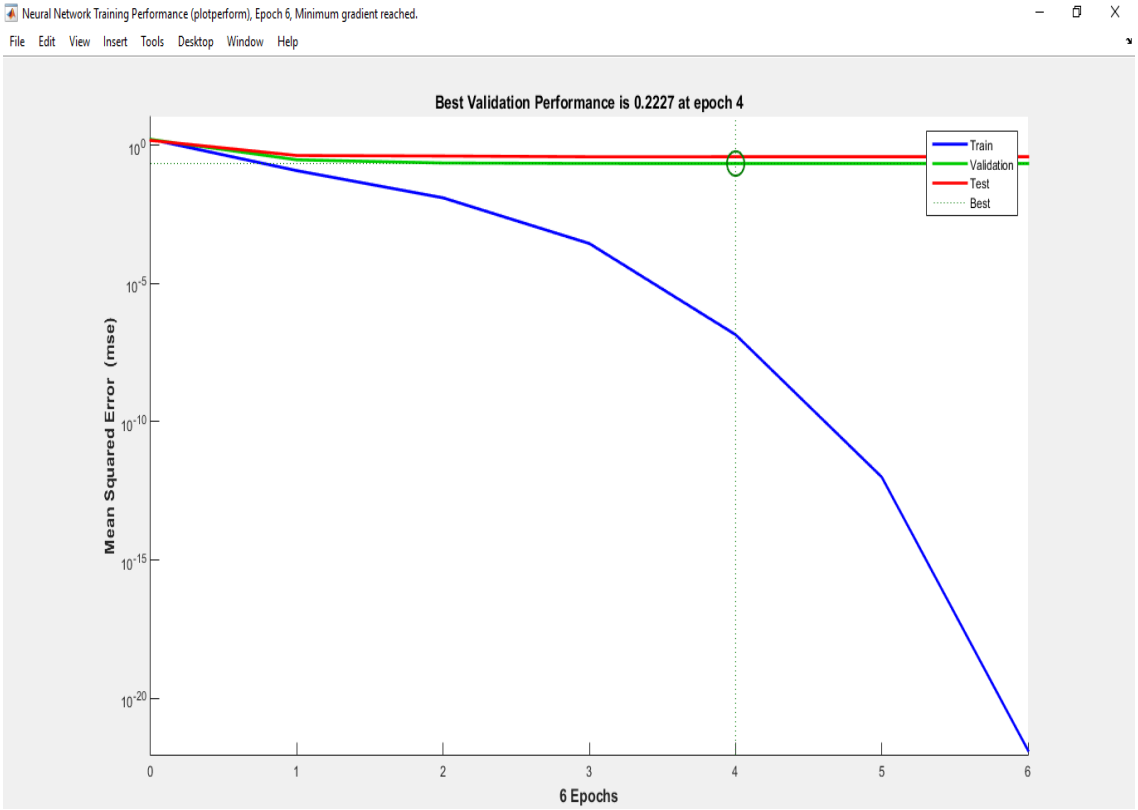


We feel that areas of neural networks has wide range of applications like character recognition, image compression, stock market prediction, medical and as well as loan application.

The scope of image processing is even more wider and lies in following fields:

- Computerized photography (e.g., Photoshop)
- Space image processing (e.g., Hubble space telescope images, interplanetary probe images)
- Medical/Biological image processing
  (e.g., interpretation of X-ray images, blood/cellular microscope images)
- Automatic character recognition (zip code, license plate recognition)
- Finger print/face/iris recognition
- Remote sensing: aerial and satellite image interpretations
- Reconnaissance
- Industrial applications
  (e.g., product inspection/sorting)

The gestures recognised by neural networks are 70-80% accurate there is a need to improve it's accuracy up to 90% in further development**.**



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