TEST Engineering & Management

*May-June 2020*
*ISSN: 0193-4120 Page No. 4603-4605*

# Neural Network Based Method for Sign Language Recognition

**[1]Anubhav Lal Dass, [2]Arghya Singha Mahapatra, [3]Astha Pandya, [4]Anjali Srivastava, [5]Nimrita Koul**

[1,2,3,4]Student, [5]Professor, School of C&IT, REVA University, Bangalore, India
[1]anubhavlaldass@gmail.com, [2]arronoid@gmail.com, [3]astha.pandya12@gmail.com, [4]anjalisonam123@gmail.com, [5]nimritakoul@reva.edu.in

***Article Info***
***Volume 83***
***Page Number: 4603-4605***
***Publication Issue:***
***May-June 2020***

## Abstract

Sign language is a language that especially abled people use to communicate with normal people. Speech impairment is a disability which affects one's ability to speak and hear. Hand signs is one of the methods used for non-verbal communications which we call Sign Language. The goal of this project is to provide a simple way to very trivial communication problems the world faces in this present scenario. We aim to build a minimalistic translation engine that recognizes and converts sign language to text (English) and could be implemented on any platform. This engine could be made with the help of Image Processing and Deep Learning.

***Article History***
***Article Received:****19 November 2019*
***Revised:*** *27 January 2020*
***Accepted:*** *24 February 2020*
***Publication:*** *12 May 2020*

***Keywords:*** *OpenCV, Darknet YOLOv3, Image Recognition, Convolutional Neural Network, Sign Language, Machine Learning, Supervised Learning.*

## 1. Introduction

The sign language is a very important way of communication for deaf-dumb people. Mainly it contains two things Sign detection and Sign recognition. Communication is a primitive ability that humans have been gifted with and it has brought our race as far as we are in terms of advancements, be it technological or in other fields. Though it is a very basic human characteristic, some people are set back on these grounds. In this 21st century, physical disabilities should not be a hindrance for people to convey their thoughts and emotions. In our project we mainly use neural networks and image processing for sign language translation. Especially abled people usually depend on Sign Language interpreters for communication. It's been observed that especially abled people find it really difficult at times to interact with normal people with their gestures. Sign Language is a language that provides visual communication and allows individuals with hearing impairments to communicate with normal people. We will use OpenCV to improve our project recognition from an image. Pillow adds support for opening, manipulating, and saving many different image file formats. Additionally, this project uses image processing to identify sign language and later uses machine learning toimprove the system efficiency over time.

## 2. Literature Survey

Author Dr Ravi Kumar V[1], proposed a solution that simplifies the communication with specially impaired people. Sign language is an incredible advancement that has grown over the years. There is always a need to communicate using sign language. Machine learning provides a versatile and robust environment to work on. Generally, in this they used methods such as pose elimination, decision trees etc.

Author Manoj Patil[2], In this paper proposed the use of histograms of oriented gradients (HOG). Here HOG is used as a feature descriptor. First part of the project in this paper is: It prepares a dataset, in this dataset there are 26 English alphabets in Indian Sign Language(ISL). Second part of the project in this paper is: Image Pre-processing and Edge Detection. Third part of the project is: Feature Extraction, it means that it extracts the features from the data. Various methods are used in this paper from extraction of features (Some methods are SIFT, HOG etc).

Author Kamal PreetKour[3], In this paper generally divides the project into three phases : In phase 1, he developed a user interface which can capture the image from any webcam. In phase 2, the images which are collected are given for training the CNN model. In phase 3, the input image which was taken from the user is given to CNN model for prediction. In this the project is

implemented in such a way that the system does not use gloves.

Author DishitaPatil[4] ,proposed a neural sign language translation. In this project firstly tokenization of source, target sequences and projecting them to a continuous space. The above process is done by using word embeddings. In neural machine translation the input sequences as well as the output sequences can be tokenized at many different levels of complexity. The two levels are Low and High-level tokenization. In this system, attention-based encoder-decoder networks are also used.

Author Oscar Koller[5], proposed some steps in this paper. The steps involved in this project are: Acquisition of data i.e. Camera Interfacing, Image processing, Noise removal,Thresholding, Image analysis, Contour detection. In this project hull algorithm is used, this algorithm can be implemented just for finger point detection and number recognition.

Author Ashish S. Nikam [6], proposed a system which follows image-based hand gesture recognition techniques. The system they proposed consists of different steps they are capturing the data with the help of webcam and later processing the same image in different steps. Steps they are following for processing of the image are:Image Enhancement and segmentation,colour filtering and skin segmentation. Then after processing the image they proposed to move to Noise removal by Erosion and Dilation, Then the 4$^{th}$ step is Thresholding and after completion of that they propose Image Analysis: Blob Detection and after this the final step which they take is Contour detection. And they are able to predict the hand gestures which has been given as input by the user through the webcam.

## 3. Proposed System

The system will consist of a video camera along with an NvidiaGPU(to leverage computing power of the CUDA cores) on premise. During training, the CNN recognizes the hand using bounding boxes and weight files generated while drawing the bounding boxes. These bounding boxes house the subject in question. When the system detects a hand in the frame, it first captures the complete frame and then the complete frame undergoes a series of normalization and background subtraction before being processed by the CNN. The network then divides the frame into regions and tries to draw bounding boxes to come up with weights(probabilities). These weights are then tallied with the existing weight file for each class label. The system can then classify the subject in frame to the weight it corresponds to.

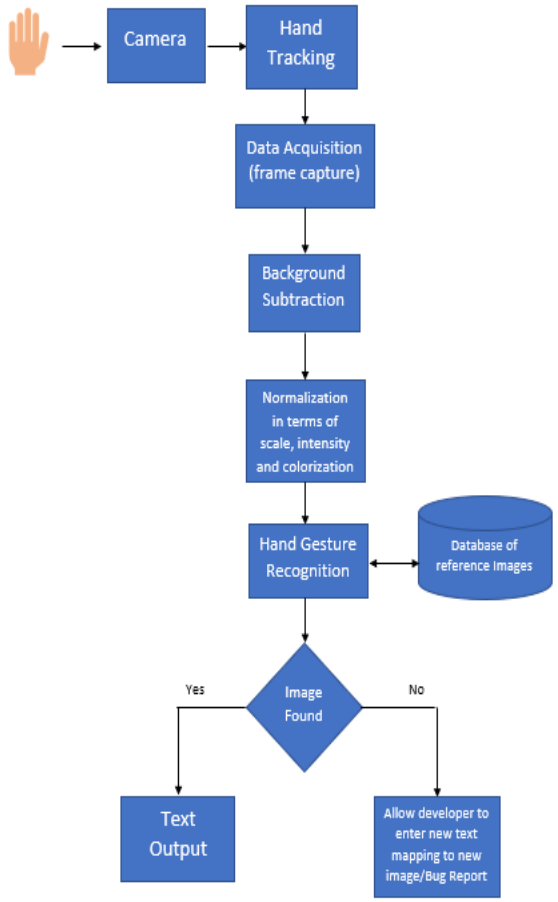


Figure 1: Flow chart representing the working of the proposed system

## 4. Working

So as we can see in Fig 1, there are many different steps which has been followed to get the desired result, first the data input is taken with the help of the inbuilt webcam or any other webcam available then our system then tries to track the hand out of all the objects in the frame and when the data had been acquired then the picture undergoes background subtraction to remove unwanted elements in the frame and reduce the size of data input for a more accurate result, then the data undergoes normalisation in the terms of scale, intensity and colorization then our system refers the database of images for recognition and if it is able to identify the image then it shows the text output to the user with the correct translation of the image from sign language to text and if the system is not able to recognise the hand sign it will show an error and then it will also give an option to the user to request the system administrator to add the gesture in the data base with the corresponding translation of the sign. Then the administrator will then verify the suggestion given and if the suggestion is correct and the translation was correct then the administrator will update the database or in other words train the neural network with the corresponding gesture and the users will be able to translate that sign too from the next update

*May-June 2020*
*ISSN: 0193-4120 Page No. 4603-4605*

## 5. Results

Once the CNN is run post-training, each frame is passed through the neural network. The system opens up an output window showing the live video feed along with a bounding box drawn on the subject detected. On the upper left corner of the bounding box, the class label and the probability of accuracy is also displayed as shown in Fig 2(a). On the terminal window in the background the FPS(frames per second), the average FPS and the object detected (class label) is also displayed simultaneously as demonstrated in Fig 2(b).

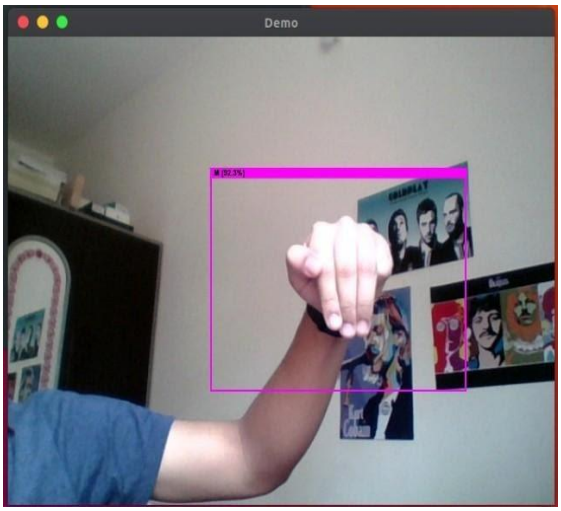


Figure 2(a): Video Output with prediction shown using a bounding box.

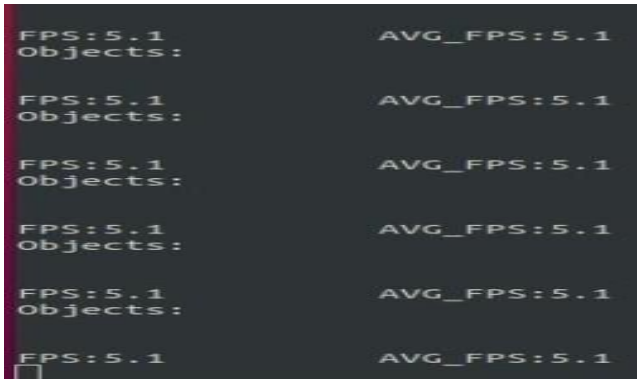


Figure 2(b): FPS, average FPS and object detected displayed on the terminal window.

## 6. Conclusion

The open source community has been contributing to this project of sign language recognition for quite a while now and all for the vision of making the world a better place for everybody to live in. Technology has helped us apply this in a lot of ways. Improvements on existing projects with respect to this project is that the speed-accuracy trade-off is better than the pre-existing SVM. This is achieved as YOLO v3 has a better speed-accuracy trade-off of 22ms at 28.2mAP at 320 x 320. GoogLeNetInception v4 is better in terms of FPS but Inception consumes more time to get the model trained.

## References

[1] Dr. Ravi Kumar V, "Sign language translator using machine learning," International Journal of Applied Engineering Research ISSN 0973-4562 Volume 13, Number 4 (2018)

[2] Manoj Patil, "Sign language interpreter using machine language and image processing", International Research Journal of Engineering and Technology (IRJET) Volume: 06 Issue: 04 | Apr 2019

[3] Kamal Preet Kour, "Sign language recognition using image processing", International Journals of Advanced Research in Computer Science and Software Engineering ISSN: 2277-128X (Volume-7, Issue-8), August 2017.

[4] Dishita Patil, "Sign language interpretation using deep learning",IOSR Journal of Engineering (IOSRJEN) Vol. 09, Issue 4 (April. 2019).

[5] Oscar Koller, "Neural sign language translation", Necati Cihan Camgoz1, Simon Hadfield 1, Oscar Koller2, Hermann Ney2, Richard Bowden1 1University of Surrey, RWTH Aachen University

[6] Ashish S. Nikam, "Sign language recognition using image based hand gesture recognition techniques", Online International Conference on Green Engineering and Technologies (IC-GET) (2016)