

Real Time English (British) Sign Language to Bengali Sign Language Translation System

K. M. Naimul Hassan
Undergraduate Student
Dept. of Electrical and Electronic
Engineering
Bangladesh University of Engineering
and Technology
Bangladesh
naimul.hassan273@gmail.com

Rahad Arman Nabid
Undergraduate Student
Dept. of Electrical and Electronic
Engineering
Bangladesh University of Engineering
and Technology
Bangladesh
ran.nabid@gmail.com

Naima Tasnim
Undergraduate Student
Dept. of Electrical and Electronic
Engineering
Bangladesh University of Engineering
and Technology
Bangladesh
naimatasnim68@gmail.com

Iztihad Mahfuz Ifti
Undergraduate Student
Dept. of Electrical and Electronic
Engineering
Bangladesh University of Engineering
and Technology
Bangladesh
ifti7322@gmail.com

Abstract—Sign language is the best way of communication for the specialized people who lack the power of hear. Every country has a sign language of its own. Hence, it is not possible for deaf people living in Bangladesh to understand the sign language of other countries. This article represents a method of translating English (British) sign language to Bengali Sign Language using basic digital signal processing and machine learning techniques. In this study MATLAB has been used through every procedures made.

Keywords—*grayscale, filter, threshold, CNN, AI, GPU, classification*

I. INTRODUCTION

There are dictionaries for sign languages and these dictionaries can convert any word to sign language. There are also lots of existing works on sign languages recognition using machine learning and image processing. Even real time sign language/gesture recognition exists. But there is lack of progressive works on translating a sign language into another sign language. It is important to note that, just because a spoken language is intelligible transnationally, such as English in the United States and the United Kingdom, does not mean that the sign languages from those regions are as well; American Sign Language and British Sign Language were formed independently and therefore are not mutually intelligible. So, there is a need to build a real time translation system of sign languages for the humanitarian benefit for those specialized people who lack the power of hearing. For example, for a English SL to Bengali SL system, deaf people in Bangladesh can understand the sign language shown in educational television programs of British Council. The purpose of this article is to discuss about an initiative of such a translation system. In this study, we have presented a simple model of English (British) sign language to Bengali sign language translation.

II. METHODOLOGY

There are four main parts of our proposed work; Database creation, image processing, database training and finally predicting label. MATLAB is used in every process made

throughout the project. External webcam is also used as the video input of English sign language.

A. Database Creation

The database is simple consisting of the British signs for nine digits (one to nine). On average, 75 samples are collected for each of the digits. The samples are in image format (.jpg) taken from mobile camera. Samples were taken from two specific angles; front and back sides of the signs. One sample for Bengali signs of nine digits are also collected in the database.

B. Image Processing

Basic image processing techniques are applied on the database to get better result from the network. Four kinds of image processing are used; gray scaling, noise removing, edge detection, thresholding.

- *Gray Scaling*: RGB images of the samples are converted to grayscale images. It is an obvious and primary step to apply any image processing techniques on RGB images.
- *Noise Removing*: Filters like median filters are used to remove unwanted noises from samples.
- *Contrast Enhancement*: Contrast of sample images are controlled using histogram equalization.
- *Edge Detection*: Handshape are detected using edge detection technique. Prewitt filter is used to detect edges.
- *Thresholding*: Finally, the grayscale image is converted into black and white images using thresholding method.

C. Database Training

The processed database is trained by feeding it into a pre-trained CNN (Convolutional neural network). This network is used for object detection. We have changed the layers of the network and instead of its own database, we have use our own database of British signs for nine digits. Each sign

represents a label of the training set. So, for this classification model, total nine labels are used. Database is used trained in MATLAB 2018a using a single GPU. Stochastic gradient descent with momentum is used as the method of training database.

D. Label Prediction

External webcam is used for video input. The real time video having British sign language is divided into frames of images and each images is processed using the same image processing techniques used to process the database. Then the frames are fed into the neural network to correlate with the trained database and predict the label. According to the predicted label, corresponding one sample Bengali sign from the database is displayed.

Overall methodology can be shown in a block diagram (Figure 1).

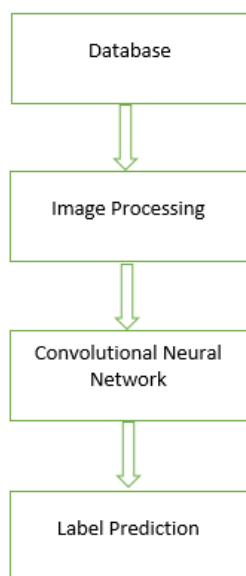


Figure 1: Block Diagram of the system

III. RESULTS AND DISCUSSIONS

Outcomes of the methods are discussed step by step:

A. Database

One sample of each British signs for nine digits (1-9) in the database are shown in Figure 2.

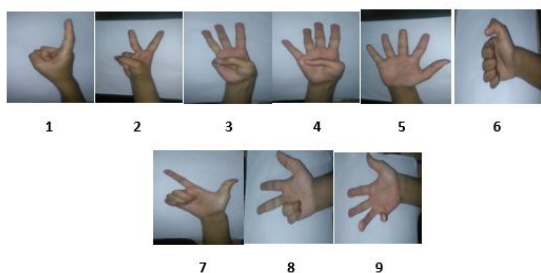


Figure 2: Samples of British signs used for the project

B. Image Processing

Different image processing such as gray scaling, noise removing, contrast enhancement, edge detection, thresholding (Figure 3) are applied to get better training result of the database from the network.



Figure 3: Samples processed by image processing techniques

C. Database Training

The database is trained by a pre-trained convolutional networks having stochastic gradient descent with momentum feature to classify the labels. As there are nine digits, number of fully connected layers are nine. CNN used 420 iterations and took about 12 minutes to train the database.

D. Label Prediction

After training the database, network is ready to predict the labels of the real time framed and processed images from the video input of the external webcam and the database for Bengali signs are also linked. If the prediction probability is high for a certain label, corresponding Bengali sign sample is displayed in the figure of MATLAB as shown in Figure 4. Here British sign for nine is translated in Bengali sign for 'নয়' (which means nine). The image in the bottom left corner is the desired and translated Bengali sign result.

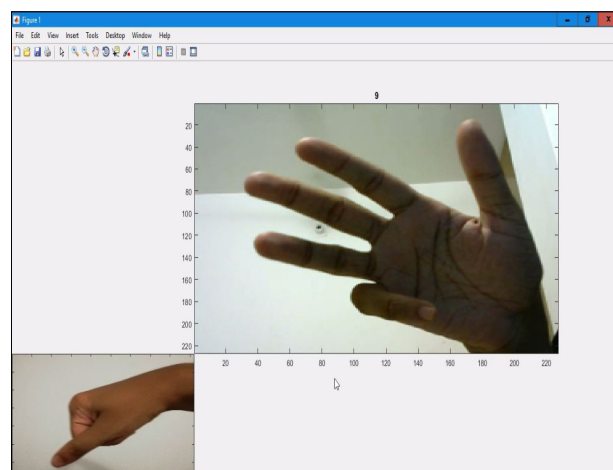


Figure 4: Real time British Sign Language to Bengali Sign Language Translation

IV. CONCLUSION

The proposed work is an initiative of building a real time translation system for sign languages. Our aim is to turn it into a universal translation system. Advanced methods like building own classification method by extracting features are needed to get the desired result. This study was only based on hand gesture static signs. Further works are needed for sign language extraction from full body image and dynamic signs.

ACKNOWLEDGMENT

We wish to express our sincere gratitude to *Dr. Celia Shahnaz*, Professor, Dept. of Electrical and Electronic Engineering, Bangladesh University of Engineering and Technology and *Mr. Jayanta Dey*, Lecturer, Dept. of

Electrical and Electronic Engineering, Bangladesh University of Engineering and Technology for their valuable supervision for this project.

REFERENCES

- [1] Yuqian Chen and Wenhui Zhang, "Research and Implementation of sign language recognition method using Kinect", 2016 2nd IEEE International conference on Computer and Communications (ICCC).
- [2] Neural Network Toolbox, MATLAB Documentation, Mathworks.
- [3] Convolutional Neural Network (CNN), MATLAB Documentation, Mathworks.
- [4] Fuchang Yang and Hijian Shi, "Research on Static Hand Gesture Recognition Technology", 2016 International Conference on Intelligent Transportation, Big Data and Smart City, Changsha, China.
- [5] Sign Language MNIST, Kaggle..
- [6] Sign Language Digit Dataset, Kaggle.