

Real Time Translator for Sign Language Using Deep Learning

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ABSTRACT: Sign Language (SL) is a gesture based language for the people who are affected by speech deficit. They use sign language as a medium of communication with the others. It is very difficult for the normal people to understand this sign language. But it is essential to understand the sign language for the communication with deaf or dumb people. Previous methods used sensor gloves, hat mounted cameras, armband etc. which has wearing difficulties along with noisy behaviour. A real time gesture recognition system using Deep Learning (DL) is proposed to alleviate these problems. It is found to be very necessary for the faster and better communication. It enables to reduce the communication gap and helps to enhance the recognition performance.

KEYWORDS: Sign Language, Gesture Recognition, Deep Learning.

I. INTRODUCTION

The sign language is a very important method for conversation with deaf and dumb people. Each gesture has a particular meaning in sign language. SL is considered basically as a non-verbal language. Lots of researches are going on image based approaches only because of pros of not need to wear complex devices like armbands, sensor gloves, Helmet etc. Sign recognition is related as understanding of image. Sign detection and sign recognition are considered as the two major phases. Sign detection can be regarded as the process of extracting feature of certain object with respect to certain parameters. Sign recognition is the method of recognizing a certain shape that differentiates the object from the remaining shapes. It is often regarded as the most grammatically structured gestural communications. This nature makes SL recognition an ideal research field for developing methods to solve different issues associated with it. The problem of conversation with those people has been addressed by several researchers and companies, who have provided their solution for these issues. However, this issue is still under considerable attention.

Paper is organized as follows. Section II describes associated works done for sign language recognition. The methodology and the modules involved in the sign language recognition are described in Section III. Finally, Section IV presents conclusion.

II. RELATED WORK

The problem of communication has persisted for the people who are physically disabled such hearing impairment or physically mutes. The problem has been addressed by various researchers. However, the problem is still under considerable attention because of its feasibility and availability. Various studies and researches are done for sign language recognition.

S. A. Mehdi et al. [2] proposed a sign language recognition approach using sensor gloves. Sensor gloves are normally gloves made out of cloth with sensors fitted on it. Using data glove is a better idea over camera as the user has flexibility of moving around freely within a radius limited by the length of wire connecting the glove to the computer, unlike the camera where the user has to stay in position before the camera. This limit can be further lowered by using a wireless camera. The effect of light, electric or magnetic fields or any other disturbance does not affect the performance of the glove. 7-sensor glove of 5DT Company is used. It has 7 sensors on it. 5 sensors are for each finger and thumb. One sensor is to measure the tilt of the hand and one sensor for the rotation of the hand. Optic fibres are mounted on the glove to measure the flexure of fingers and thumb. Artificial Neural Network with feed forward and back propagation algorithms have been used. Feed forward algorithm is used to calculate the output for a specific input pattern.

Purohit et al. [3] introduced a wearable hand gloves gesture detection based on flex sensors for disabled people. The data glove is fitted with flex sensors along the length of each finger. The flex sensors output a stream of data that varies with degree of bend. The analog outputs from the sensors are then fed to microcontroller. It processes the signals and perform analog to digital signal conversion. The gesture is recognized and the corresponding text information is identified. The user need to know the signs of particular alphabets and he need to stay with the sign for two seconds. There are no limitations for signs it is hard to build a standard library of signs. The new sign introduced should be supported by the software used in the system.

A. S. Nikam et al. [4] proposed image based hand gesture recognition technique. Image based gesture recognition system is divided into three steps In Image pre-processing color to binary conversion & Noise filtering is done for captured image. The set of operations which performs on the image based on shapes are known as Morphological operations. There are two most basic morphological operations: Erosion and Dilation, it uses for Removing noise, Separation of individual elements and joining misaligned elements in an image, even Finding of intensity bumps or holes in an image. Erosion shrinks boundaries of an image and enlarges holes. Erosion can be used to remove noises from an image. And Dilation is used to add pixels at region of boundaries or to fill in holes which generate during erosion process. Dilation can also be used to connect disjoint pixels and add pixels at edges. Tracking is mainly used for tracking a hand gesture from capture image using Convexity hull algorithm. Finally recognition is done with the help of features like convex hull and convex defects taken from tracking.

A. G. Jaramillo et al. [5] proposed hand gesture recognition with EMG using machine learning. Myo armband is a sensor which is used because of the following reasons: low cost, small size and weight, software development kit (SDK) and because the Myo is a small and open source sensor that is easy to wear. The Myo armband has eight EMG surface dry sensors, and an inertial measurement unit (IMU). The eight surface sensors measure 200 samples per second of the electrical activity of the muscles. The IMU has 9 degrees of freedom (accelerometer, gyroscope, and orientation in the X, Y, and Z-axes). The Myo armband uses Bluetooth technology for transmitting the data to the computer. Finally, the Myo armband has incorporated a proprietary system capable of recognizing five gestures of the hand.

III. METHODOLOGY

After the collection of the dataset, inception model which is an image recognition model is created. Inception model thus created using the dataset is loaded into the tensorflow memory. Tensor flow is an open source platform. The live video of gestures produced by the signer is captured by using the web camera. The captured image frames is also loaded into the tensorflow memory. The input gestures to be recognised thus passed through the inception model and recognises the gesture and returns text corresponding to the gesture. There are four modules involved in sign language recognition. Following are the modules:

1. Dataset Preparation

Various images of hand gestures are collected as folders. Fig. 1 shows the gestures of alphabets.



Fig. 1 Sign Language of Alphabets

2. Training

Inception v3 model is a pre-trained neural network. This model consists of mainly two parts namely, feature extraction part and classification part. It extracts general features from the input images in the first part and classifies them based on the extracted features in the second part.

3. Image Acquisition

The web camera is used for capturing the live video. A rectangular frame is visible on the screen and gestures are made by the signer inside that frame. It is able to capture the hand gestures of the signer in a proper manner. Fig.2 represents the acquisition of images.

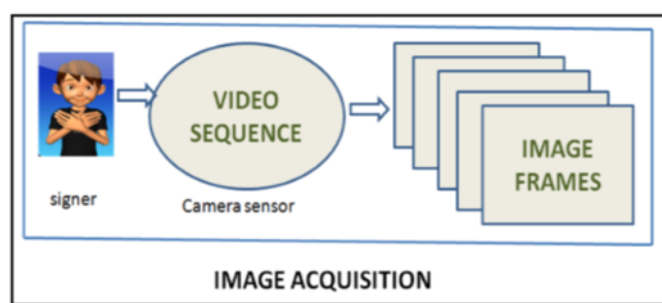


Fig. 2 Image Acquisition

4. Gesture Recognition

The hand gestures made by the signer are loaded into the tensorflow memory. Inception model is also loaded there. At the time of gesture recognition, input gesture images passed through the inception model and classify the gestures by a classification algorithm. The English text corresponding to the hand gestures is thus produced as output.

IV. EXPERIMENTAL RESULTS

The proposed method was implemented and tested with set of images. The training set consists of all alphabets A to Z (26 patterns). The live video of doing sign language is taken by using the web camera. The system is designed to recognize simple gestures or signs. The design is very simple and does not require any kind of gloves to be worn. Also the system is applicable to white background. Recognized gesture is converted into text and displayed on the screen. The proposed method has a better recognition rate compared to some of the existing methods and techniques.

V. CONCLUSION

The issue of communication has persisted for the people who are physically disabled such hearing impairment or physically mutes. The problem has been addressed by various companies and researchers. However, the problems are still under considerable attention because of its feasibility and availability. Various methods employ sensor gloves, armband, helmets etc. These all methods have their own limitations and disadvantages such as wearing difficulties and noisy behaviour. To alleviate these limitations and cons, a real time gesture recognition system using deep learning is proposed. This helps to achieve significant improvements on the recognition performance.

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