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Real Time Translator for Sign Language

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ABSTRACT

Sign language (SL) is commonly considered as the primary gesture based language for deaf and dumb people. It is a medium of communication for such people. Basically image-based and sensor- based are the two important sign language recognition methods. Because of the difficulties in wearing complex devices like Hand Gloves, armbands, helmets etc. in sensor based approaches, lots of researches are done by companies and researchers on image based approaches. Sign language is used by these people to communicate with the normal people. Understanding this sign language is a difficult task according to the normal people. To address these difficulties, a real time translator for sign language using deep learning (DL) is introduced. It enables to reduce the limitations and cons of other methods to a greater extent. With the help of this real time translator, communication will be better and fast without causing any delay.

KEYWORDS: *Sign Language, Deep Learning (DL)*

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INTRODUCTION

The sign language is a major way of communication for deaf-dumb people. They have no ability to speak or hear by themselves. The difficulty of communication for deaf and dumb people with others is a major issue in the society. In sign language each gesture has its own meaning. A third party who knows the sign language is necessary for their communication. Otherwise there will be no use of third party. There may be a chance of communication gap between the deaf-dumb people and normal people even in the presence of third party. In various fields, they are facing many difficulties in communication. Lots of researches are going on image based methods. The proposed method of real time translator using deep learning can achieve a better recognition performance.

RELATEDWORKS

Several works can be done in the field of sign language recognition. Many researchers have used skin color based segmentation for gesture recognition. But it has many problems that negatively affect the accuracy of the segmentation. Variation in illumination is very difficult to accommodate for accurate segmentation. There are other methods to acquire input data, such as accelerometer, helmets, armbands, sensory gloves. Some uses camera and color gloves to acquire the feature they need. These all methods suffer with wearing difficulties. The flex sensors are planted inside the gloves and provide fingers' flexes. The accelerometer provides tilting movement of palms. Another system used Leap Motion Controller (LMC) to acquire the data. LMC is 20 a touch less controller developed by Technology Company based in San Francisco called Leap Motion. It can operate roughly around 200 frames rate per second and is able to detect and track hands, fingers, and finger-like objects. Most of researchers acquire their training data by recording the data from their signer. But most of these methods have noisy behaviour. As a result of these problems, the accuracy of the gesture recognition is very low.

H. Brashear et al. [8] proposed multiple sensor types for disambiguation of noise in gesture recognition. In this case, accelerometers with the three degrees of freedom, mounted on the wrists and torso to increase our sensing information are used. The accelerometers will capture information that the vision system will have difficulty with such as rotation (when hand shape looks similar) and vertical movement towards or away from the camera. The camera will provide information not gathered by the accelerometers such as hand shape and position. Both sensors collect information about the movement of the hands through space.. It is important to add that sensor selection is based on the amount of information the sensor collects and its "wear- ability".

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 low cost, small size and weight. 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: pinch, fist, open wave in, and wave out.

A. S. Nikam et al. [4] proposed image based hand gesture recognition technique. 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. Dilation is used to add pixels at region of boundaries or to fill in holes which generate during erosion process. It 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.

METHODOLOGY

The proposed system uses deep learning for sign language recognition. It provides a real time translator for sign language. Transfer learning is an advanced technique of Deep Learning where a model developed for a task is used as a starting point for a model on a second context similar task. The proposed system focuses on removing the barrier of communication between normal and physically disabled people. Images of various hand gestures are collected for training purpose. After the dataset preparation, images of hand gestures are trained. Inception model which is the summation of dataset is created and stored as file. It is a graphical format which is not human readable which is loaded into memory when required. By using deep learning with the help of tensorflow platform, the input imagescan be processed.

The person conveying in the sign language can be obtained by using a web camera in a video format. The hand gestures are made by signer in rectangular box which is visible on the screen. It is able to capture the hand gestures in a right manner. The hand gestures to be recognized is loaded into tensor flow memory. It passes through the inception model which is also loaded into tensor flow memory. KNN, K Nearest Neighbor is used as classification algorithm. Using this algorithm, the output corresponding to the gesture is obtained as text. The modules involved in the proposed method are the following:

A. Dataset Collection
B. Training Images
C. Image Acquisition
D. Recognition of gestures

A. Dataset Collection

The first module of the proposed system is dataset collection module. Using the Sign Language MNIST dataset from Kaggle, the proposed model is evaluated to classify hand gestures for each letter of the alphabet. The gesture images of each alphabet are collected and stored as folders. A large set of hand gesture images of each alphabet are included. Along with these, there are gestures for backspace, space and some words also. The gestures for backspace are used to clear the wrong one while translating the gestures. The gestures for space are used to keep the gap between two different words during the appearance of the text. The image preprocessing steps included conversion of the images to required image format using Python's open-source libraries Pandas, NumPy and others to obtain PNG format 28x28 gray scale images. First load the dataset using pandas. Pandas are the package used to load the documents (in any format). All the operations can be performed by using NumPy module in the python.

Figure1. Sign Language

B. Training Images

Transfer learning is a machine learning method which uses a pre-trained neural network. The Inception V3 is a convolutional neural network .The Inception model is retrained on the mentioned dataset From the dataset, the classification of data is as follows, 10% data is used for testing purposes, 10% data is used for validation purposes and 80% data is used for training.

C. Image Acquisition

The main device used for taking the input images in Sign Language Recognition (SLR) is web camera. The proposed method used a webcam for capturing the image and then stored in a directory. Signer must be ready to perform sign language hand gesture before camera getting on. The gestures are made in bounding boxes that will appear on the screen. It enables to capture the hand portion of the signer who is trying to communicate with the others. The proposed system is a real time translator for sign language; therefore there must be not a communication gap. So to process the hand gesture portion only, gestures are made in bounding boxes

The video of hand gestures are captured using the web camera. From these video sequences, the images are acquired automatically as frames. These input images of gestures are then passed into the tensorflow memory.

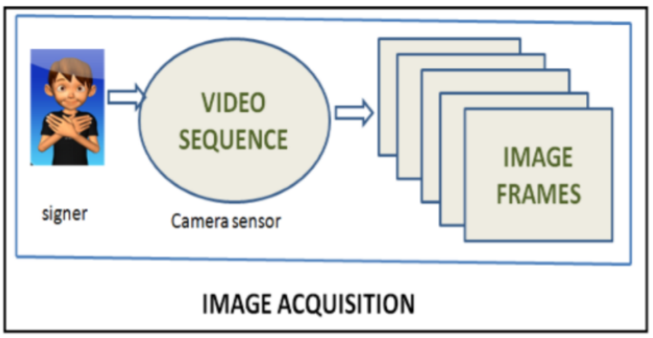

Figure2. Image Acquisition

D. Recognition of gestures

The hand gesture images as frames are loaded into the tensorflow memory. At the same time, inception model which is the summation of the dataset is already present in the tensorflow memory. Then there is a need of classification algorithm for classification.KNN (K-Nearest Neighbor) is a classification algorithm used for the purpose of the classification. It is a non-parametric method used for classification and regression. KNN is asupervised machine learning algorithm

EXPERIMENTAL ANALYSIS

A. Result and Analysis

This section discusses the experimental results of the proposed system. Visual Studio Code is used. The dataset from Kaggle is used for training purpose. The proposed system is implemented using four modules i.e., dataset preparation, training images, image acquisition and recognition of gestures. The hand gestures are made by the signer in the rectangular frame which is visible on the screen.

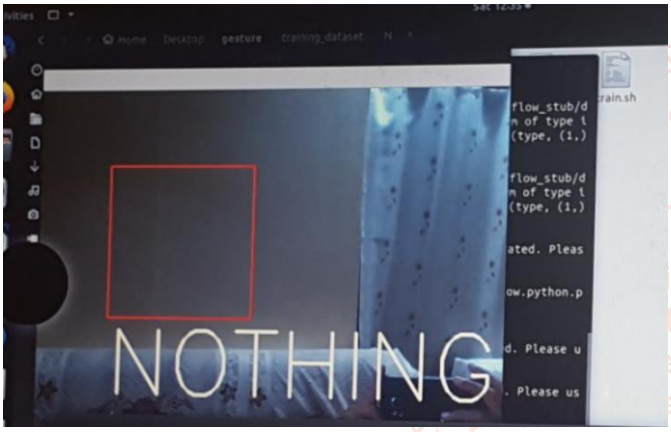

Figure3.Capturing Input Image

B. Performance Requirements

Performance requirements describe all the hardware specifications of the system. For deep learning project, the minimum system requirement is it needs i3 or above processor. Mostly deep learning projects used 64 bit Ubuntu operating system.

CONCLUSION

Sign language recognition system proposed for the communication of deaf-dumb people using deep learning technique was implemented successfully with better accuracy. We have tried to improve the recognition rate compared to the previous works and achieved a better success rate. The proposed method could develop hand gesture recognition model successfully which enables to recognize dozens of gestures of the hand, with recognition accuracy greater than the existing real-time models.

Acknowledgment

I undersigned hereby declare that the project “Real Time Translator for Sign Language”, submitted for partial fulfillment of the requirements for the award of degree of Master of Technology of the APJ Abdul Kalam Technological University, Kerala is a bonafide work done by me under supervision of Ms. Anju J Prakash. This submission represents my ideas in my own words and where ideas or words of others have been included. I have an adequately and accurately cited and referenced the original sources. I also declare that I have adhered to ethics of academic honesty and integrity and have not misrepresented or fabricated any data or idea or fact or source in my submission.

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