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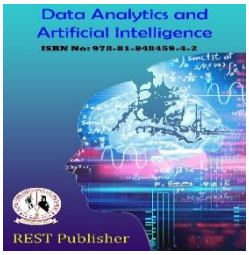

Sign Language Recognition

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Abstract : *Sign Language is used by deaf and dumb people to exchange information with others. Hand gesture is one of the styles used in sign language for non-verbal communication. It's most generally used by deaf & dumb people to communicate with others. Sign language to help deaf and dumb people to communicate more effectively with each other or normal people. Dumb people are generally deprived of normal communication with other people in the society, also normal people find it hard to understand and communicate with them Computer recognition of sign language deals from sign gesture acquisition and continues till text/speech generation. Sign gestures can be classified as static and dynamic. They use a concurrent and specific combination of hand movements, hand shapes and orientation in order to convey particular information. One such set of language is the Indian Sign Language (ISL) system which is predominantly used in south Asian countries. Certain aspect that distinguishes ISL from other sign languages is that ISL devoid of any temporal inflections in its finger spelling chart and also the usage of both the hands. Sign language recognition is a challenging task, particularly the ISL recognition is complicated due to its usage of both the hand. Many people in India are speech and or hearing impaired, and they use hand gestures to communicate with other people. This project aims to narrow this communication gap by developing software which can predict the ISL hand gestures in real time. They use concurrent and specific combination of hand movements, hand shapes and orientation in order to convey particular information.*

Keywords: *Sign language recognition, Hand tracking, Hand gesture recognition, Gesture analysis, Face recognition.*

1. INTRODUCTION

Sign language is the mode of communication which uses visual ways like expressions, hand gestures, and body movements to convey meaning. Sign language is extremely helpful for people who face difficulty with hearing or speaking. Sign language recognition refers to the conversion of these gestures into words or rudiments of being formally spoken languages. Therefore, conversion of sign language into words by an algorithm or a model can help bridge the gap between people with hearing or speaking impairment and the rest of the world. Sign language (SL) [1] is a visual-gestural language used by deaf and hard-hearing people for communication purposes. Three dimensional spaces and the hand movements are used (and other parts of the body) to convey meanings. It has its own vocabulary and syntax Sign language (SL) is a visual-gestural language used by deaf and hard-hearing people for communication purposes. Three dimensional spaces and the hand movements are used and other parts of the body to convey meanings. Sign language uses the visual faculties which is different from spoken language. A sign language recognition system consists of an easy, efficient and accurate mechanism to transform sign language into text or speech. The computerized digital image processing and a wide variety of classification methods used to recognize the alphabet flow and interpret sign language words and phrases. Sign language information can be conveyed using gestures of hands, position of head and body parts. Four essential components in a gesture recognition System are: gesture modeling, gesture analysis, gesture recognition and gesture-based application systems.

2. OBJECTIVES

The sign Language Recognition Prototype is a real- time vision- based system whose purpose is to detect the Indian sign language.

- The purpose of the prototype was to test the validity of a vision- based system for sign language recognition and at the same time, test and elect hand features that could be used with machine learning algorithms

allowing their applications in any real- time sign language recognition systems. The implemented algorithm uses only one camera, and is grounded on a set of hypotheticals. The speaker must be within a defined border area, in front of the camera.

- The speaker must be within a defined distance range, due to camera limitations.
- Hand gesture is defined with a bare hand and not clotted by other objects.
- The system must be used in closed areas, since the named camera doesn't work well under sun light conditions.

3. LITERATURE SURVEY

The researches done in this field are substantially done using a glove-based system. In the glove-based system, detectors similar as potentiometer, accelerometers etc. are attached to each of the finger. Grounded on their readings the corresponding alphabet is displayed. Christopher Lee and Yangsheng Xu developed a glove-based gesture recognition system that was suitable to recognize 14 of the letters from the hand alphabet, learn new gestures and suitable to modernize the model of each gesture in the system in online mode. Over the times advanced glove gadgets have been designed similar as the Sayre Glove, Dexterous Hand Master and Power Glove. The main problem faced by this gloved based system is that it has to be recalibrate every time whenever a new speaker on the finger-tips so that the fingertips are linked by the Image Processing unit. We are enforcing our design by using Image Processing. The main advantage of our design is that it is not confined to be used with black background. It can be used with any plane background. Also wearing of color bands isn't needed in our system. Two main classes can be set up in biometrics:

- **Physiological –** It is associated with the body shape, includes all physical traits, iris, palm print, facial features, Fingerprints, etc.
- **Behavioral –** Affiliated to the behavioral characteristics of a person. A characteristic extensively used till moment is autographs. Modern methods of behavioral studies are arising similar as keystroke dynamics and voice analysis.

4. METHODOLOGY

The system is a vision-based approach. All the signs are represented with bare hands and so it eliminates the problem of using any artificial gadgets for communication. Converting real time sign language into text can be classified into flow of simple steps like:

- Recognizing a man's or woman's hand motions
- Developing a system learning model for picture to textual content translation
- Putting words together
- Putting sentences together
- Creating the complete content

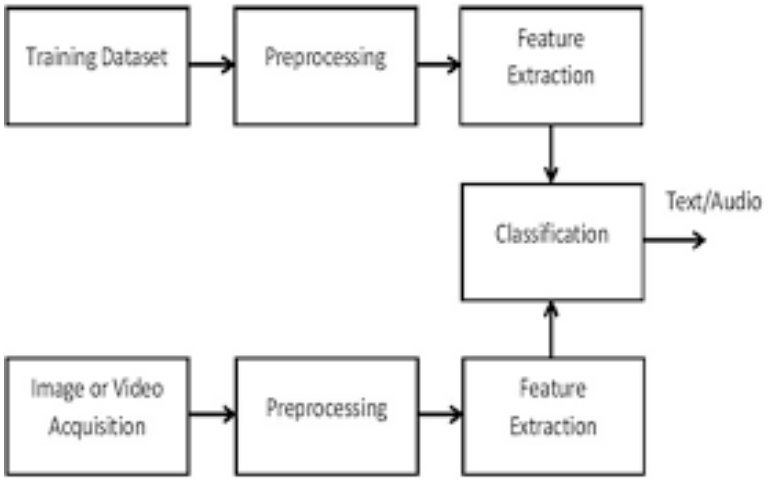

FIGURE 1. Flow diagram of sign language

Image Acquisition:

The camera is put to use for capturing the motions. The full signing duration is captured with the help of this Open CV video stream. The frames are taken from the stream and converted to grayscale images with a 50*50 pixel resolution. Because the entire dataset is the same size, this dimension is consistent throughout the project.

- **Hand Region Segmentation & Hand Detection and Tracking**

In the collected photographs, hand gestures are scanned. Before the image is fed into the model for prediction, this is a phase in the preprocessing process. The passages in which gestures are used have been emphasized. This increases the chances of making a successful prediction by a factor of ten.

- **Hand Posture Recognition**

The preprocessed images are sent to the Keras CNN model. The model which was already trained generates the projected label. There is a probability associated with each of the gesture labels. The label which has the highest probability determines the expected label.

- **Display as Text**

The model converts gestures, which are known, into words. The recognized words form a sentence. Therefore, forming the entire context.

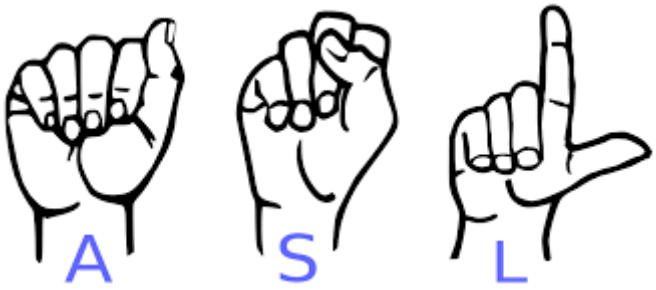

FIGURE 2. Display as Text

5. DATASET GENERATION

It is needed to make a proper database of the gestures of the sign language so that the images captured while communicating using this system can be compared. Procedure we followed to produce our data set are as follows. We used Open computer vision (OpenCV) library in order to produce our dataset. Originally, we captured around 13 images of each of the symbol in ASL for training purposes and around 2 images per symbol for testing purpose. First, we capture each frame shown by the web cam of our machine. In each frame we define a region of interest (ROI) which is denoted by a blue bounded forecourt as shown in the image below. From the whole image we uprooted our ROI which is RGB and convert it into labeled Image. Finally, we apply our single shot detection to our image which helps us extracting various features of our image.

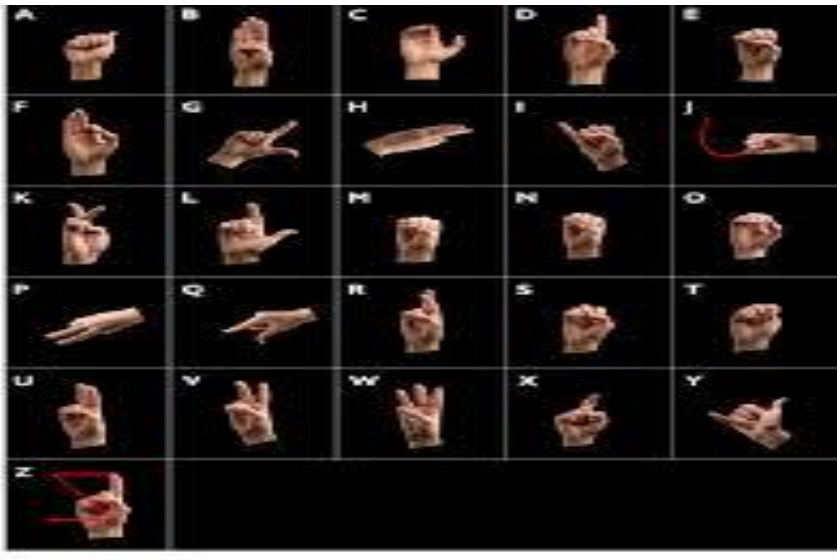

FIGURE 3. Dataset Generation

6. GESTURE CLASSIFICATION

The approach which we used for this design is our approach uses two layers of algorithm to predict the final symbol of the speaker.

Labelling Algorithm

- Apply labelling made easy for algorithm to recognize the gestures from the pictures.
- Instead of training whole image algorithm focus mostly on the cropped part of the picture. Hence algorithm will be efficient in duration.
- And computational power is saved as well.

Algorithm

- We used Tensor flow object detection algorithm.
- And we used single shot detector algorithm.
- Due to labelling it doesn't need a huge dataset. So the training duration will be deduced and space will be used effectively.
- Collect images for deep learning using your webcam and Open CV.
- Label images for sign language detection using Labelling.
- Setup Tensor flow Object Detection pipeline configuration.
- Use transfer learning to train a deep learning model.
- Detect sign language in real time using Open CV

7. TRAINING AND TESTING

We label our input images (RGB) and create a new xml file which holds details about the labeled part of the image. We apply adaptive threshold to extract our hand from the background and resize our images to 128 x 128. We feed the input images after pre- processing to our model for training and testing after applying all the operations mentioned.

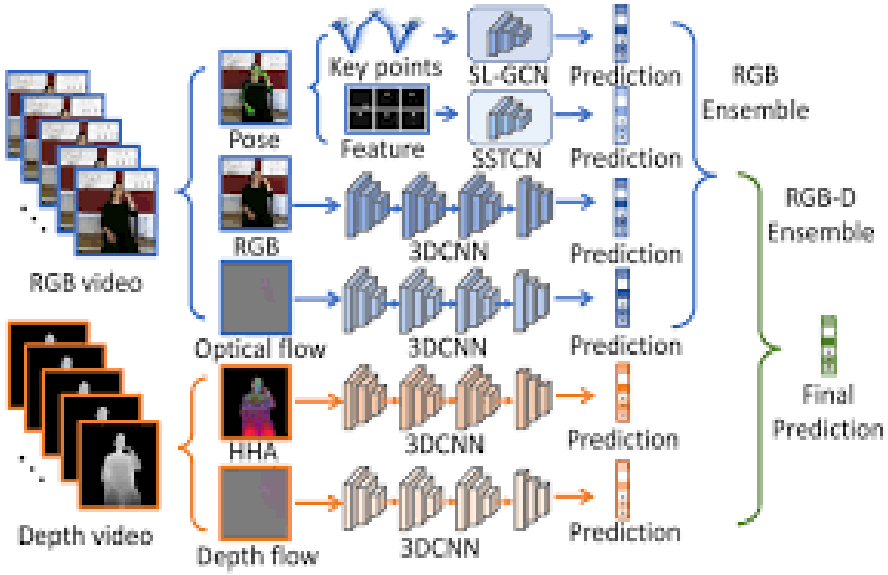

FIGURE 4. Training and Testing

8. CONCLUSION

This project is to predict the ISL hand-gestures in real time. The above work shows that it can be solved with better accuracy when we actually consider the segmented in hand-gestures. Our model showed good accuracy while predicting the hand gestures and result in text. This model tries to solve the problem of people who are dumb and deaf and who wants to convey what they are saying to others using Sign language. The model is efficient and highly accurate and hence works without

any problem. Sign language recognition system shows what the position of hands in viewfinder of camera module means with good accuracy.

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