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Duplex Sign Language Communicator

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Abstract: ***In this paper we are introducing a sign language converter which works as a duplex system as it can convert text to sign language as well as it can do a real time video to text conversion. It is basically a system that can be used by all people who know sign language as well as who are not familiar with it. The main aim of this system is to involve the specially abled people as much as possible to interact with others. Our system uses the basic NLP i.e. the Natural language Processing and algorithms like CNN classifier to make the implementation of this translator. Along with that this system focuses on the Indian Sign Language so that it can be used by our country people. The finger gestures are captured by the camera and using various machine learning algorithms the system will automatically translate the signs to the readable text, similarly in sign to text conversion, based on the data sets and various Machine learning algorithms the text will be converted to sign language.***

Keywords: Sign Language; Machine Learning; NLP; CNN; Translator.

I. INTRODUCTION

In today's world where everything is going on virtually, communication is the necessity, but when it's a case of specially abled people then everyone is not able to understand what those people want to say. So in this project we are trying to minimize this line of difference by trying to create a platform that can easily recognize the sign language and by means of text or video the message will be translated, and similarly the text or video will be converted into different signs which will be effectively understood by the specially abled people. To implement this we are using various machine learning models so that we can automate the system for dynamic use.Gesture recognition is an interpretation of gestures using mathematical algorithms. It comprises of any gestures made by face or hands. This technique has a wide range of applications and uses. Gesture recognition can be used to control devices merely through gestures without any physical link with the actual machine. Using gesture recognition, a person can point at the computer screen or at a mobile screen and use sign language to select and use different applications in the device. Sign language used by deaf and mute people can be interpreted using this technique and converted to text , thus enabling and aiding better communication between the deaf and mute and people interacting with them.An application with a user-friendly graphical interface that captures gestures and interprets them to text in a natural language will enable the disabled people to connect and interact with the masses without the need of a controller. All input images are captured by camera present in an android device. The captured images are then sent to via an online server and are converted in binary form of size defined so that it takes less time and memory space during pattern recognition. The converted text is then sent back to the users device.

II. LITERATURE SURVEY

This paper aims to cover methods of deaf-mute communication interpreter system. In this paper we proposed a system for communication with deaf and dumb people using Indian sign language (ISL) with normal people where hand gestures will be converted into appropriate text message. Main objective is to design an algorithm to convert dynamic gesture to text at real time. Paper presents the recent research and development of sign language based on manual communication and body language. Sign language recognition system basically elaborate in three basic steps: 1] pre-processing, 2] feature extraction and 3] classification. Classification methods used for recognition is Neural Network(NN).

A. Indian Sign Language Recognition

The Indian Sign Language Recognition system is considered as pattern recognition system that has two important modules: feature extraction and classification. Feature extraction and nearest neighbour classifier is used to recognize the sign language.

B. Hand Gesture Recognition

In this paper a scheme using a database driven hand gesture recognition is described. Initially, hand region is segmented. In the next Stage thresholding is applied to separate background. Finally, template based matching technique is developed for recognition.

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III. SYSTEM ARCHITECTURE

A. Text to Sign

In this paper a scheme using a database driven hand gesture recognition is described. Initially, hand region is segmented. In the next Stage thresholding is applied to separate background. Finally, template based matching technique is developed for recognition.

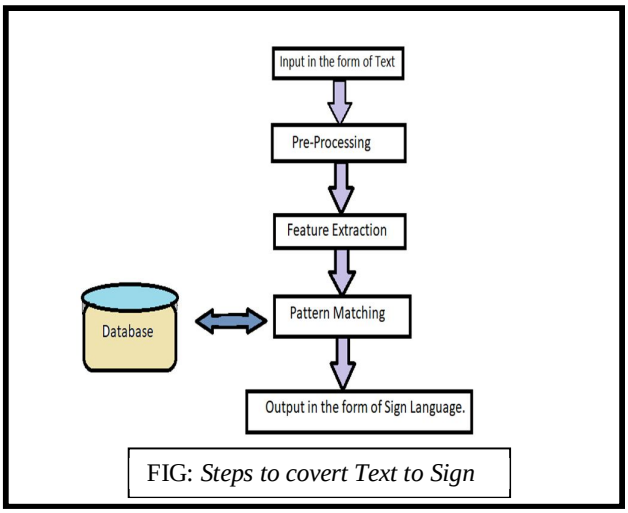


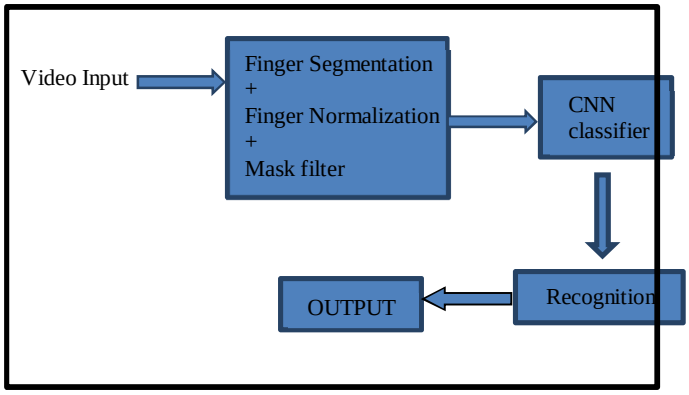
FIG: *Steps to covert Text to Sign*

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Pre-processing includes the input in the form of text. In Pre-processing stage the data is changed after obtained. It also helps the classifier to perform better by reducing some bad data that may cause an inaccuracy. Pattern Recognition and Matching parameters obtained from input or text is compared with database. After matching the corresponding result is displayed. Output is sign language image which has meaning of that text. Database plays an important role in giving correct output for the system.

B. Sign to Text

The system works in the following way as show in the figure:



Firstly the input is taken from the real time webcam video input and it is passed to the next stage of segmentation normalization and filter, the finger segmentation is used to detect the real time hand gestures and in this a labelling algorithm is used to mark the regions of the fingers. This helps in recognizing the pattern.

Then along with this the finger normalization is used to detect the curvature intensity and helps in increasing the precision of sign detection.Mask filter is an efficient way to filter out unwanted data or snapshot or images that are captured so , basically this stage makes the processing faster relevant and much more error free.

C. Convolutional Neural Network for Detection

CNN is a class of neural network used in solving computer vision problems. CNN makes a use of a filter to scan through the entire pixel values of the image and make computations by setting appropriate weights to enable detection of a specific feature. The CNN is equipped with layers like convolution layer, max pooling layer, flatten layer, dense layer, dropout layer and a fully connected neural network layer.

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T is a process where we take a small matrix of numbers, we pass it over our image and transform it based on the values from filter. The input image is denoted by f and our kernel by h. The indexes of rows and columns of the result matrix are marked with m and n respectively. After placing our filter over a selected pixel, we take each value from kernel and multiply them in pairs with corresponding values from the image. Finally, we sum up everything and put the result in the right place in the output feature map. Above we can see how such an operation looks like in micro scale, but what is even more interesting, is what we can achieve by performing it on a full image.

$$G[m,n] = (f * h)[m,n] = \sum_j \sum_k h[j,k] f[m-j, n-k]$$

After this the reduced image will be passed to a machine learning algorithm with some predefined data sets which will be trained accordingly to recognize the best possible outcome and finally the output will be given through the UI.

IV. ALGORITHM

Algorithm for sign language conversion to text :
-Set the hand to adjust with the lighting conditions.
-Apply data augmentation to the data set to reduce the overfitting.
-Group the data set according to train, test and validation data sets.
-Train the CNN model.
-Prepare prediction file- this file predicts individual gestures, accumulates them into words and displays the words as text.
- Stop.

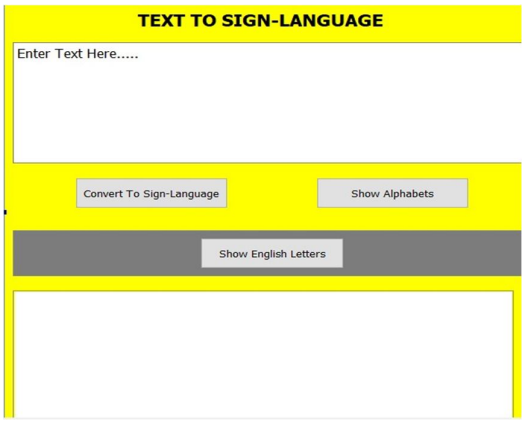


Fig: *Text to Sign Conversion Interface*

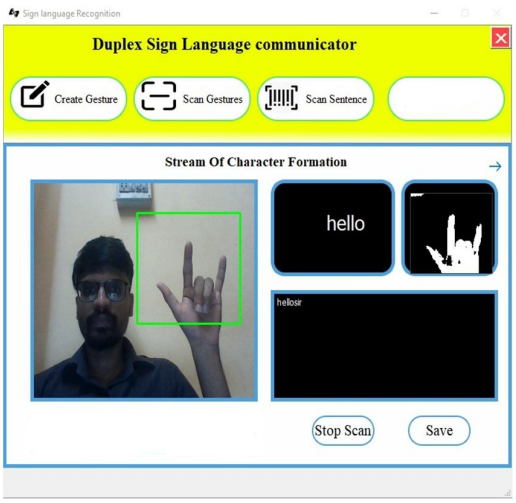


Fig: *Sign to text Conversion Interface*

V. CONCLUSION AND FUTURE SCOPE

Using this system it becomes possible to have normal conversation with the specially abled people which would help in eliminating the hassle of including a lot of middleware like translator or interpreter as this system incorporates the basic aspect of communication i.e exchange of information and makes it easier for collaboration with the people irrespective of their mode of communication without words.

Proposed sign language recognition system recognizes the gestures in constrained environment like dark background. The performance of the algorithm used can decrease due to varying lighting conditions, lighter background and background noise. So, further work should focus on hand segmentation method on the resource constrained devices with varying light conditions and skin color background.

This system can be further developed to recognize gestures in real time and in video format. Many other gestures of the sign language can also be made a part of the database. This project has also majorly based on the vision based techniques as these are easy to implement and faster in performance. The system can also be modified to be included into current video conferencing application which would help for long distance communication in real time.

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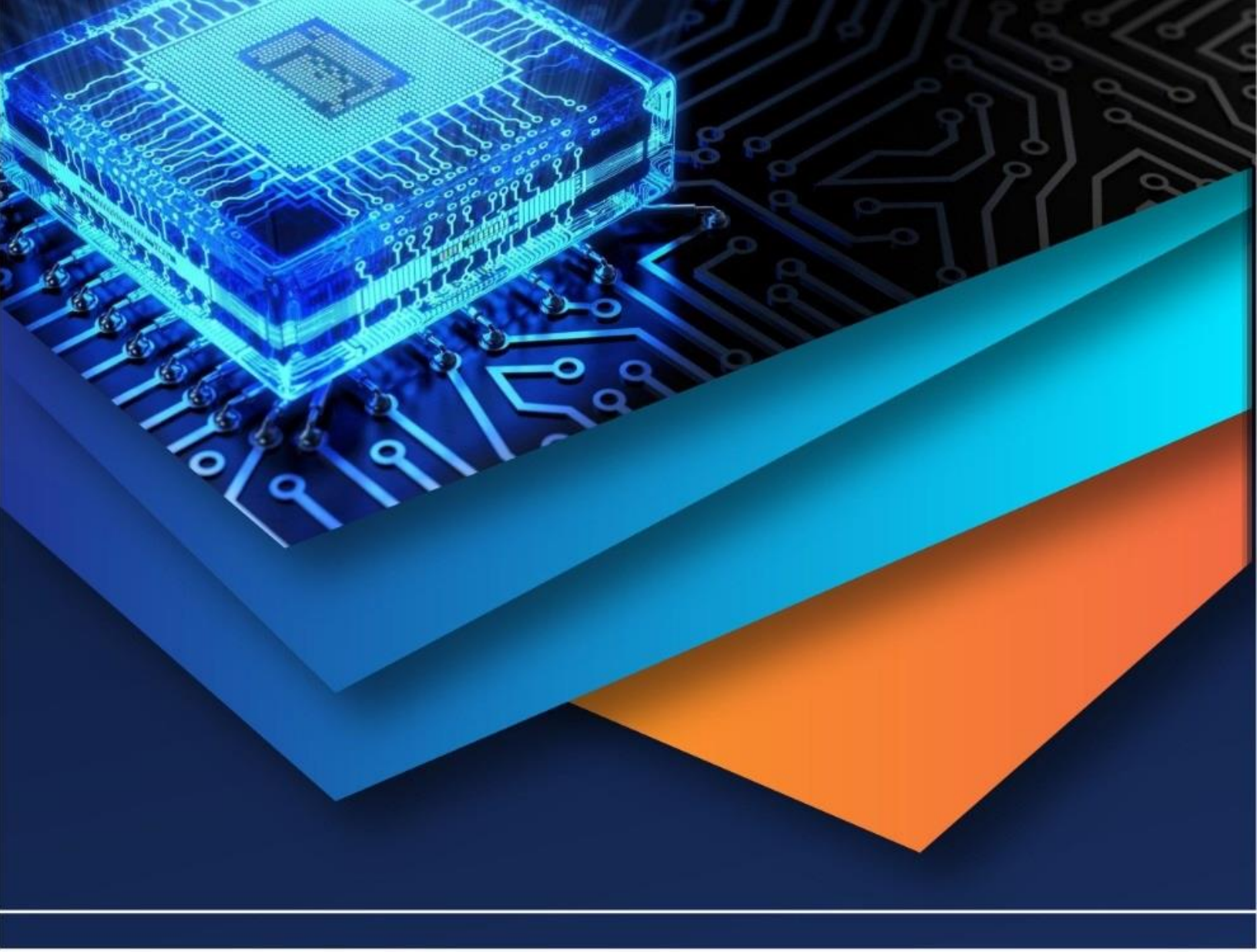
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