Sign Language Recognition

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***Abstract*: Sign language is used by deaf and dumb people to share information with others in their community. Talking to someone with a hearing problem is always a big challenge. Sign language recognition is an improvement in helping deaf and dumb people and has been around for years. Unfortunately, all research has its limitations and cannot be used commercially. Some research is known to be successful in recognizing sign language but requires expensive costs to be done for commercial purposes. Electronic recognition of sign language is associated with the acquisition of signals and continues until the production of text/speech. Touch gestures can be classified as permanent and flexible. Yet vertical touch detection is easier than recognizing dynamic touch but both awareness systems are important in human society. There are 26 symbols in Indian sign language corresponding to the alphabet where the proposed algorithm provides 95 accurate alphabetical results and its image is captured at all possible angles and distances i.e. in all the letters indeed though they've about 5 pictures independently. Angle and distance and algorithm work accurately for 45 input types. This paper aims to review sign language recognition methods and to determine the best method used by researchers. Other future research guides in this area are also suggested. In this paper, we discuss sign language recognition.**

***Keywords*: Sign language recognition, computer vision, machine learning, hand tracking, hand gesture recognition, gesture analysis, face recognition.**

I. INTRODUCTION

As stated by Nelson Mandela [1], *"Speak to the man in a language that you can understand. Speak to him in his language, which goes to his heart",* language is undoubtedly important in human relations and has existed since the dawn of human civilization. Sign language is a visual language used by the deaf and hard of hearing for communication purposes. Gestures are a form of physical activity performed by a person to convey a piece of meaningful information. Gestures are a powerful way to communicate between people. There are three-dimensional spaces and hand movements are used (along with other body parts) to convey meanings. It has its own words and syntax that is completely different from spoken languages/written language. The spoken language uses rules to generate a broader message and convey their thoughts and better interpretations to users who do not use sign language to understand what the character means. There are two types of hand gesture recognition methods: vision-based methods and data glove methods. This work focuses mainly on idea-based creation; similarly, sign language is controlled by complex grammar. A variety of symbols convey complex meanings, and recognizing them is a challenge for people who do not understand the language. It is difficult to find a skilled and experienced sign language translator at all times and all human-computer systems can be installed wherever possible. The visual touch of human-computer interaction is the site of effective research in computer vision and machine learning. We prioritize sign language recognition systems. It will be a great tool for people with hearing impairments in a system that can perform sign language recognition in real-time. The reason for choosing a vision-based system is related to the fact that it provides a simple and accurate way of communicating between a person and a computer. This paper aims to discuss the sign language recognition system used by researchers. This paper will discuss sign language recognition from the application perspective. This paper will discuss the device used for data acquisition, data acquisition, such as previous research data or self-generated data, the most recent method used by researchers, and the results of previous research.

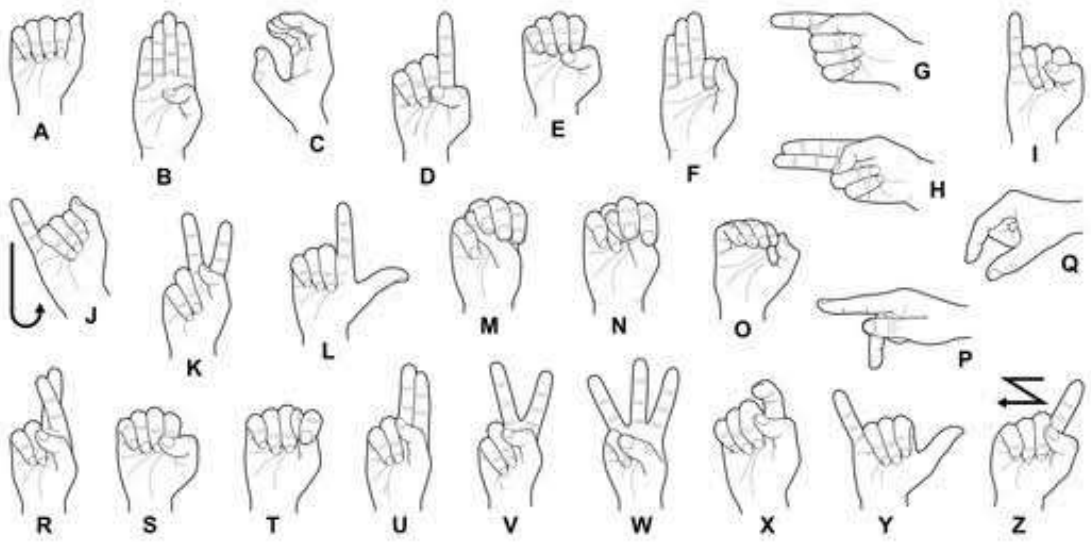

Figure 1 Alphabet Signs

I. LITERATURE SURVEY:

Tanuja Bohra et al. [1] proposed a real-time two-way sign language communication system built using image processing, deep learning, and computer vision. Techniques such as hand detection, skin color segmentation, median blur, and counter detection are performed on images in the dataset for better results. CNN model trained with a large dataset for 40 classes and was able to predict 17600 test images in 14 seconds with an accuracy of 99%.

Muthu Mariappan H. and Drs. Gomathi V. [2] designed a real-time sign language recognition system as a portable unit that uses contour detection and an incomprehensible c-means algorithm. Concerts are used to see the face, left hand, and right hand. Although an incomprehensible c-means algorithm is used to divide the input data into a specific number of clusters. The program was used on a database containing video recordings of 10 signatories and a few words. It was able to achieve 75% accuracy.

Kshitij bantupalli and Ying Xie [3] worked on an American sign-language recognition system based on CNN, LSTM, AND RNN. The CNN model called implementation was used to extract local features in the frames, LSTM long-term dependence, and RNN to extract temporary features. Various tests were performed for different sample sizes and the database had 100 different markers performed by 5 signers and high accuracy of 93% was obtained. Sequences are then added to LSTM for longer durations. Soft-max layer extracts and many later compounds are incorporated into RNN formulations to remove temporary features in the soft-max layer.

Hand gesture recognition for sign language recognition: A review in [4] author introduced a variety of hand gestures to recognize sign language in the past research. For deaf and dumb people, sign language is the only medium of communication. With the help of sign language, these disabled people are expressing their feelings and thoughts to someone else.

Design issue and proposed implementation and communication aid for deaf and dumb people in [5]: In this paper, the author proposes a program to facilitate communication with deaf and deaf people using Indian Sign Language (ISL) and the general public where sign language will be converted to the appropriate text message. The main goal is to design an algorithm to convert flexible touch text into real-time. Finally, after testing, the system will be used on the android platform and will be available as an app for smartphones and tablet pc.

II. METHODOLOGY

In this sign language recognition, we try to create a sign language recognizer. Which detects alphabet characters from ‘A’ to ‘Z’ that can very easily be extended to cover a vast multitude of other sign and hand gestures including the alphabets.

Data processing: Data processing, manipulation of data by a computer. It include the conversion of raw data to machine-readable form, flow of data through the CPU and memory to output devices, and formatting or transformation of output. Any use of computers to perform defined operations on data is included under data processing.

It is required to make a proper database of gesture of the sign language so that the images captured by communicating using this system cam be compared. Steps we followed to create our data set are as follows. We used open computer vision (OpenCV) library in order to produce our dataset. Firstly, we captured 300 images of each of the symbols in ASL for training purpose and around 300 images per symbol for testing purpose.

First, we captured each frame shown by the webcam of our machine. In each frame we define a region of interest (ROI) which is denoted by a blue bounded square. From the whole image we extracted our ROI which is RGB and convert it into grey scale image.

Finally, we apply our gaussian blur filter to our image which helps us extracting various features of our images.

Figure 2 ROI box representation

Classify gesture: After a model has been trained, it can be used to classify a new gesture that is available as a file on the file system. The user inputs the file-path of gesture image. Pre-process the file the same way as the model has been trained.

III. LIMITATIONS AND CHALLENGES

Models described in the given literature give poor results if the dataset includes faces of signers as the model ends up training incorrect features, the same problem occurs with the color of the background. These models also face problems if they are trained on color images and the skin tone in testing images differs from training images. While working with videos, the models take a lot of time to predict the signs and the dumb people are habituated to sign language so their speed cannot be matched with these existing systems.

The non-manual approach could be more effective in recognition as it considers facial expressions along with hand gestures but it can increase the complexity of implementation because variation in facial expression and body language can be much higher compared to variation in just hand gestures of different people. Though sensor-based techniques also give more accurate results in recognition, they suffer in aspects of portability and affordability.

IV. CONCLUSION:

In this paper, a check on sign language recognition is presented and varied ways have been studied and anatomized for the same. In the recognition process, segmentation plays a pivotal part in which skin region is separated from the background which generally affects the recognition accurateness. Besides segmentation, the category also depends on the feature extraction strategies which perform dimensionality reduction and reduce the calculation cost. A study of various category ways concludes that deep neural network (CNN, Inception model, LSTM) performs better than traditional classifiers similar to KNN and SVM.

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