Indian Sign Language Recognition System

Nilay N. Patel[1], Vansh J. Rodge[2], Prof. Ajaykumar T. Shah[3]
Department of Computer Engineering
[1,2] Alpha College Of Engineering And Technology
[3]HOD, Alpha College Of Engineering And Technology

Abstract- *Sign Language is used by people with hearing and speaking disabilities. This language is used by such people but normal people do not understand this language. In India there are only about 250 certified sign language interpreters translating for a deaf population of between 1.8 and 7 million. This recognition system relies on visual image recognition through phone camera and image processing algorithms to recognize the hand gesture and then convert it to text or speech output. The main aim of the system is to bridge the communication gap between disabled people and normal people. and decreases the encryption and decryption delay.*

Keywords- Hand Gesture Recognition, Image Processing, Real time text output, Sign Language.

I. INTRODUCTION

Indian Sign Language is basis for communication for deaf and mute people in India. There are very few certified sign language interpreters in India i.e. 250 interpreters for a disabled population about 7 million. This scarcity in interpreters proves to be troublesome for disabled people to communicate with normal people in day-to-day activities and also professional activities in workplace. We have thus decided to develop a system which recognizes these hand gestures and then converts them to text or speech as an output. This system is real-time, so it is handy for people to use and takes very few time in conversion. A sign language gesture has a particular word or meaning associated with it. Different combinations of these gestures compiles a whole idea. As these gestures are unique for particular word, we can differentiate it from other gestures and it makes task easier for the system to analyze and generate results more accurately. There has been a growing interest in the field of sign language recognition to provide human-to-human communication to human-to-computer communication. Finding an interpreter is very tough and having the interpreter for period of life is in itself an expensive task. So having human-to-computer communication will make it more affordable for disabled people. The research that has been carried out were focused on capture and classification of gesture of sign language. The remarkable contributions from Japan, Australia, Korea and America. After this there were many methods were proposed based on image processing, pattern recognition. There has not been such contribution for Indian Sign Language and we are focused on developing system for this.

II. RELATED WORK AND RESEARCH

Indian Sign Language Recognition is not new computer-vision problem, the work on it has been done in last 20 years. Researchers have used feature extraction methods, linear classifiers, neural networks and Bayesian networks to solve this. There have been some degree of success in recognizing alphabets and words but still the whole statement recognition has not achieved the accuracy that it demands. If this accuracy is achieved then it would be practical and efficient to use in day-to-day activities. The need for this system is very crucial among disabled people and especially in India.

Sign Language uses both physical and non-physical communication. Hand gestures are physical movements using hand and eyes and nonphysical movements are body position, head movement, facial expression, etc. Disabled people can express their feelings with these kinds of movements. Sign language can be recognized using different approaches such as Kinect sensor which is used to sense the signs, data glove to track the hand movement patterns to recognize the meaning, image processing to capture gesture and detect it by complex algorithms and leap motion. The solution that we are aiming recognizes the gesture and in real-time converts that to text or speech as an output. We will use large amount of data to train the system to recognize quickly and more accurately.

The recent work done on sign language is presented here: Al-Ahdal and Tahir demonstrated a novel method for designing sign language recognition system based on Electromyography (EMG) sensors with a data glove. This method is based on electromyography signals recorded from hands muscles for allocating word boundaries for streams of words in continuous sign language. Iwan Njoto Sandjaja and Nelson Marcos proposed color gloves approach which extracts important features from the video using multi-color tracking algorithm. Ibraheem and Khan have reviewed various techniques for gesture recognition and recent gesture recognition approaches. For gesture recognition Genetic Algorithm is used. Paulraj M P et al. had developed a simple sign language recognition system that has been developed using skin color segmentation and Artificial Neural Network.

Linear classifiers are easy for implementation as they use relatively simple models. It requires preprocessing methods and feature extraction. Singha and Das had got 96% accuracy on 10 classes of image of gesture of one hand using karhunen-Loeve Transforms. These translate and rotate the axes to establish a new coordinate system based on the variance of the data. This transformation is applied after using a skin filter, hand cropping and edge detection on the images. They use a linear classifier to distinguish between hand gestures including thumbs up, index finger pointing left and right, and numbers.

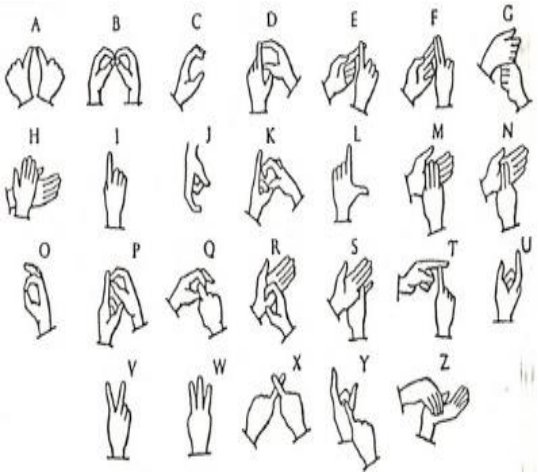
From a computer vision point of view, this problem represents a difficult challenge due to a number of reasons, including:

• Environmental (e.g. background, lighting sensitivity and camera position)

• View of gestures (e.g. some or all fingers, or an entire hand can be out of the field of view)

• Co-articulation (when a sign is affected by the preceding or succeeding sign)

• Sign boundary recognition (when a sign ends and the next begins)

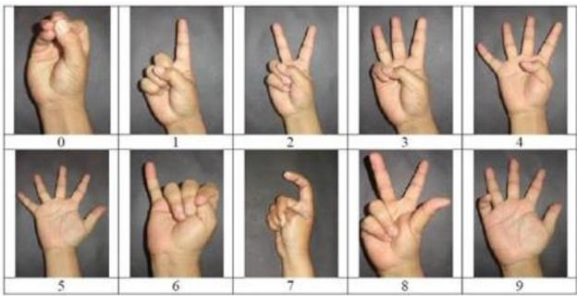


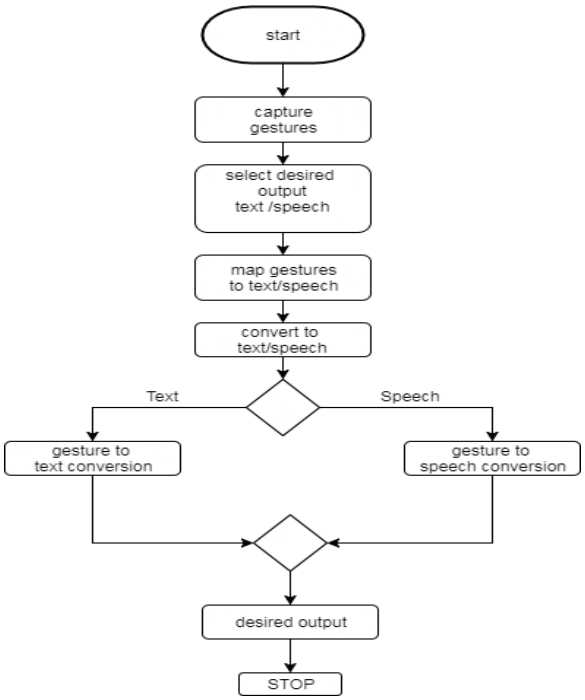
The figure shows the alphabets done in hand signs and just analyzing them more thoroughly shows the issue that the hand gestures that may escape from camera due to hindrances in lighting and camera quality. People use these signs quickly and to detect it more accurately camera frame rates needs to be faster to capture such transitions in sign and associate accurate meaning and also to discriminate between similar looking to signs.

III. METHODOLOGY

Our system first scans the gesture captured through camera. This gestures are then mapped to database consisting of hand gesture and their equivalent meaning. Out of all signs it chooses the best match filtered through neural network algorithms. Now this generated result is displayed as text or speech after the conversion of gesture from image to text/speech. This all happens in real time and through in our research we saw that it takes very less time after training the machine with wide variety of hand gesture dataset. Neural network algorithms are very efficient and accurate with large amount data as it learns more effectively through wide spectrum of data. The flow in which the whole process occurs is shown in flowchart on the next page.

The capture of hand gesture relies on good light to see the hand and camera pixel quality so the system get a high resolution picture and can detect the gesture easily and this way it can exclude the possibility of ambiguity. While recording the hand movements, it's advised to have good light exposure for more accurate results. The fact that mentioned earlier is that the camera should contain whole hand movements otherwise the result will be different. For example, if the camera has not scanned whole hand and one finger is missing then it will display the result where 3 finger is used. Here is an example of number 0 to 9 and their respective gestures.





IV. LITERATURE REVIEW

The Indian sign language recognition system requires tons of hand gesture data and the variety of images are required to make machine learn the different patterns and shapes and skin tone of hands and accurately map the meaning to correct gesture. The factors of camera quality, sufficient lighting, etc. are yet to be taken in account in measuring the accuracy of system in identifying the gestures. The feature extraction and other methods and algorithms are used in analyzing the performance. The other part which deals with either text or speech as an output. The application will be in mobile phones and tablets, so the display screen and speaker quality is also crucial as robot sound may sound unclear if the speaker doesn't have sensitivity to low-pitched voice. In a nutshell, taking all the variables in account, the system produces satisfying results and with small changes it will produce more accurate results. We are also going to add a translator if possible as India have 22 official languages, so the system remains versatile throughout the nation. Currently the system will generate output in English as both text and speech.

V. KEY FEATURES

- Real-time recognition of hand gestures in Indian Sign Language
- Fast conversion of gestures to text or speech as output
- Text to Speech/Speech to Text
- Bridges the communication gap between hearing-impaired/mute people to normal people
- Effective and useful in day-to-day activities for communication and also in workplace

VI. CONCLUSION

We have done thorough research and analysis on Sign Language Recognition technology. The technology is still being researched and experimented. There is limited data-sets for different kinds of sign gestures and the data is still being collected. Although with limited resources, the system has produced quite satisfying results and with introduction to large set of data the system will perform more accurately across many combinations. The application will help hearing-impaired, deaf and mute population in communicating with people who don't know the Indian Sign Language. This will also be helpful for them in workplace and educational institutions.

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