Indian Sign Language Translator

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Abstract— Sign language is a language which is used to communicate with the dumb and deaf people. It is mixture of hand moves, orientation, hand shapes and expression of face. This system will recognize the signs and convert it into text and audio so that it is understood by dumb and deaf people. This system will be so simple that it does not require gloves, coloring finger cap, etc. instead it requires only camera and microphone which is available easily. This system is a Two Way ISL (Indian Sign Language) system.

Keywords: Indian Sign Language Translator, Sign Language Translator

I. INTRODUCTION

Sign language is the only medium through which specially disabled people can connect to rest of the world through different hand gestures. With the advances in machine learning techniques, Hand gesture recognition (HGR) became a very important research topic. K. K. Dutta, Sunny Arokia, et. al. [1] People who are deaf and dumb face various difficulties while using latest technology such as using a computer or printing and editing a document. For such users reading a document can be an extremely difficult task for this people. In this system, through camera images or continuous video image is acquired and is interpreted by the system. Today the improvement of technology can bring a better opportunity of life for this disabled people.

In this process the steps of translation are acquisition of images, is converted into binary form, classification, hand shape edge detection and feature extraction. After extraction pattern matching is done by comparing existing database. The interpreted symbols are then converted into text format and then using Google TTS this text is converted into audio i.e. voice output. Our GUI system will display the text output and also have the voice output.

The reverse process include taking voice input from normal person and converting it into text and then matching with database of sign and symbol and then display those signs in the form of images or continue video images. In this paper we have proposed method of Integrated Two Way Indian Sign Language Translation System. The first translation is sign to speech (i.e. if dumb and deaf people want to communicate to normal people) Image from camera acquired is converted into binary form, noise removed, boundary of finger detected, finding exact text match and finally text with audio is sent to receiver(a normal person who doesn't know Indian sign language).

The second translation is speech to sign (i.e. if normal people want to communicate to dumb and deaf people) the voice input of normal person is taken and is converted to text then appropriate text meant sign will be displayed.

In the recent years technology has rapidly changed. With the arrival of the latest technologies it is becoming possible to fill the communication gap between the hearing impaired and normal people.

Barriers for people who have hearing problems have been eliminated. Through the use of image processing, AI and pattern matching techniques developers have developed a way for communication through hardware and software for the dumb and deaf people with the normal people (who don't know sign language). Sign language is the language that is used by the dumb and deaf as a primary means of communication. Using sign language people could communicate with the dumb and deaf effectively.

Generally there is no difficulty when two hearing impaired people communicate. Most of the deaf and dumb people in the world have been in a difficult situation because of their inability to communicate with normal people easily. In such scenario there is need of sign language and sign language translator i.e. a mediator who can convey the message of dumb and deaf people to normal people and message of normal people to dumb and deaf people. A sign is a movement of one or both hands, accompanied with facial expression, which corresponds to a specific meaning. In our system it is only hand signs that will be detected and corresponding message of that hand sign will be delivered.
Sign language (SL) is the native language for the hearing impaired people. Although they successfully communicate with each other when using sign language, they face many find difficulties when they try to communicate with normal person, especially those who are unfamiliar with sign language. The overall motive of our project is to develop such a technology for recognizing and translating continuous sign language to text and vice versa.

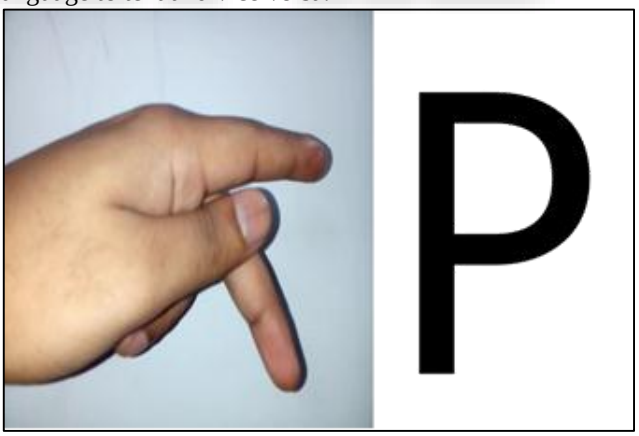


Fig. 1: Indian Sign Language Symbol for P

Firstly, the video shall be captured frame-by-frame, the captured video will be processed and the appropriate image will be extracted, this retrieved image will be further processed using BLOB analysis and will be sent to the statistical database; here the captured image shall compared with the one saved in the database and the matched image will be used to determine the performed alphabet sign in the language. Krishna Modi, Amrita More, et. al. [2] Although facial expressions add important information to the emotional aspect of the sign; but in this project work they are excluded from the area of interest, since its analysis complicates the already difficult problem. Our system aims at listening to

deaf, which means that it could be used as a translator between deaf and people that do not understand sign language

II. METHODOLOGY

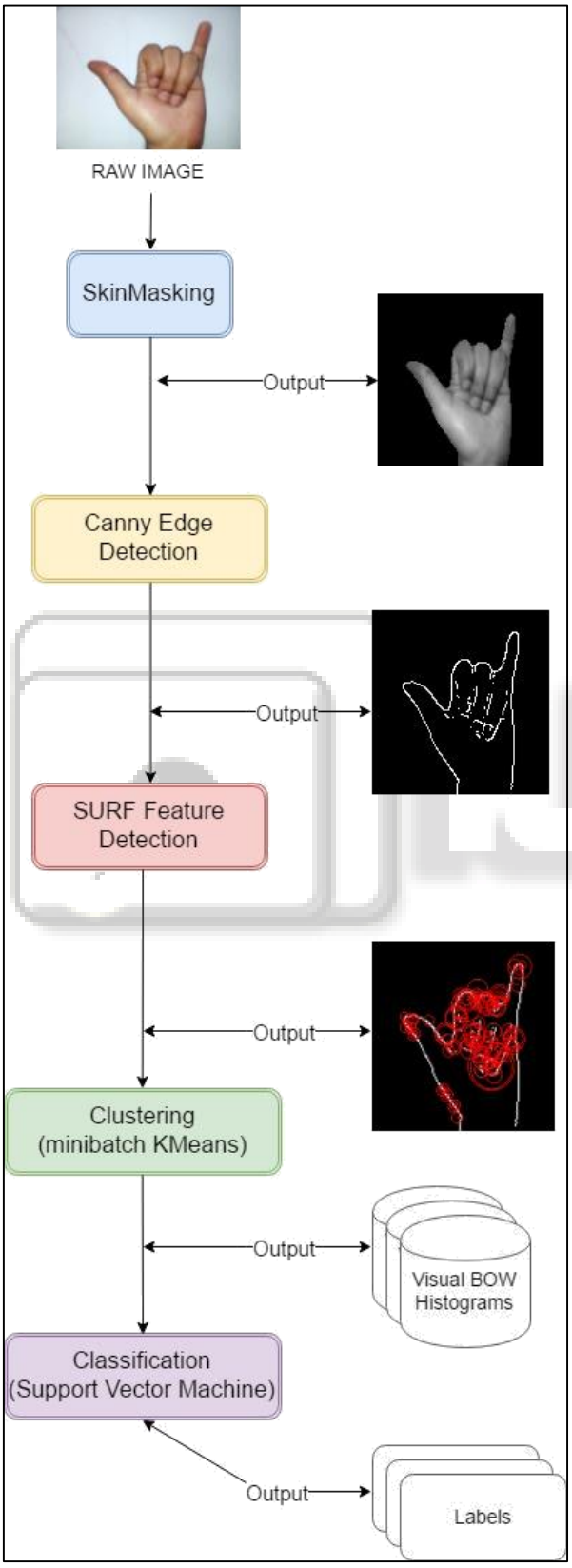


Fig. 2: Working of ISL translator

In this paper we are proposing our Two Way Indian Sign Language translation system. In this system we are giving two modes of translation. First one is if a deaf-dumb person can communicate with normal person (who doesn't know sign language) and the second one is reverse of first one i.e. a normal person speaks, it is converted to text and then appropriate text meant sign will be displayed.

A. Sign to Speech Translation:

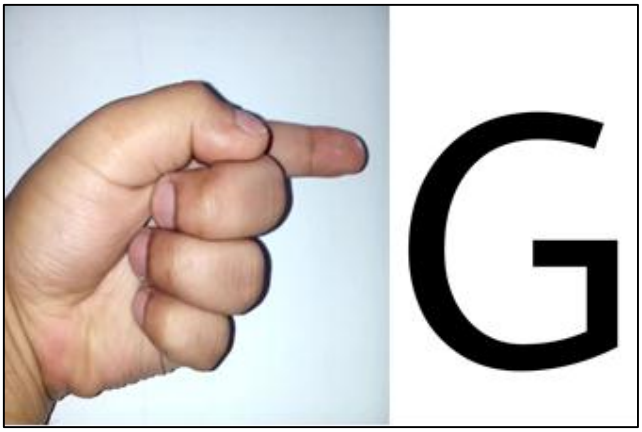


Fig. 3: Indian Sign Language Symbol for G

The dumb can communicate with normal people with less complexity and requirement using our proposed sign to speech translation system. The hand movement or fingers movement of signer will be is taken as an images or continuous images from the input device (Cell phone camera, web cam, etc.). The captured image will be then sent for pre-processing. It is compared with existing sign symbol database for finding the meaning of the sign. After finding the meaning it is converted to text. The recognized signs meaning translated as text or word will then be generated.

The methodology which is regarding how the dumb and deaf people will communicate with normal person starts as our system will let the dumb or deaf person perform the hand gesture then our system will take this gesture i.e. hand sign as an image and apply segmentation on it in this process it will remove the background noise leaving only the region of interest which is the information most needed this will be achieved by Skin Masking defining the threshold on RGB schema then converts RGB to grey scale image and then canny edge detection technique is applied to identify and detect the sharp discontinuity in image, hereby detecting the edge of image.

After this the Speeded up Robust feature is used to extract the descriptors from the image after the segmentation process. From each image we extract number of descriptor of same dimension and this descriptor are quantized into 150 clusters using K-means clustering. For given set of descriptor K-means clustering categorizes numbers of descriptor into k numbers of cluster center and from this cluster using various classifiers such as Naive Bayes, Support Vector Machines, K-Nearest Neighbours we predict corresponding alphabet for that hand sign. This how the hand sign will be recognised and corresponding alphabet will be displayed. This whole process is further classified into various steps as follows:-

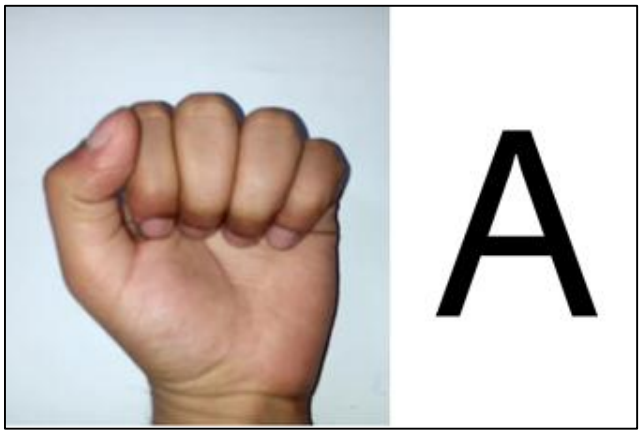


Fig. 4: Indian Sign Language symbol for A

1) Preprocessing

Hand gesture or Sign will be taken as an image from (mobile phone camera or web cam). Frame rate is 20 frames per second are enough. We are taking still images of signed hand. To differentiate between signs we are maintaining a time gap. For example 3 seconds for signing and gap between sign is 3 seconds. If there is no sign after 3 second we conclude that signing is completed. Captured sign image will be sent to for converting into binary form that is conversion of image in black and white pixels. It is easy to identify the edges in black and white tone. Next is removing the noise from binary from of image.

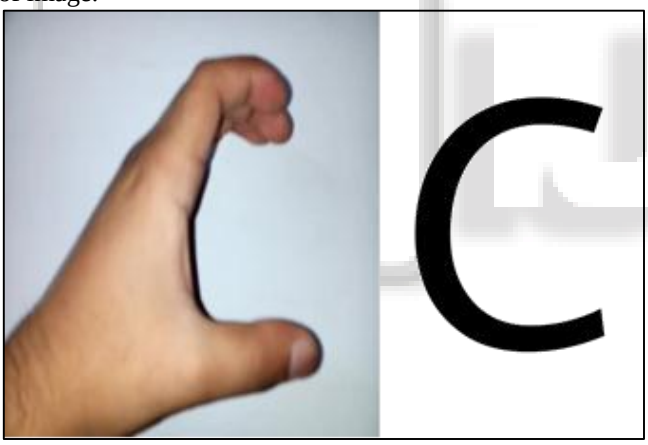


Fig. 5: Indian Sign Language Symbol for C

2) Classification

Each frame here is having time gap of 3 seconds. Suppose the signer is not followed the time frame definitely signs are not clear. Sometime misinterpretation may happen. At the classification phase, we use HMMs (Hidden Markov Model) to model each sign and classify with maximum likelihood criterion. Hidden Markov Model (HMM) is a statistical Markov model in which the system being modeled is assumed to be a Markov process with unobservable (i.e. hidden) states.

The hidden Markov model can be represented as the simplest dynamic Bayesian network. The mathematics behind the HMM were developed by L. E. Baum and coworkers. HMMs are used in many research areas, like speech recognition and bioinformatics, for modeling variable-length sequences and dealing with temporal variability within similar sequences. The system trains the HMM models for HMM manual.

Then, it extracts the cluster information through the joint confusion matrix of HMM. Summing the validation sets confusion matrices in a cross-validation stage forms this joint confusion matrix. The system then investigates the miscalculations using the joint confusion matrix. If the system correctly classifies all samples of a sign class, the sign class cluster only contains itself. Otherwise, for each miscalculation, the system marks that sign as potentially belong to the cluster.

3) Feature Extraction

After getting vectors feature extraction state then pattern matching done by comparing existing database. The interpreted symbols (meaning – words) can be translated into text information (Words in English). M.Suresh Anand, A.Kumaresan, et. al. [3] Feature extraction phase is to identify the meaning of the signed letters and accordingly to understand the signed word. In this stage the system detects the frame edges using image processing filters, and then giving a new frame containing only the edges pixels to make use of it in the following stage of the feature extraction phase that is feature vector creation stage.

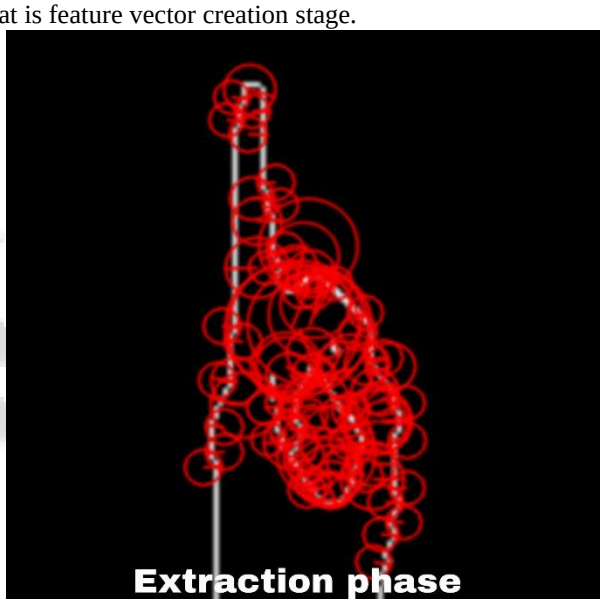
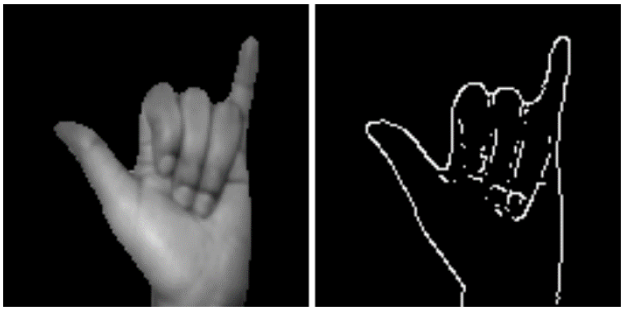


Fig. 6: Extraction Phase

There are many methods for edge detection. Canny edge detection method is best method to do edge detection. The Canny edge detector is an edge detection operator that uses a multi-stage algorithm to detect a wide range of edges in images. It was developed by John F. Canny in 1986. Canny also produced a computational theory of edge detection explaining why the technique works. Feature vectors are generated by machine learning algorithms.



Raw image canny edge detection

Fig. 7:

4) Pattern Matching

During the training phase, the patterns are matched with database and the corresponding pattern is selected for display. If there are more than one matching results for a single pattern then the one which matches the most or the first result in the matches will be selected.

III. CONCLUSION

Our paper proposes a two way sign language translation system which will help to communicate between common people and deaf and dumb people just by using software or a mobile app. It will help common people in India to communicate with deaf and dumb people just by using this app or software without the use of human translators.

ACKNOWLEDGMENT

We thank Tanzeem Syed (Project Guide) and Harshal Patil (H.O.D) IT Department, Theem College of Engineering for giving us a chance to make an IEEE paper allowing us to showcase our talents.

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