

Comparative Study of Sign Language Recognition Systems

Ms. Rashmi D. Kyatanavar, Prof. P. R. Futane

Department of Computer Engineering, Sinhgad College of Engineering,
Pune, India

Abstract- Sign Language (SL) is the communication method for deaf people. But these sign languages are not standard & universal. The grammar differs from country to country. As the sign language is the only method for deaf community to communicate with normal people, we need Sign Language Translators (SLT).

The basic automatic SLT uses two approaches. First one is using the electronic data gloves. These gloves have inbuilt sensors & it is worn by the signer to detect hand posture. But these gloves are having high cost. So, visual approach is most suitable & widely used. Here a camera is used to capture images of signer & then image processing is carried out to perform recognition. For the vision based Sign Language Recognition (SLR), various methods are available. Three such methods are discussed & compared in this paper.

Index Terms- Sign Language Recognition (SLR)

I. INTRODUCTION

Deaf people interfacing is a very challenging issue due to its cardinal social interest and its inherent complexity like,

- (1) Nature of information is multi-channel.
- (2) Signing vary from person to person.
- (3) Presence of disturbances (surrounding furniture, cloths)
- (4) Sign languages from different region differ significantly.

There are two main directions in sign language recognition. One is using data gloves & other is visual approach. Instrumented glove approach simplifies the recognition but complicates the hardware. Also it is expensive & less user friendly. On the other hand, vision-based approach is most suitable, user-friendly & affordable. So, it is widely used.

II. VISION BASED METHODS FOR SIGN LANGUAGE RECOGNITION

A. SLR Based on Skin Color [2]

This is an intelligent & simple system for converting sign language into voice signal by tracking head & hand gestures. This system proposes a simple gesture extraction algorithm for extracting features from the images of a video stream.

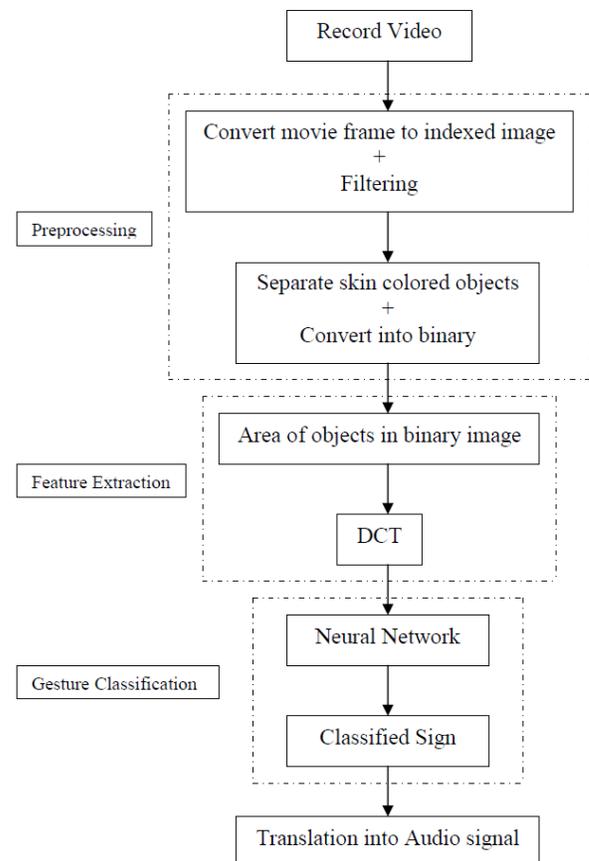


Figure 1: System block diagram for SLR using skin color [2]

This system is very simple & subject is not required to wear any glove. But the subject must wear a dark color, long sleeve shirt. Then the gesture signs are recorded. Each image frame is segmented into three regions- head, left hand and right hand. Then these segmented images are converted into binary images. In feature extraction stage, for each frame the area of objects in segmented binary image is calculated. So, each frame has 3 segmented areas- head area, left hand area and right hand area. There is a different segmented area for each gesture type. Each segmented area is treated as a discrete event & DCT is applied to it. First 15 DCT coefficients are considered as features. They correspond to each segmented area. Combination of DCT coefficients from 3 segmented image areas are used as feature vector for Neural Network (NN). Here, a simple NN model is developed for sign recognition. The features computed from video stream are given as an input to this NN. To classify the

gesture, a NN model uses error back propagation. So we get the classified signs at the end of gesture classification phase. Finally, an audio system is used to play words corresponding to gesture.

B. SLR Using Custom Made Color Gloves [1]

This is an automatic vision based SLT system. It uses custom made color gloves. These are ordinary gloves with specific color on palm & each fingertip. Initially, image acquisition is done using a camera & custom made color gloves. Then the frames of images are collected. Then, motion of hand is tracked using color segmentation & image processing. Finally, Artificial Neural Network (ANN) is used to classify gestures & to translate them.

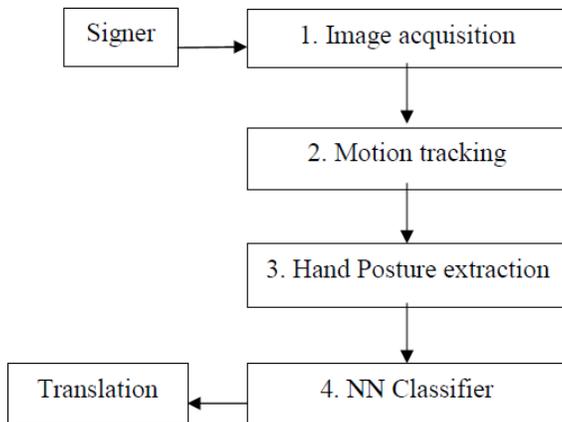


Figure 2: Vision-based automatic SLT using custom made color gloves [1]

In image acquisition stage, camera is used to obtain images & video of signer. Signer uses color coded gloves. The color helps in extraction of data from sign images through color segmentation. In image acquisition, we collect frames of images at suitable interval so that frames are sufficient to detect the movement of hand. In motion tracking phase, color segmentation is performed to remove influence of moving objects in background. Then, centroid of color segmented region is found. Motion tracking phase consists of two steps:

- A. Hand posture extraction
- B. Tracking of hand movement

In Hand Posture Extraction, location of each finger is determined & finally, NN classifier is used. Here we use two layered feed forward NN.

C. SLR Using Finger Detection [3]

This method introduces an efficient & fast algorithm for identifying the number of fingers opened in gesture. Here the finger detection is performed using the concept of boundary tracing & finger tip detection. This system does not have limitations like hand should be perfectly aligned to camera, use of special markers, use of input gloves on the hand etc. According to this method, it is possible to identify the gesture of an alphabet if we know the number of fingers opened. The aim of this method is to design a system that should automatically

capture, recognize & translate sign language to the speech for blind people. Also it should analyze & convert the speech to either sign or textual display on screen for deaf people.

This method has three main steps of processing – edge detection, clipping and boundary tracing.

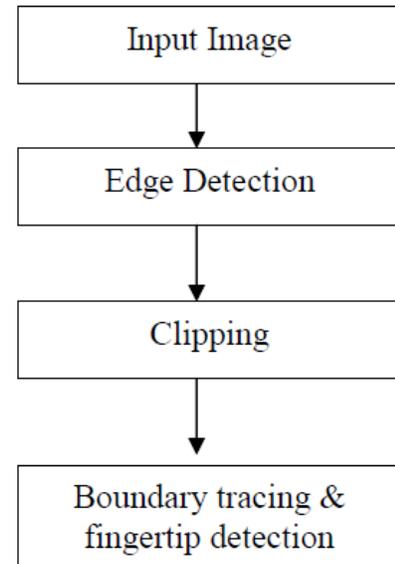


Figure 3: SLT using Finger Detection [3]

The first phase of this method is edge detection. It is the process of identifying points in the digital image at which image brightness changes sharply or has discontinuities. For this phase Canny edge operator is used. The output of this step is an edge detected image. The next phase is clipping. It clips or removes the undesirable portion of edge detected image for further processing. The final step is boundary tracing. It is the phase which actually detects the finger tips n the number of fingers open.

III. COMPARISON OF RESULTS

A. SLR Based on Skin Color [2]

This gesture recognition method based on skin color is an intelligent & simple system for converting sign language into voice signal using head & hand gesture. This system is very simple & subject is not required to wear any glove. But the subject must wear a dark color, long sleeve shirt. This system has minimum and maximum classification rates as 88.47 and 95.69 respectively.

B. SLR Using Custom Made Color Gloves [1]

This method is an automatic visual based sign language translator system. This automatic visual-based sign language translator can achieve the recognition rate of over 90%.

C. SLR Using Finger Detection [3]

The finger detection algorithm designed for sign language recognition is a simple, fast, efficient and robust method to locate

finger tips and enables us to identify a class of hand gestures. This system does not have limitations like hand should be perfectly aligned to camera, use of special markers and use of input gloves on the hand etc. Finger recognition works accurately for 95% of the cases.

IV. CONCLUSION

There are various methods for sign language recognition. Some use electronic glove while other use vision based approach. But, as the electronic glove approach is the costlier one, vision based approach is widely used. Three such methods are discussed and compared. The skin color based method is simple & does not require the signer to wear any glove. The accuracy of this method is also good. The custom made color glove method requires the color segmentation to be performed. But the accuracy is less. The SLR using finger detection is simple, fast and efficient. But it can detect only those gestures that have fingers open. Also, two different gestures having same number of fingers open will be recognized ambiguously. Each of these three methods has its own pros and cons. So, depending on the type of application, appropriate method should be chosen.

ACKNOWLEDGMENT

The research in this paper was carried out at Sinhgad College of Engineering, Pune. So, special thanks to Head of Computer Department, Principal and Management of Sinhgad College of Engineering.

REFERENCES

- [1] Rini Akmeliawati, Melanie Po-Leen Ooi and Ye Chow Kuang, "Real-Time Malaysian Sign Language Translation using Colour Segmentation and Neural Network", IMTC 2007 - Instrumentation and Measurement Technology Conference Warsaw, Poland, 1-3, May 2007.
- [2] Paulraj M P, Sazali Yaacob, Hazry Desa, Hema C.R., "Extraction of Head & Hand Gesture Feature for Recognition of sign language", International Conference on Electronic Design, Penang, Malaysia, December 1-3, 2008.
- [3] Ravikiran J, Kavi Mahesh, Suhas Mahishi, Dheeraj R, Sudheender S, Nitin V Pujari, "Finger Detection for Sign Language Recognition", Proceedings of the International MultiConference of Engineers and Computer Scientists 2009 Vol I IMECS 2009, Hong Kong, March 18 - 20, 2009.
- [4] Wu jiangqin Gao wen Song yibo Liu wei Pang bo, "A Simple Sign Language Recognition System Based On Data Glove", Proceedings of IXP, 1998.
- [5] Tan Tian Swee, Sh-Hussain Salleh, A.K. Ariff, Chee-Ming Ting, Siew Kean Seng and Leong Seng Huat, "Malay Sign Language Gesture Recognition System", International Conference on Intelligent and Advanced Systems, 2007.
- [6] Pham The Bao, Nguyen Thanh Binh, Tu Duy Khoa, "A New Approach To Hand Tracking And Gesture Recognition By A New Feature Type And Hmm", Sixth International Conference on Fuzzy Systems and Knowledge Discovery, 2009.

AUTHORS

First Author – Ms. Rashmi Kyatanavar, ME Computer Networks, Sinhgad College of Engineering, Pune, r.d.kyatanavar@gmail.com

Second Author – Prof. P. R. Futane, Head o Computer Department, Sinhgad College of Engineering, Pune, prfutane.scoe@sihngad.edu