

# Sign Language Recognition for Deaf and Dumb People

Y.M.Pathan<sup>1</sup>, S.R.Waghmare<sup>2</sup>, P.K.Patil<sup>3</sup>

<sup>1</sup> Bharti vidyapeeth college of engineering for women,pune

[yasmeenpathan@gmail.com](mailto:yasmeenpathan@gmail.com)

<sup>2</sup> Bharati vidyapeeth college of engineering for women,pune

[shtlwaghmare94.sw@gmail.com](mailto:shtlwaghmare94.sw@gmail.com)

<sup>3</sup> Bharati vidyapeeth college of engineering for women,pune

[pkspatil12@gmail.com](mailto:pkspatil12@gmail.com)

**Abstract-** Gestures are basically the physical action form performed by a person to convey some meaningful information. Gestures are a powerful means of communication among humans. The Sign language is very important for people who have hearing and speaking deficiency generally called Deaf and Mute. It is the only mode of communication for such people to convey their messages and it becomes very important for people to understand their language.

The aim of our project is to implement a system that will help deaf and dumb people to communicate with others. It recognises the hand gestures with highest accuracy and in least possible time and translates them into corresponding voice so that the people who don't know the sign language, can understand the meaning. It is implemented in MATLAB and uses Eigen Value Weighted Euclidean Distance Based Classification Technique. The output is the sound corresponding to the recognised sign.

**Keywords:** Sign Language, Feature Extraction, Sign Recognition, PCA.

## 1.INTRODUCTION

Sign language is a communication skill that uses gestures instead of sound to convey meaning – simultaneously by the orientation and movement of the hands, arms or body, and facial expressions along with combining hand shapes to express fluidly a speaker's thoughts. Sign languages are commonly developed in deaf communities and often used by their interpreters, friends and family as well as people who have difficulty hearing themselves.

The hearing impaired people become neglected from the society because the normal people never try to learn ISL nor try to interact with the hearing impaired people. This becomes a curse for them and so they mostly remain uneducated and isolated. Sign language is a language which is used for communication between the normal people and disabled people. Sign language relies on sign patterns, i.e., body language, orientation and movements of the arm to facilitate understanding between people. In all around the world about 9.1 billion people are deaf and dumb. In their day to day life they faced lot more problems on their communication This project is used to reduce the communication gap between the normal people and disabled people. The proposed system is able to recognize single handed gestures accurately with a single normal webcam using bare human hands and convert it into text and voice message. The aim of this project is to recognize the gestures with highest accuracy and in least possible time and translate the alphabets of Sign Language into corresponding voice in a vision based setup. Standard sign

languages (SL) are known as Deaf and Dumb languages SLs are gestural languages which contain symbolic encoded message for communication without speech channel. They are unique in

some ways in that they cannot be written like spoken language. Sign language varies from country to country with its own vocabulary and grammar. Even within one country, sign language can vary from region to region like spoken languages. Gestures are powerful means of communication among humans. Among different modality of body, hand gesture is the most simple and natural way of communication mode.

It is implemented in MATLAB and uses Eigen Value Weighted Euclidean Distance Based Classification Technique. The output is the sound corresponding to the recognized sign. Here vision based approach has been used. This method design and implementation of real time Sign Language Recognition system to recognize gestures by using matlab. The signs are captured by using web cam. This sign is preprocessed for feature extraction using HSV color model. The obtained features are compared by using Principle Component Analysis algorithm. After comparing features of captured sign with testing database minimum Euclidean distance is calculated for sign recognition. Finally, recognized gesture is converted into voice format.

## 2.PROPOSED SYSTEM

The block diagram of the proposed system is given in Fig. 1 which comprises of mainly four phases: Skin filtering, Hand cropping, Feature Extraction and Classification. In our proposed system, we have considered 5 alphabets of Indian sign language, each with 10 samples thus a total of 50 images captured by camera.

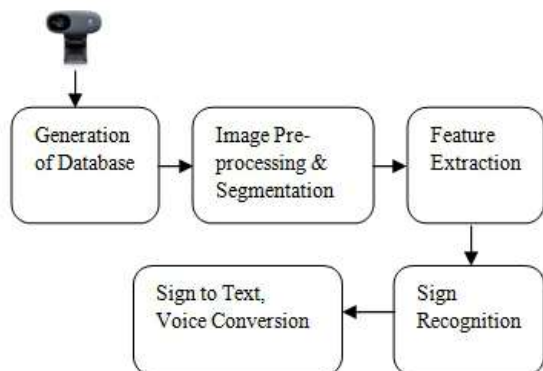


Figure.1 Block Diagram of Proposed System

### 2.1. SKIN FILTERING

The first phase for our proposed system is the skin filtering of the input image which extracts out the skin colored pixels from the non-skin colored pixels. This method is very much useful for detection of hand, face etc. The steps carried out for performing skin filtering.

The input RGB image is first converted to the HSV image. The motive of performing this step is RGB image is very sensitive to change in illumination condition. The HSV color space separates three components: Hue which means the set of pure colors within a color space, Saturation describing the grade of purity of a color image and Value giving relative lightness or darkness of a color. Then the HSV image is filtered and smoothed and finally we get an image which comprises of only skin colored pixels. Now, along with the hand other objects in the surroundings may also have skin-color like shadows, wood, dress etc. Thus to eliminate these, we take the biggest binary linked object (BLOB) which considers only the region comprising of biggest linked skin-colored pixels. Results obtained after performing skin filtering

### 2.2 HAND CROPPING

Next phase is the cropping of hand. For recognition of different gestures, only hand portion till wrist is required, thus the unnecessary part is clipped off using this hand cropping technique. Significance of using this hand cropping is we can detect the wrist and hence eliminate the undesired region. And once the wrist is found the fingers can easily be located as it will lie in the opposite region of wrist. skin filtered image is scanned from all direction left, right, top, bottom to detect the wrist of the hand. Once the wrist is detected its position can be easily found out. Then the minimum and maximum positions of the white pixels in the image are found out in all other directions. Thus we obtain Xmin, Ymin, Xmax, Ymax, one of which is the wrist position.

### 2.3. FEATURE EXTRACTION

After the desired portion of the image is being cropped, feature extraction phase is carried out. Here, Eigen values and Eigen vectors are found out from the cropped image. In our project, only five significant Eigen vectors out of 50 has been considered because the Eigen values were very small after this and so can be neglected. This provides advantages

like data compression, data dimension reduction without much loss of information, reducing the original variables into a lower number of orthogonal or non-correlated synthesized variables.

### 2.4 SIGN RECOGNITION

Sign reorganization using PCA is a dimensionality reduction technique based on extracting the desired number of principal components of the multidimensional data. The gesture recognition using PCA algorithm that involves two phases

- Training Phase
- Recognition Phase

During the training phase, each gesture is represented as a column vector. These gesture vectors are then normalized with respect to average gesture. Next, the algorithm finds the eigenvectors of the covariance matrix of normalized gestures by using a speed up technique that reduces the number of multiplications to be performed. Lastly, this eigenvector matrix then multiplied by each of the gesture vectors to obtain their corresponding gesture space projections. In the recognition phase, a subject gesture is normalized with respect to the average gesture and then projected onto gesture space using the eigenvector matrix. Finally, Euclidean distance is computed between this projection and all known projections. The minimum value of these comparisons is selected for recognition during the training phase. Recognized sign is converted into appropriate voice which is displayed on GUI.

### 3.CLASSIFIER

Classification based on Euclidean Distance: Euclidean distance was found out between the Eigen vectors of the test image and the corresponding Eigen vectors of the database image. As five Eigen vectors were considered, we get five Euclidean distances for each database image and then the minimum of each was found out. Mathematically,

$$sE.D =$$

$$\sqrt{\sum_{n=1}^m (EN1(n) - EV2(n))^2}$$

where EV1 represents the Eigen vectors of the test image and EV2 represents the Eigen vectors of the database image. Classification based on Eigen value weighted Euclidean distance: The difference of Eigen values of the test image and the Eigen values of the database image was found out. Then, it was multiplied with the Euclidean Distance obtained in the first level of classification given as C2 in equation below. Then sum of results obtained for each image were added and minimum of them was considered to be the recognized symbol. Mathematically,

$$C2 = (E.D) * [E1 - E2]$$

where E1 and E2 are the Eigen values of the test images and database images respectively.

### 4. PRINCIPLE COMPONENT ANALYSIS(PCA)

PCA is a useful statistical technique that has found application in fields such as image recognition and image compression, and is a common technique for finding patterns in data of high dimension. It covers standard deviation, covariance, eigen vectors and eigen values.

Eigen values and Eigen vectors are a part of linear transformations. Eigen vectors are the directions along which the linear transformation acts by stretching, compressing or flipping and Eigen values gives the factor by which the compression or stretching occurs. In case of analysis of data,

the Eigen vectors of the covariance are being found out. Eigenvectors are set of basis function which describes variability of data. And Eigen vectors are also a kind of coordinate system for which the covariance matrix becomes diagonal for which the new coordinate system is uncorrelated. The more the Eigen vectors the better the information obtained from the linear transformation. Eigen values measures the variance of data of new coordinate system. If  $x$  is a one column vector with  $n$  rows and  $A$  is a square matrix with  $n$  rows and columns, then the matrix product  $Ax$  will result in vector  $y$ . When these two vectors are parallel,  $Ax = \lambda x$ , ( $\lambda$  being any real number) then  $x$  is an eigenvector of  $A$  and the scaling factor  $\lambda$  is the respective eigen value.

## 5. RESULTS

The proposed procedure was implemented and tested with set of images. A fig.2 show the set of 5 images of different person is used for training database which are captured by web cam in white background. The preprocessing results of the same are shows in Fig.3.



L C Y W V

Fig2 .sample 26 sign alphabets



L C Y W V

Fig3. preprocessing result

These preprocessed gesture taken as input for feature extraction. Minimum Euclidean distance is calculated between test and train image and gesture is recognized. Recognized gesture is converted into voice format and also respective features will be display on GUI screen. Fig.3 shows a snapshot of application working and detecting hand gestures for Sign C.



Figure.4 Snapshots of application performing real-time sign detection.

## 6. CONCLUSION

A MATLAB based application performing hand gesture recognition for human– computer interaction using PCA technique was successfully implemented with accuracy comparable with those of recent contributions. The proposed method gives output in voice form that helps to eliminate the communication barrier between deaf-dumb and normal people. In future this work will be extended to all the phonemes in Marathi signs.

## ACKNOWLEDGMENT

We offer our sincere and heartily thank, with deep sense of gratitude to our guide prof. S.A.Dhole for their valuable guidance, direction and inspiration to our project work without taking care of their voluminous work.

We are thankful to the all teacher for taking personal interest in giving us constant encouragement and timely suggestion and notable guidance and for their help in clarifying some aspects of the reported results.

## REFERENCES

- [1] Joyeeta Singha, Karen Das " Indian Sign Language Recognition Using Eigen Value Weighted Euclidean Distance Based Classification Technique " (IJACSA) International Journal of Advanced Computer Science and Applications, Vol. 4, No. 2, 2013
- [2] Shreyashi Narayan Sawant " Sign Language Recognition System to aid Deaf-dumb People Using PCA" International Journal of Computer Science & Engineering Technology (IJCSSET)
- [3] Archana S. Ghotkar, Dr. Gajanan K. Kharate "Study OF Vision Based Hand Gesture Recognition Using Indian Sign Language" International Journal on Smart Sensing and Intelligent systems vol. 7, no. 1, March2014.
- [4]Noor Adnan Ibraheem and Rafiqul Zaman Khan,"Survey on Various Gesture Recognition Technologies and Techniques"International Journal of Computer Applications (0975 – 8887) Volume 50 – No.7, July 2012
- [5] Mahmoud Zaki Abdo<sup>1</sup>, Alaa Mahmoud Hamdy<sup>2</sup>, Sameh Abd El-Rahman Salem<sup>3</sup>, El-Sayed Mostafa Saad<sup>4</sup>" An Interpolation Based Technique for Sign Language Recognition" April 16-18, 2013, National Telecommunication Institute, Egypt.
- [6]Nasser H. Dardas and Emil M. Petriu" Hand Gesture Detection and Recognition Using Principal Component Analysis" international conference on computational intelligence for measurement system and application (CIMSA), pp:1-6, IEEE,2011 .