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# AMERICAN SIGN LANGUAGE INTERPRETER SYSTEM

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## ABSTRACT

***The proposed scheme recognizes and interprets American sign language symbols. ASL hand gestures help the hearing and speech impaired people to communicate using computers. It starts with a database with static hand gestures. The proposed system recognizes and translates static hand gesture of alphabets in ASL into textual output. This text can further be converted into speech. The user of the system is free from data acquisition devices. The concepts of Principal Component Analysis (PCA) are used on the static gesture images of the ASL alphabet. The PCA features extracted from the image are used to classify the image into one of the ASL alphabet. The PCA features are then applied to SVM classifier for gesture recognition. The recognition of ASL gestures results in a textual output. Thus, the scheme helps the hearing and speech impaired to talk using computers. The method is image based and simple.***

**Keywords**—***American sign language, Principal component analysis, Support vector machine.***

## I INTRODUCTION

We depend on verbal communication and body language for our daily life communication. The speech and hearing-impaired people can only on gestures to communicate. Gestures are defined as the motion of the body that is intended to communicate with other agents. For a successful communication sender and the receiver must have the same set of information for a particular gesture. As per the context of this project, gesture is defined as an expressive movement of hands which has a particular message, to be communicated precisely between a sender and a receiver. Hand gestures can be classified in two categories: static and dynamic. A static hand gesture is a particular hand configuration and pose, represented by a single image. A dynamic hand gesture is a moving gesture, which is represented by a sequence of images This project focuses on the recognition of static images.

American Sign Language (ASL) is a natural language which is a predominant sign language of speech and hearing-impaired people in the United States and most of Canada. Besides America, dialects of ASL are used in many countries around the world, including much of West Africa and parts of Southeast Asia.

That is why, a fast and accurate system is required to make this human computer interaction (HCI) more convenient to the deaf and dumb people.

There are two fundamental techniques to gather the data identified with motion acknowledgment. First is the gadget-based estimation which does it with the help of information gloves and sensors. While the second way is the vision-based procedure, which covers the hand signer.

Following is a list of papers which were referred for this project. The research till now has been limited to small systems which are able to recognize minimal number of gestures.

Soumya and Muzameel developed [1] a gesture recognition system to identify and classify the images of Bharatnatya mudras using the shape parameters like area, centroid, eccentricity, major axis length etc. and artificial neural network (ANN). Sruthi and Thamizharasi proposed [2] an American sign language interpreter using the concepts of principal component analysis (PCA) and K nearest neighbor classifier. Tin Hninn Maung developed [3] a real time hand tracking and gesture recognition system using orientation histograms (HOG) and a perceptron network. Ahsan, Ibrahimy and Khalifa proposed [4] a hand motion detection system by utilizing the electromyography (EMG) signals and a back-propagating network with Levenberg-Marquardt algorithm. Wang, Syu, Li and Yang [5] employed symmetric mask based discrete wavelength transform to reduce the computational time by 66%. Ankita Saxena, Deepak Jain and Ananya Singhal developed [6] hand gesture recognition system for an android device using sobel algorithm and back propagation neural network. Rahat Yasir and Riasat Azim Khan [7] proposed a two-handed hand gesture recognition system for Bangla sign language using linear discriminant analysis (LDA) and artificial neural network. Khan Mohammed and Razib Chandra Deb [8] utilized hidden markov model to recognize gestures. Some other researchers used techniques like edge detection, cross correlation and even fusion of neural network with different architectures of fuzzy technique.

The process has four stages, namely, image acquisition, image pre-processing, feature extraction and classification.

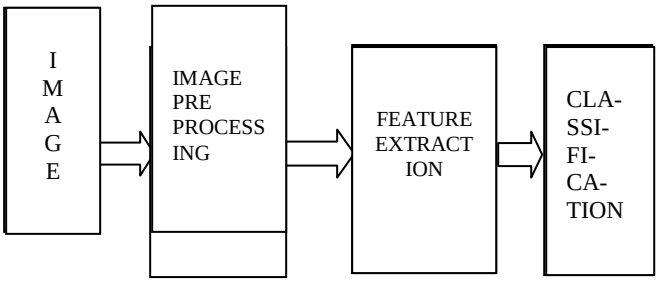


**Figure 1: Block Diagram**

The block diagram of the system is shown in the above figure 1. Here, we don't need any image acquisition device as a database named 'hand gesture recognition (HGR)'is used. The database contains 899 original RGB images (jpg files) of 25 ASL gestures by 12 individuals. The image dimensions vary from 174x131 up to 640x480.The images are taken in uncontrolled lighting conditions and have uncontrolled background. The

images from this database are the input to the pre-processing stage. A number of pre-processing steps are carried out in the second stage. In the third stage, principal component analysis (PCA) is used to extract features from the pre-processed image. In the final stage, the PCA features are subjected to a Support vector machine (SVM) classifier.

MATLAB software is used for the development of this project. The reason behind selects MATLAB is its toolboxes. Toolboxes are comprehensive collections of M files that extend the MATLAB environment to solve particular classes of problems. It includes image processing, neural networks and classification learner toolboxes.

This paper is organized into six sections. Section II, III and IV elaborates on pre-processing, feature extraction and classification techniques respectively. While section V and VI discusses the results and the conclusion. Future work is specified in section VII.

## II IMAGE PRE-PROCESSING

The images of gestures in the HGR database are input to this hand gesture recognition system. While processing these images, every image is converted into matrix form. This matrix of a RGB image is a matrix of very high order having elements of different values. Working with such high values is very difficult, time consuming and will increase the computational time. Hence, the input RGB image is resized to 150x150 and then converted into a grayscale image. Resizing is done because image dimension of the input images varies from 174x131 up to 640x480.The matrix of a grayscaled image has values from 0 to 255 only which makes it easy to work with. These images are then subjected to thresholding to separate the region of interest (hand) from the surroundings. Here, global thresholding is used for this purpose. As the name suggests, the intensity level (threshold) is global to the image, i.e. same threshold value is used to distinguish between the ROI and the background noise. This thresholded image is the input to the feature extraction stage.

## III FEATURE EXTRACTION

This section describes the feature extraction procedure implemented in this project. Here, PCA features are extracted from the ROI (probable skin region) of the pre-processed image. Principal component analysis (PCA) is a popular and widely used technique for feature extraction. It also comes with an additional advantage of dimensionality reduction. In this process, a n-dimensional data can be represented in a lower dimensional space. This reduces the degrees of freedom along with space and time complexities. This in turn reduces computational time. The procedure followed here is rather simple and easy. The mean vector μ and nxn dimensional covariance matrix are computed from the full preprocessed database. The formula for covariance matrix is given below.

Covariance matrix (A)= $\frac{1}{n}\sum (X-\mu)(X-\mu)^T$

Where X is a feature vector and μ is a mean vector.

After this, eigen values (e1, e2…) and corresponding eigen vectors (λ1, λ2…) are computed using the covariance matrix. Then, they are sorted based on decreasing eigen value. The eigen vector corresponding to the largest eigen value is called the first principal component, that with second largest eigen value is called second principal component and so on. These principal components are then used for classification of the gestures. PCA is one of the simplest true eigen vector based multivariate feature extraction techniques. This technique can be thought of as revealing the internal structure of the data which best explains the variance in the data. PCA technique gives a lower dimensional picture and a projection of the object with only the most important part of the information. This is done by considering only the first few principal components of the image. Hence the dimensionality of the data is reduced.

## IV CLASSIFICATION

The classification of the ASL hand gestures is done by implementing the support vector machine (SVM) classifier. The PCA features extracted from the previous stage are used to classify the hand gestures. The PCA features are the input to the SVM classifier. The SVM classier effectively and efficiently classifies the hand gestures based on the PCA features. SVM is a supervised learning algorithm wherein each data item is plotted in a nxn dimensional space (n is the number of features). Here the value of each feature is the value of that particular coordinate. Then, it determines a hyperplane which helps in segregation of the data items into different classes. The best choice will be the hyperplane that leaves the maximum margin from the classes involved. The margin is determined by its distance from the support vectors. SVM works the best when there is a clear margin of separation between the classes and is also very effective in high dimensional spaces. The SVM classifier is used in a number of applications like face detection, handwriting recognition, bioinformatics etc. Its algorithm makes SVM an opt choice for this hand gesture recognition project having 26 different classes.

## V. EXPERIMENTAL RESULTS

This section discusses the various results of the different processes involved in this hand gesture detection project. Out of 899 images from the database, there are 35 images of a particular gesture with different orientation. The results are obtained by testing the implemented system with the images of ASL hand gestures in the database.

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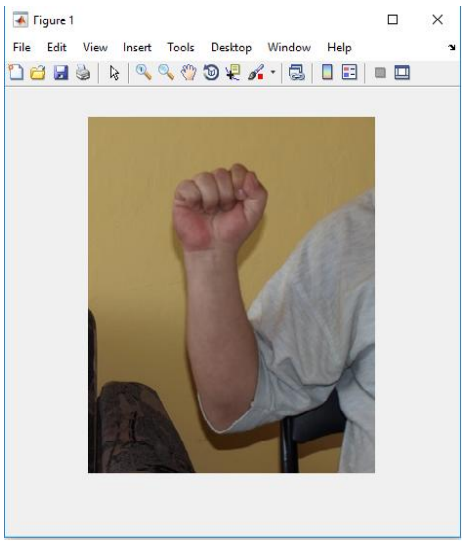


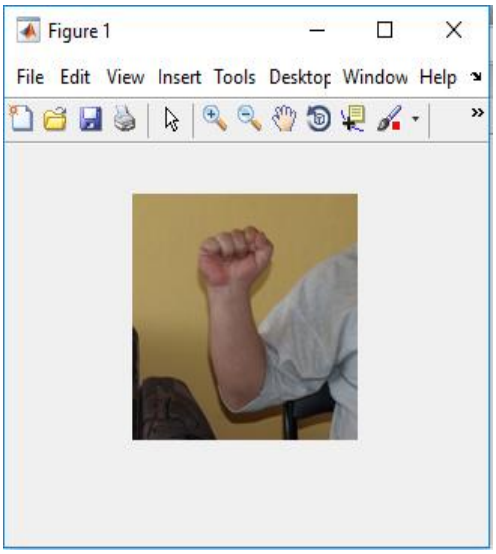
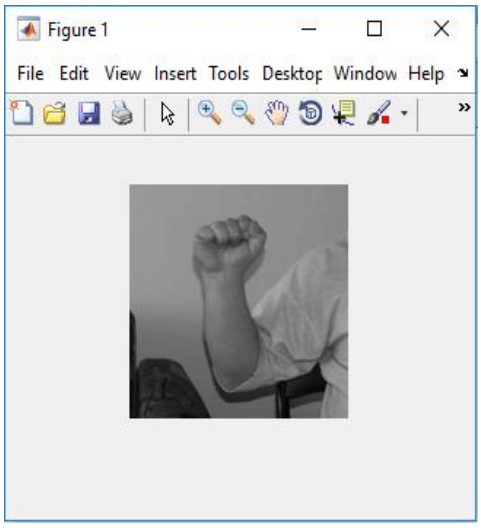




**Figure 2: Original RGB image from database Figure 3: Resized RGB image**



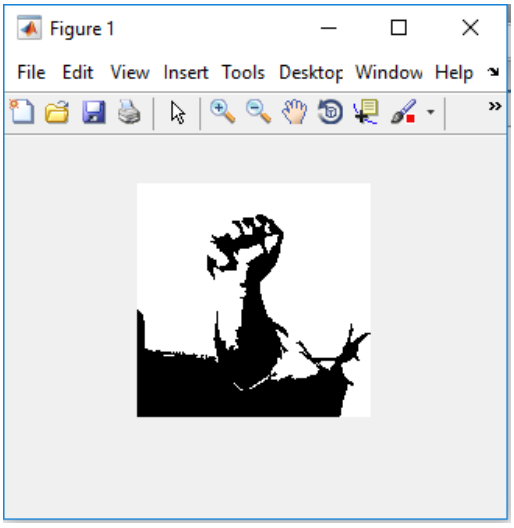




Figure 3: Grayscale image Figure 4: Thresholded image

According to the given input and obtained outputs, the accuracy of the system is calculated. As the system is under experiments, a 100% accuracy couldn't be achieved. An accuracy of 70% is obtained from this system.

## VI CONCLUSION

The aim of this project is to provide the speech and hearing-impaired people with a fast and accurate hand gesture recognition system which can help them in their daily life communication. The system implemented

here obtained an accuracy of 70% which can be increased further. The images with light as well as dark background and clicked in uncontrolled lighting conditions are involved in this project.

## VII FUTURE WORK

By properly studying the limitations and shortcomings of this implemented processes like feature extraction and classification, a more accurate hand gesture recognition system can be developed. Features which are most effective in differentiating between the gestures need to be extracted. Effective classification methods like convolutional neural network (CNN), deep learning need to be implemented to meet the target.

## REFERENCES

[1] C.V Soumya, Muzameel Ahmed,"Artificial Neural Network based Identification and Classification of images of Bharatnatya Gestures",International Conference on Innovative Mechanisms for Industry Applications 2017.

[2] Sruthi Upendran, Thamizharasi A,"American Sign Language Interpreter for Deaf and Dumb Individuals",International Conference on Control,Instrumentation,Communication and Computational Technologies 2014.

[3] Tin Hninn Hninn Maung," Real Time Tracking and Gesture Recognition System using Neural Networks",International Journal of Computer,Electrical,Automation,Control and Information Engineering 2009.

[4] Md R Ahsan, Muhammed I. Ibrahimy,Othman O. Khalifa," Hand motion detection from EMG signals by using ANN based classifier for human computer interaction", International Conference on Innovative Mechanisms for Industry Applications 2011.

[5] Yuh Rau Wang, Jia Liang Syu ,Hsin Ting Li,Ling Yang,",Fast hand detection and gesture recognition",International conference on machine learning and cybernetics 2015.

[6] Ankita Saxena,Deepak Kumar Jain,Ananya SInghal,"Hand gesture recognition using an android device",International conference on communication systems,and network technologies,2014.

[7] Rahat Yasir, Riasat Azim Khan," Two handed hand gesture recognition for Bangla sign language using LDA and ANN", International Conference on Innovative Mechanisms for Industry Applications 2015.

[8] Khan Mohammad Irteza, Sheikh Md. Masudul Ahsan, Razib Chandra Deb," Recognition of Hand Gesture Using Hidden Markov Model", International Conference on Control,Instrumentation,Communication and Computational Technologies 2014.