

Sign Language Decoder for the Hearing Impaired

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Article Info

Page Number: 571- 578

Publication Issue:

Vol 71 No. 3s2 (2022)

Abstract

Sign language, the sole medium of contact for dumb and deaf people. These visually disabled people communicate their feelings and ideas to other persons with the aid of sign language. As it is difficult for the normal human to understand these languages, these mentally disabled individuals always have to hold the interpreter along for connecting with the world. Recognition of sign's has since become an analytical assignment. Since sign language contains a variety motions and hand gestures, the consistency of sign's relies on the exact recognition of hand gestures. This paper presents a novel approach for sign language recognition. The primary aim is correctly classify and identify the hand gesture. The following work consists of segmentation models concerning skin color for areas of hand and detection from the background, HOG method is used, extracts the shape information features and finally Random Forrest machine learning classifier is utilized with effective results. The accuracy of our new models was It was revealed to be considerably higher than existing one.

Article History

Article Received: 28 April 2022

Revised: 15 May 2022

Accepted: 20 June 2022

Publication: 21 July 2022

Keywords: - Sign Language, Hand Gesture, Skin Segmentation, Histogram Of Gradients (HOG), Machine Learning, Random Forest, Indian Sign Language

I. INTRODUCTION

Sign language, the commonly used as a means for communicating by people who are deaf-dumb. There's nothing but, sign language which consists of various signs shaped by different hand forms, their motions, orientations, and many facial expressions.

There are almost 466.5 million people who suffer hearing loss globally, and 34.5 million of them are youth. Deaf people have no or very little hearing capacity. For communicating, they use sign language. Different places of the world, people use numerous sign languages.

Indian Sign Language also known as ISL, is developed and used exclusively in India. A few schools for deaf children remain in developed nations. In developed countries, unemployment rates are high for people having hearing loss.

According to data from Ethnologue, the rate of students attending school's literacy rate are much lower among the deaf community in India, that is around 1 percent of the total population. It goes on that official acceptance of sign languages dramatically boosts usability, enhances the availability of interpreters offers documentation of sign languages. Finger spelling, the illustration of writing system's letters and occasionally numeral systems. Using finger spelling, Sign Language will represent the English alphabet A-Z. Maybe one handed or two handed, and the two-handed form is followed by ISL. Several scholars have suggested various forms of hand gesture edge detection techniques in the last year, but these techniques have demonstrated several disadvantages, such as false edge detection, broken edges, high calculation time, etc. In edge configuration, edge orientation and noisesetting, the set of edge detection variables is constrained.

This paper approaches identifying sign language and to recognize it by image processing segmentation through feature extraction techniques and the machine learning model. It's been implemented by skin color segmentation; HOG feature extraction; Random Forest classification models.

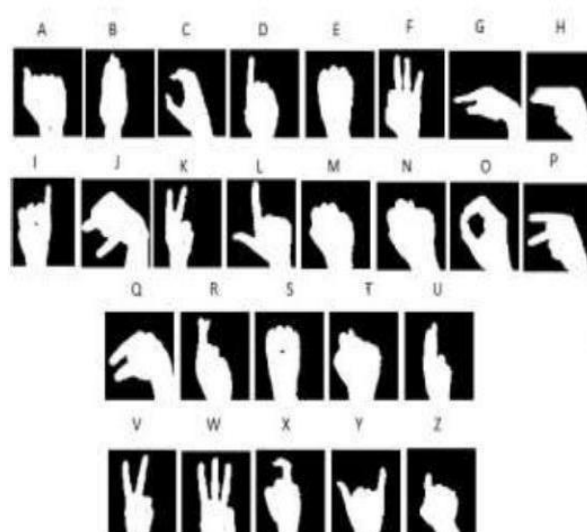


Fig.1 Samples of Indian Sign Language

II. PREVIOUS WORKS

Previously, less work was performed on the ISL. In [5], the main techniques involve key point image recognition using SIFT and then comparing new image key point with the regular image key point for each and every letter in the current database to recognize fresh image reaching up to nearest matches.

Firstly image representation vector is used to calculate eigen vectors of covariance matrix, then euclidean distance of new image proprietary vector present in the newest image classification training dataset is obtained [1].

In [4], Using Neural networks in preparation, it is obvious that the dataset consists of only single- handed images. The extracted feature vectors are exactly on the centre on angle between fingertips, number of fingers.

With all these works, the major issue was about datasets, it was never mentioned anywhere about where did the datasets come and from whom were it taken. Authors may have formed on getting sets from the people who works for the thesis.

It's possible the authors compiled the dataset from single source of team members as observed in a project for similar work, it is noted at [3] and split testing and training sets before revealing the accuracy. Only a single subset of alphabets was tested.

III. PROPOSED METHODOLOGY

The proposed sign language recognition doneas per below steps:

1. The first step, segment the portion of the skin (hand region) from the entire image (background), as remaining part of character classification can be considered asnoise.
2. The second step, derive relevant features or characteristics from hand segmented images that can prove useful, i.e., classification, for the next stage.
3. As described above, the third step, use supervised learning model to input derived features for training and learned models for classification purpose.

As in image segmentation, skin colour segmentation model is proposed which used to segment the hand from background and used for next feature extraction process.

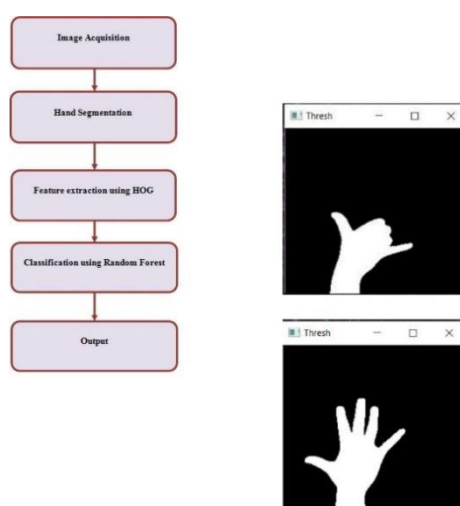


Fig.2 Overall Proposed Model

A. Image Acquisition

In sign recognition, the foremost step is, Interfacing with the camera is very important aspect. To catch hand gesture, a webcam is used. The webcam included in laptops or an external camera is used to interface. But it's important to mandatory be in high res for captured images. So, selecting a decent webcam & its interface is an essential task of this technique.

B. HAND SEGMENTATION

Image preprocessing involves cropping, filtering, change of brightness, contrast and others. Image segmentation & image cropping techniques used to do some process enhancement. There are captured images form of RGB. The foremost step, transform images in RGB to Binary, so that unused portions of image scan be eliminated by cropping images.

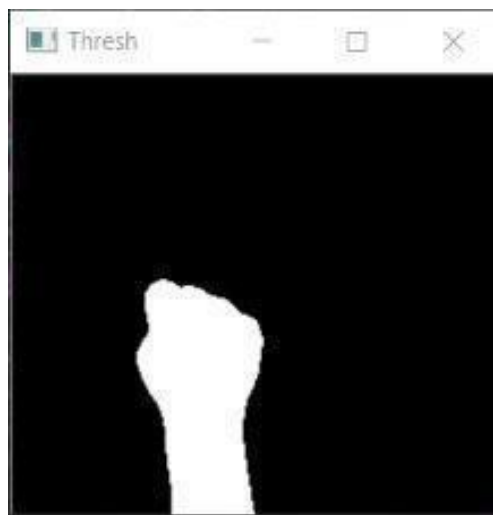


Fig.3 Hand (Skin) Segmentation Results

C. Feature Extraction

Extracting features is very helpful step in building a sign recognition database. Global and local visual features procured define the various visual concepts of alphabets in manual efficiently for the purpose of letter image similarity characterization. In sign recognition, there are primarily two kinds that makes feature extraction technique involved. First is shape representation and description approaches based on Contour, and second is shape representation and description techniques based on Region. Among these chosen are those focused on implementation processes. Here we propose HOG feature descriptor method for extracting feature which is applied hand segmented image. HOG method is presented to extracting shape features.

Histogram of Gradients (HOG)

The descriptors of HOG features (shown in Fig.4) are always similar to descriptors of SIFT features, but different in the way they are calculated on grid of differently yet uniformly spaced cells and uses overlapping for local contrast normalization to enhance precision.

Images were analyzed using the HOG approach and features were used efficiently. Since HOG is a descriptor of the feature, its key duty is to take the image and extract the important component from image and then reject all the remaining redundant parts. The size of the file, which is the width and height of the image, along with the 3 channels, is taken into consideration in determining the attribute descriptors. An attribute vector is computed using all this information and then information is passed and on into the classifier to be remembered. First, the horizontal and vertical gradients should be measured to determine the HOG function descriptor.

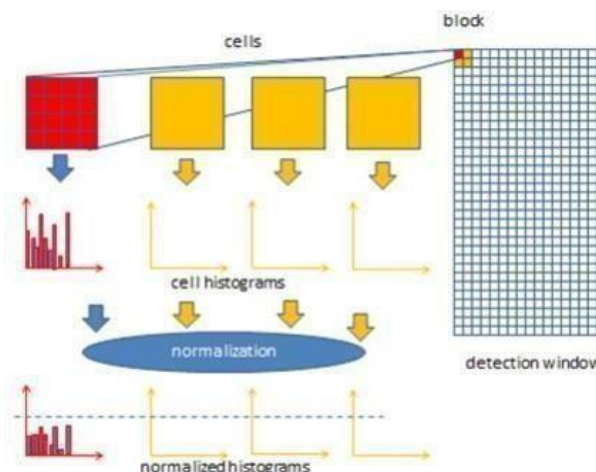


Fig.4 HOG Features

It is also possible to take several steps to optimize the HOG solution, such as gamma correction. The image broke as many cells in which there are 2 values assigned to each cell pixel, which are direction and magnitude, helping to compactly represent the image.

D. CLASSIFICATION

Above-generated feature vector for each image is trained through by classifiers like Random Forest, and finally that will be the last technique. Accuracy is calculated for model and by passing them after the testing set.

Random Forest

Random Forest, the popular most model in supervised machine learning models. RF, is an ensemble model that concentrates on regression and classification. It is known as ensemble random forest, which is used for integrating diverse classifiers for complex problem solving and efficiency of the model.

In RF, before having result multiple decision trees used. Thus, combining many trees for decision. The below diagrams and steps, illustrate its working:

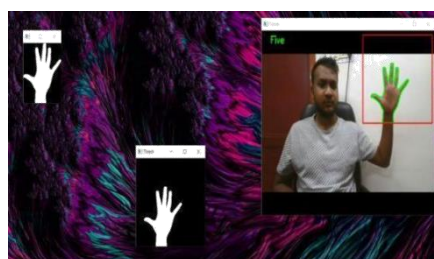
Step 1: From training set, pick random P datapoints.

Step 2: Form decision trees from chosen data points/subset.

Step 3: Denote N as number of decision trees to build.

Step 4: Repeat initial two steps.

Step 5: Appraise the result of every decision tree with fresh data points and allocate them to a group based on majority votes.



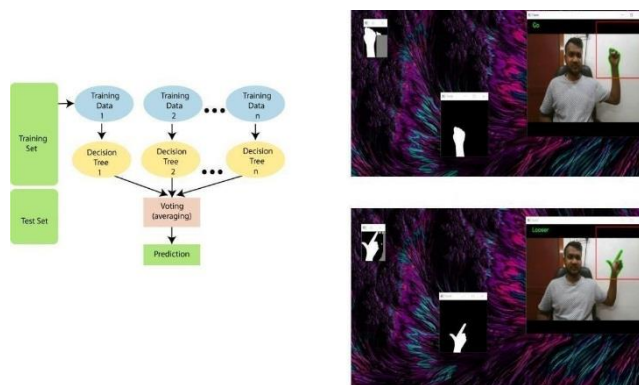


Fig. 5 Working of Random Forest

IV. EXPERIMENTAL RESULTS

The system uses the approach of machine learning classification to identify hand gestures such as alphabets or numbers or words so that the system can predict the precise outcome of the hand sign and make the words as phrases.

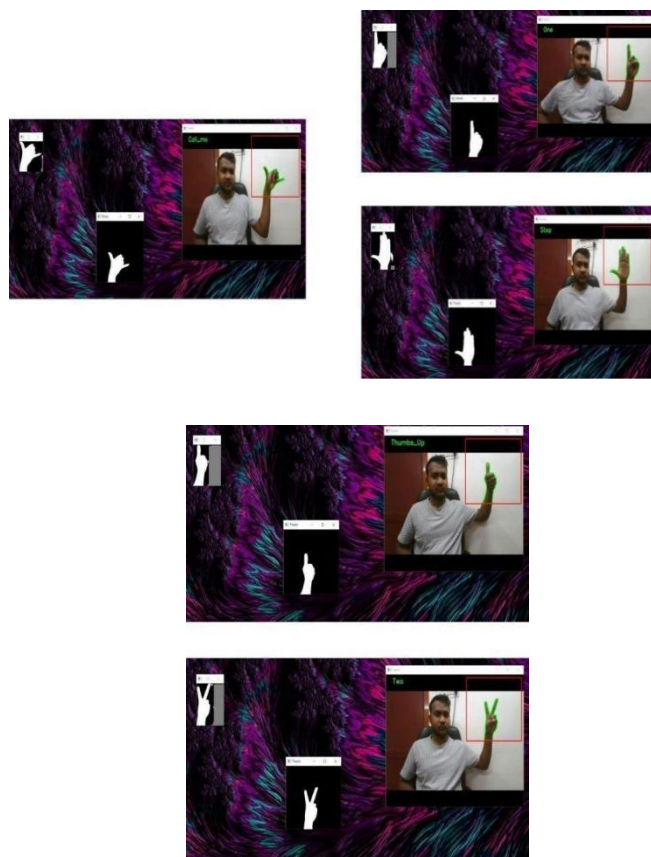


Fig.6 Sign Recognition Results by Proposed Model

V. CONCLUSION

In this paper, we used novel methodology to present automated hand sign language gesture recognition in real time. The system to recognize sign language was a success thanks to the

solutions- skin color segmentation for hand detection, HOG for shape feature extraction, and a machine learning model I.I., Random Forest for classification. The proposed model obtains the highest accuracy like **94.3%** by HOG and Random Forest classifiers mixed. This work will be extended in the future to enhance obtained results and create a Sign-Voice application which will prove to be handy to people with hearing difficulties to easily and fluently communicate with people.

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