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Sign Recognition Using Machine Learning Algorithms for Indian Sign Language

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ABSTRACT: Sign Language is mainly used for communication among deaf and dumb peoples. In an American Sign Language system is based on American sign for their peoples of deaf communities. Thus we are going to develop the same system implementation for our Indian peoples deaf and dumb community. In this system, we are implementing the alphabet recognizer basis of the different sign data samples to be builds our system most accurate with help of Artificial Neural Network (ANN). Today, many of research has been going on the field of sign language rectification but existing study failed to invent such strong technique. The purpose of our system is to build a real time HGR technique based on Indian Sign Language (ISL) recognition with higher accuracy. Indian Sign Language (ISL) used by Deaf peoples community in India, does have acceptable, meaningful essential and structural properties.

KEYWORDS: Artificial Neural Network, Indian Sign Language, Hand Gesture Recognition, Deaf community

I. INTRODUCTION

An India is country of inequality in geographic, religion wise many state wise as well. So such wide verity nation has verity of peoples as well verity of regional spoken languages like Marathi, Hindi, Tamil etc. All normal peoples can communicate each other by using these languages. There are one other community in our nation called deaf and dumb peoples community which has not any specific language to communicate. These peoples communicate each other or with us by using symbolic signs. So motive behind these research is to give a widely acceptable sign language system to the deaf and dumb community. Our primary goal to invent this system to bring all deaf and dumb community peoples in reliable communication with all normal persons. Indian Sign Language (ISL) is one of the living languages in India used by the Deaf community peoples.

This system acquires gesture images of ISL with black background from mobile video camera for feature extraction. There are analysing phase, pre-processing unit the noise removal, grey scale conversion, binarization of images followed by feature extraction. In future extraction five steps followed in which fingertips searches by eccentricity. Next are elongations of images, measured by considering pixel segmentation as well as rotation of images. In feature extraction, algorithmic study used to find the feature vectors of systematic results combines K curvature and convex hull algorithms. In present work “K convex hull” algorithm which is used to detect fingertip with greater accuracy. In our system, Artificial Neural Network (ANN) is used for future recognition in which we having the input unit of training data set of images. Next we have hidden unit which acts upon this training dataset to evaluate the output unit results data set. This entire ANN works by considering the factors namely textures of images, colours, shapes, spatial rotations.

In current work Sign language is the primary language of the people who are deaf or hard of hearing and also used by them who can hear but cannot physically speak. It is a complex but complete language which involves movement of hands, facial expressions and postures of the body. Sign language is not universal. Every country has its

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own native sign language. Each sign language has its own rule of grammar, word orders and pronunciation. The problem arises when deaf and dumb people try to communicate using this language with the people who are unaware of this language grammar. So it becomes necessary to develop an automatic and interactive interpreter to understand them. People want something more natural. Another one is based on computer vision based gesture recognition, which involves image processing techniques. Consequently, this category faces more complexity.

II. LITERATURE SURVEY

Noor Adnan Ibraheem et al. [1] has been examined that Hand gesture is a method of non-verbal communication for human beings for its freer expressions much more other than body parts. Hand gesture recognition has greater importance in designing an efficient human computer interaction system. Using gestures as a natural interface benefits as a motivation for analysing, modelling, simulation, and recognition of gestures. In this paper a survey on various recent gesture recognition approaches is provided with particular emphasis on hand gestures. A review of static hand posture methods are explained with different tools and algorithms applied on gesture recognition system, including connectionist models, hidden Markov model, and fuzzy clustering. Challenges and future research directions are also highlighted.

Sabaheta dogic et al. [2] has been studied that Sign language plays a great role as communication media for people with hearing difficulties. In developed countries, systems are made for overcoming a problem in communication with deaf people. This encouraged us to develop a system for the Bosnian sign language since there is a need for such system. The work is done with the use of digital image processing methods providing a system that teaches a multilayer neural network using a back propagation algorithm. Images are processed by feature extraction methods, and by masking method the data set has been created. Training is done using cross validation method for better performance thus; an accuracy of 84% is achieved.

Vaishali.S.Kulkarni et al. [3] has been introduced in these paper objectives to build up a framework for programmed interpretation of static motions of letter sets in American Sign Language. In doing as such three highlight extraction techniques and neural system is utilized to perceive signs. The framework manages pictures of uncovered hands, which enables the client to interface with the framework in a common way. A picture is prepared and changed over to a highlight vector that will be contrasted and the component vectors of a preparation set of signs. The framework is revolution, scaling of interpretation variation of the signal inside the picture, which makes the framework increasingly adaptable.

Sonali N Jadhav et al,[4] investigates the different parts of hand sign images continuously utilizing neural systems. Hand sign can be a indispensable path for the client to interface with any framework. In this framework we catch a hand motion from the client and after that play out the activity identified with it. This gives us a choice to mouse and console to control a framework. Hand signal acknowledgment can be useful in different fields and territories where connecting with the framework without contact is imperative.

Zafar Ahmed Ansari et al, [5] has been finds individuals with discourse inabilities convey in gesture based communication and accordingly experience difficulty in blending with the healthy. There is a requirement for a translation framework which could go about as a scaffold among them and the individuals who don't have the foggiest idea about their gesture based communication. A utilitarian unpretentious Indian gesture based communication acknowledgment framework was executed and tried on true information. A vocabulary of 140 images was gathered utilizing 18 subjects, totalling 5041 pictures. The vocabulary comprised for the most part of two-gave signs which were drawn from a wide collection of expressions of specialized and every day utilize starting points. The framework was executed utilizing Microsoft Kinect which empowers encompassing light conditions and question shading to have irrelevant impact on the effectiveness of the framework. The framework proposes a technique for a novel, minimal effort and simple to-utilize application, for Indian Sign Language acknowledgment, utilizing the Microsoft Kinect camera.

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Guillaume Plouffe et al, [6] examines the advancement of a whiz signal UI that tracks and perceives progressively hand signals in light of profundity information gathered by a Kinect sensor. The intrigue space relating to the hands is first portioned based on the suspicion that the hand of the client is the nearest protest in the scene to the camera. A novel calculation is proposed to move forward the checking time with a specific end goal to recognize the main pixel on the hand form inside this space. Beginning from this pixel, a directional scan calculation takes into account the recognizable proof of the whole hand form. The k-arch calculation is then utilized to find the fingertips over the form, and dynamic time twisting is used to choose motion competitors and furthermore to perceive motions by contrasting a watched motion and a progression of pre-recorded reference motions. The examination of results with cutting edge approaches demonstrates that the proposed framework beats a large portion of the answers for the static acknowledgment of sign digits and is comparable regarding execution for the static and dynamic acknowledgment of well-known signs and for the communication through signing letter set. The arrangement at the same time manages static and dynamic motions also similarly as with various hands inside the intrigue space. A normal acknowledgment rate of 92.4% is accomplished more than 55 static and dynamic signals. Two conceivable utilizations of this work are talked about furthermore, assessed: one for elucidation of sign digits and signals for friendlier human– machine cooperation and the other one for the normal control of a product interface.

Javeria Farooq et al,[7] finds Hand motion acknowledgment is a characteristic and natural way to connect with the PC, since cooperation's with the PC can be expanded through multidimensional utilization of hand motions as contrast with other information techniques. The reason for this paper is to investigate three unique strategies for HGR (hand signal acknowledgment) utilizing fingertips location. Another methodology called "Arch of Perimeter" is given its application as a virtual mouse. The framework exhibited, utilizes just a webcam and calculations which are created utilizing PC vision, picture and the video handling tool stash of Mat lab.

Angur M. Jarman et al, [8] exhibits another calculation to distinguish Bengali Sign Language (BdSL) for perceiving 46 hand signals, including 9 motions for 11 vowels, 28 motions for 39 consonants and 9 motions for 9 numerals as indicated by the similitude of elocution. The picture was first re-sized and after that changed over to double configuration to edit the locale of enthusiasm by utilizing just best most, left-most and right-most white pixels. The places of the fingertips were found by applying a fingertip discoverer calculation. Eleven highlights were extricated from each picture to prepare a multilayered feed-forward neural system with a back-spread preparing calculation. Separation between the centroid of the hand area and each fingertip was ascertained alongside the points between every fingertip and flat x pivot that crossed the centroid. A database of 2300 pictures of Bengali signs was developed to assess the viability of the proposed framework, where 70%, 15% and 15% pictures were utilized for preparing, testing, and approving, separately. Exploratory outcome demonstrated a normal of 88.69% exactness in perceiving BdSL which is particularly encouraging contrast with other existing techniques.

Yo-Jen Tu et al, [9] presented a face and signal acknowledgment based human-PC communication (HCI) framework utilizing a solitary camcorder. Not the same as the traditional specialized strategies among clients and machines, we consolidate head posture and hand motion to control the hardware. We can recognize the situation of the eyes and mouth, and utilize the facial focus to assess the posture of the head. Two new techniques are displayed in this paper: programmed signal territory division what's more, introduction standardization of the hand signal. It isn't compulsory for the client to keep signals in upright position, the framework fragments and standardizes the signals consequently. The explore demonstrates this technique is extremely precise with motion acknowledgment rate of 93.6%. The client can control different gadgets, counting robots all the while through a remote system.

Sharmila Konwar et al, [10] states This System is aimed to design an automatic vision based American Sign Language detection system and converting results in to text. The work introduced in this paper is meant to outline a programmed vision based American Sign Language recognition framework and interpretation to content. To distinguish the human skin shading from the picture, HSV shading model is utilized. At that point edge recognition is connected to distinguish the hand shape from the picture. An arrangement of morphological activity is connected to get a refined yield for the gesture based communication acknowledgment This work is mainly focussed on the colour model and

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edge detection phenomenon. Edge detection algorithm the hand gestures are detected successfully for the alphabets in American language. Some images are not detected successfully due to geometric variations, odd background and light conditions.

III. METHODOLOGY USED IN PROPOSED SYSTEM

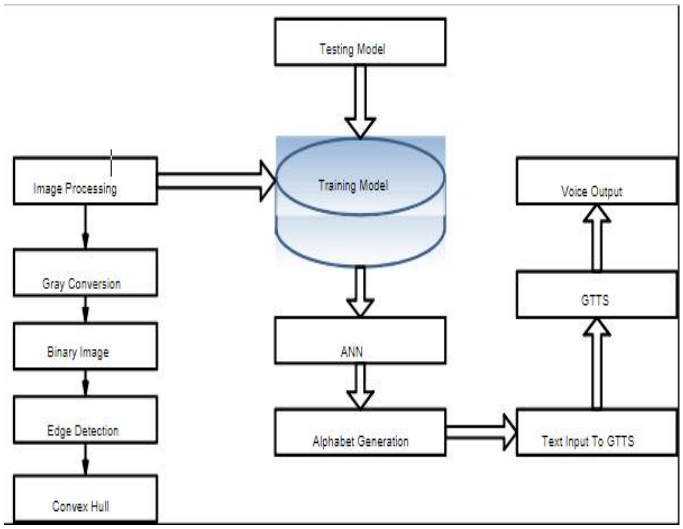

Fig. System Architecture

A. OPEN-CV:-

Open-CV (Open Source Computer Vision) is a library of programming functions mainly aimed at real-time computer vision. In easy language it is library used for Image Processing. It is mainly used to do all the operation related to Images. In our implementation's needs we capture real time camera image using Open CV. After read camera image, write image and show image on console by using Open-CV python.

B. Image Processing :-

Every image is formation of RGB colours. Each and every captured image has some noise, unwanted background. Thus there is need of process those captured image before assign to our recognition module. Pre-processing unit made up of noise removal, grey image conversion, binary image conversion of sign inputs after that feature extraction done on those samples. In future extraction five steps applied in which finger count finding by eccentricity. Next elongations of images are evaluated by calculating pixel segmentation as well as rotation of input images.

C. Feature Extraction:-

Feature Extraction is nothing but simply technique to finds meaningful statistical evaluation of image pixels, algorithmic methods used to find the feature vectors from images. Systematic results capsules K curvature and convex hull methods. In present work "K convex hull" methodology which is used to finds fingertip counts with greater accuracy. In our system, Artificial Neural Network (ANN) is used for future recognition in which we having the input unit of training data set of images.

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D. **Feature Recognition:-**

As per our system prospective
Brain-inspired systems used to replicate how humans learn. Consist of input, hidden and output layers that transform the input into something that the output layer can use. Excellent for finding patterns which is complex to human for extract and teach the machine to recognize. ANN gathers their knowledge by detecting the patterns and relationships in data and learns (or is trained) through experience, not from programming.

IV. RESULTS AND DISCUSSION

Thus finally we get more accurate sign recognition module which converts real time sign samples into a words. After getting text from sign's we writes those text into a text file. After writing text we are converting that text result into a voice form with help of Google's text to speech module. Sign Language Recognition system implemented based on highly trained model that can accurately interprets hand gesture signs into a text. Our system we had used Gaussian blur for gray image conversion, Otsu's approach for binary image conversion of input sign after that we used convex hull for edge detection.

E. **Gray scale conversion**

In gray scale conversion colour image is converted into a gray form using Gaussian blur. Colour image containing noise and unwanted background which is removed or blurred by using this method.

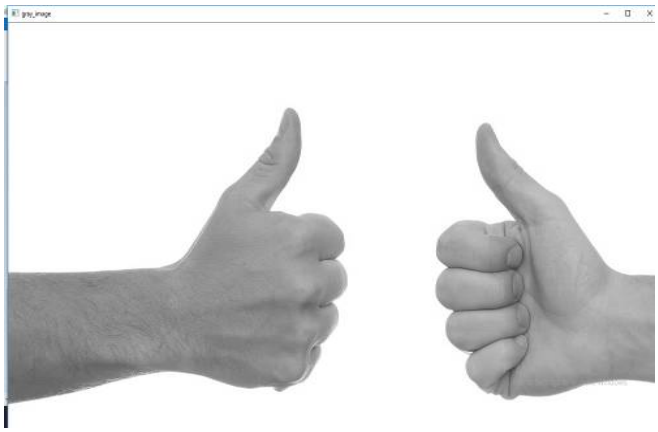

Fig.1 Gray Image

F. **Binary conversion**

Gray scale image is given to input for Otsu's method for binary conversion. In Binary form of images converted in 0 and 1 form means black and white.

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Fig.2 Binary Image

G. **Edge Detection**

In Edge detection binary image get dimensions by counters using convex hull algorithm. In which eccentricity finding drawing edges around white portion of binary image.

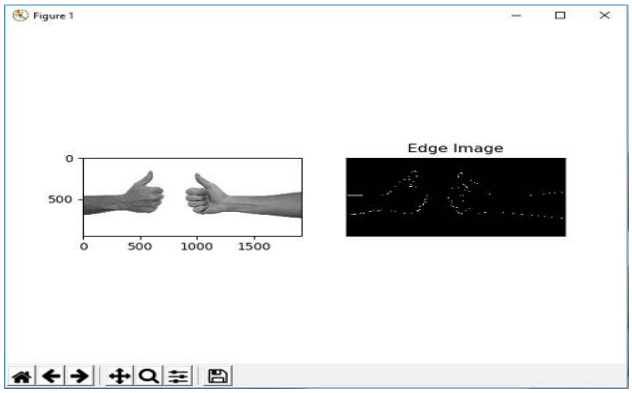

Fig.3 Edge Detection Image

H. **Training Model**

Training of sign dataset is primary task of our system. We collected sign dataset by using internet of high dimensional data. After getting this dataset we trained it by using python machine learning techniques by using tensor flow.

I. **Testing Model**

Once our training model done we come on testing model. In testing model we gives runtime input images captured by our cv2.

After matching hand gestures respective alphabets display on console and stored in text file as well. Finally we have been used Google text to speech for converting into a voice.

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TABLE I

In our experimental setup, In table 1 describe our system modules and respective generated output.

Sr.No	No of Input Sign Sample's	Output Generated
1	1 to 5 Hand gesture Images	Finger tip counts 1 to 5
2	26 Hand gesture's	A-Z or a-z
3	N No of Words	Voice

Table 1 Modules of System

J. Accuracy Rate of Sign Recognition

All sign sample images trained by our trained model approximately 3000 images per alphabet. Total around 87000 images trained so we have been conclude the accuracy rate average 88%.

V. CONCLUSION

Finally we implemented the efficient and most accurate system for deaf and dumb community. We get higher accuracy rate over real time hand gestures by applying machine learning with the advantages of python libraries which helps better results. Many algorithms are applied to achieve greater accuracy in recognition system. Image samples taken by camera vision with the computer are tested by our trained ANN.
In future we will work on motion detection and text prediction system with big dataset.

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