

Real Time Bidirectional Communication Interpreter For Deaf Community

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Abstract

Sign Language research field based on real time hand gestures called sign samples and recognition unit of computer. The sign language is the only method which can be used by deaf and dumb community as a communication platform. In this system, we are going to work on the American Sign Language (ASL) dataset for (A-Z) alphabet recognition followed by our word recognition dataset of Indian Sign Language (ISL). Sign data samples to be making our system more accurate with help of Convolutional Neural Network (CNN). Today, more research has been going on the field of sign language recognition and detection but existing study failed to develop trust full communication interpreter. The purpose of this system is to represent a real time two way communication interpreter based on Indian Sign Language (ISL) with higher accuracy. Indian Sign Language (ISL) used by Deaf peoples community in India, does have acceptable, meaningful essential and structural properties.

Keywords— - Convolution Neural Network (CNN), Indian Sign Language (ISL), Hand Gesture Recognition (HGR), Deaf community

I. INTRODUCTION

There are so many languages in India used as officially and locally. Such bigger diversity countries have many challenges to maintain typical single method in language interpretation. In language interpretation there are difficulties, problems when it is used to communicating over different sectors, audiences and states. Indian Sign Language (ISL) is one of the live prominent languages in India used by the Deaf community peoples. But as we know there is no any general language present till today, so we are processing on various sign language datasets to provide Indian sign language as an interpreter.

We have implemented two way communication for Sign language which is used by the people who are deaf or find it difficult hearing and also used by them who can hear but cannot physically speak. Our objective to implement this system is to create entire language which includes movement of hands, facial expressions and gesture of the body. The Sign language is a varying regionally and so we are making our contribution towards sign language development. Every country has its own native sign language like American Sign Language work for alphabet recognizer. Each sign language has its own rule and semantic meanings. The problem comes when deaf and dumb people want to communicate or trying to say something there is not any language for them. So it becomes necessary to develop an automatic language interpreter to assist them for their fluent communication. They people want something more helpful which makes there communication universal and easy. Another one is based on computer vision based gesture recognition, which involves image processing techniques. Consequently, this category faces more complexity. Our motive to develop this system based on real time signs.

This system captures hand gesture images of ISL with system camera for feature extraction. The analysing phase, pre-processing unit is used to the noise removal, grey scale conversion by using Gaussian filter, binary conversion of images done by using OTSU's method followed by feature extraction. In our system, Convolutional Neural Network (CNN) is going to be 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 train model. This entire CNN works by considering the factors namely matrix feature of images for drafting into a train

model for real time sign recognition. The working with real time sign language we know that the dataset need to be large and rich in processed features.

II. LITERATURE SURVEY

Sharmila Konwar et.al [1] states that it is used to implement an automatic vision based American Sign Language detection system and converting results in to text. The work initiated in this paper is intended to outline a programmed vision based American Sign Language recognition framework and interpretation to content. To differentiate the human skin tone colour from the image, HSV shading model is used. At that point edge recognition is connected to distinguish the hand shape from the picture. A positioning of morphological activity is joined to get a proper purified yield for the gesture based communication acknowledgment. This work is primarily centralised on the colour model and edge detection process. Edge detection algorithm works as per procedure and then hand gestures are recognized correctly for the alphabets in American language. Some images are not recognized correctly due to geometric differences, uneven or unspecified background and light conditions.

Yo-Jen Tu et.al [2] presents 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 detect the situation of the eyes and mouth, and use 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 is not necessary for the client to keep signals in upright position, the framework fragments and standardizes the signals consequently. They explore demonstrates this technique is extremely precise with motion acknowledgment rate of 93.6%. The client can control various gadgets, and other robot system all the while through a remote system.

Angur M. Jarman et.al [3] 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.

Javeria Farooq et.al [4] states that 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 MATLAB.

Guillaume Plouffe et.al [5] 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.

ZAFAR AHMED ANSARI et.al [6] states 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, totaling 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.

Keerthi S Warriar et.al [7] states Hand Gesture Recognition System (HGRS) for detection of American Sign Language (ASL) has become essential and powerful communication tool for specific users (i.e. hearing and speech impaired) to interact with general users via computer system. Numerous HGRS have been developed for identification of diversified sign languages using effective techniques. There exist two main approaches in the hand gesture analysis namely; vision-based and device-based approach. In vision-based approach the user does not require to wear any extraneous mechanism on hand. Instead the system requires only camera(s), which are used to capture the images of hand gesture symbol for interaction between human and computers

III. METHODOLOGY USED IN EXISTING SYSTEM

There are different approaches for image capturing is being used before. The captured images from either real time cam or static from dataset is used for further processing. Digital image processing is an area of technology that analyses image processing techniques. The image being processed in this is a static image from computer vision (web-camera). Computationally, the image is a formed due to light intensity on two-dimensional field. The image which is then processed by a system or computer, should be presented statistically with numerical values. A digital image can be given by a two-dimensional matrix $f(m, n)$ consisting of M columns and N rows. The colour image processing [RGB], there are various types of models like hue and saturation, value (HSV) model. This model is utilized with an object with a certain color can be identified and to decimate the noisy light intensity from the outside. Further Tests on images were performed using six kinds of colours, ie brown, yellow, green, blue, and black and white.

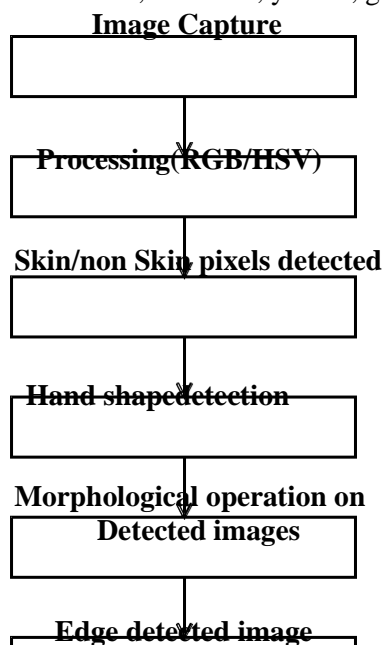


Fig.1 Existing System Architecture

IV. METHODOLOGY USED IN PROPOSED SYSTEM

We are trying to reduce the existing communication barrier by implementing modules for two way communications for deaf and dumb peoples. Input provided to a system is the action of hand gestures and then it will convert it into common words of communication and then after getting this in text, convert it into voice. After getting voice, normal people can understand it. Similarly, normal people can talk in their own voice. Our system will convert it into text and then further convert it into actions which are then simply recognizable by deaf people.

In this system Sign language is the primary language of the people who are deaf or find it hard of hearing and also used by them who can hear but cannot physically speak. It is somewhat hard but complete language which involves movement of hands, facial expressions and gestures and postures of the body. Sign language is not geographically same. Every nation has its own developed sign language. Each sign language has its own rule of grammar, word orders and pronunciation. The problem comes when deaf and dumb community requires communicating using this language with the people who are unaware of this language grammar. So it becomes essential to develop an automatic and interactive interpreter to understand them.

So it's mandatory to overcome this communication gap between the deaf community and normal persons. Two way communications system is providing for deaf and dumb peoples. We take input as action of hand gestures and convert it into common words of communication after getting this in text, convert it into voice. After getting voice, normal people can understand it. Similarly, normal people can speak in form of voice; our system will convert it into text and further convert it into actions which are simply understandable by deaf people.

The developed system performs two way communication systems by using machine learning and image processing techniques.

The current real time application will work for real time assistance.

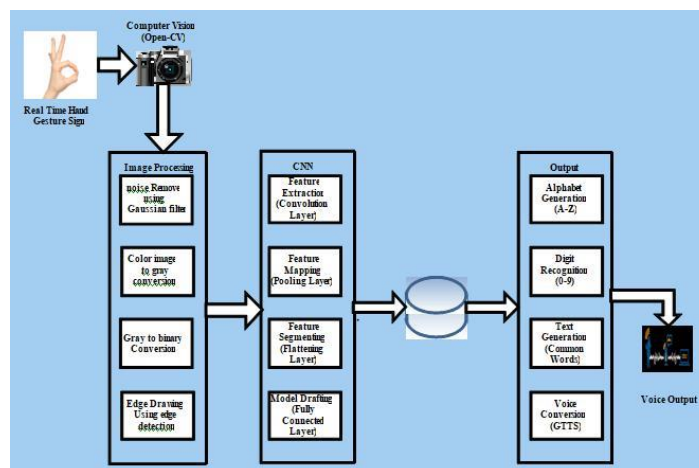


Fig.2 System Architecture

1. Hand action recognition

Open-CV (Open Source Computer Vision) is a library of programming functions used for real time image processing with computer vision. In our implementation we are going to use open compute vision for taking real time snap of hand gestures for further processing. After getting real time hand gestures image processing applied on it for removing noise from it.

2. Image processing

After getting real time image of hand gesture send for image processing module. In image processing image gets converted in grey format by deleting unwanted noise in it using Gaussian filter. After gray conversion image thresholding by adjusting its RGB colour values to zero and preserving only black and white [0 and 1] values. Gray to binary conversion is carried out by using OTSU's method. After obtaining black formatted image hand shape is then automatically extracted from image. The exact shape of hand will be obtained by drawing edge with the help canny edge detection method.

3. Feature extraction

After getting exact shape of hand gestures features get extracted from it by using pixels weight calculations. The image pixels get placed in matrix with help the of weight gradient functions. Feature extraction done on all hand gesture dataset for training model creation and drafting. The train model creation done by using deep learning (CNN) algorithm.

4. Feature mapping & text generation

In real time image of hand gestures is going through image processing and subsequent phases of feature extraction. After getting image features these statistical features get matched with pre trained model and respective text generated. After text generation those text get converted into a voice.

5. Voice conversion

The text generated further gets converted into voice by using Google's text to speech library. After voice generation will be used for communication purpose deaf person to normal person.

6. Text to action conversion

For normal person to deaf communication normal person use their own language in the form of voice. The voice obtained from normal people gets recognized by speech recognizer and this speech gets converted into a text. After text from normal person get semantically mapped with sign samples. The matched sign samples will show by using open-CV automatically. The sign images get easily understand by deaf and dumb community persons.

V. RESULTS AND DISCUSSION

In two way communication system we have implemented greatly trained model that can analyse hand gesture signs. In this system we used tensor-flow machine learning framework and predefined libraries.

A. 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.3 Gray Image

B. 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.



Fig.4 Binary Image

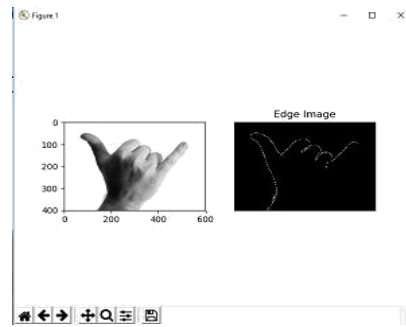


Fig.5 Edge Detection Image

1. 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.

Testing Model

In final phase of data testing in which real time hand gesture images matched by our training model.

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.

Second way we get real-time voice input from user to get desired text from it. After getting text from voice then output sign sample displayed by developed system for visually understand by deaf person. As well as we have suggested video samples for general activity for better understanding of deaf persons.

TABLE I

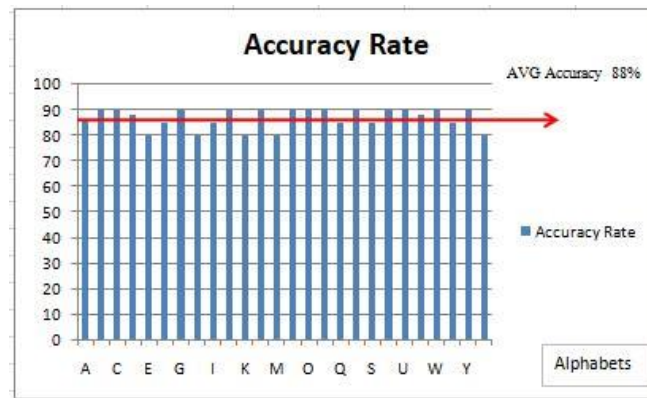
In our experimental setup, in table 1 describe our system modules and respective generated output.

Sr. No.	Number of Input Sample's	Output Generated
1	1 to 5 Hand gesture Images	Finger tip counts 1 to 5
2	29 Hand gesture's	A-Z , Nothing , Space and Delete
3	15 Basic Words	Voice
4	Real time voice input	Text
5	Text input	Sign/video

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Tab 1 Modules of System

E. Comparative Study Graph



Graph 1: Sign sample Average Accuracy Rate

VI. CONCLUSION

Thus the implemented system perform the two way communication interpreter using American Sign Language to accurately recognize the real time hand gestures and convert those alphabets and words. The recognized sign converted into text and further it converted into voice. Convolutional Neural Network algorithm is applied to achieve greater accuracy in real time sign recognition. In future, we will more focus on real time action recognition to overcome hand sign limitations.

VII. ACKNOWLEDGMENT

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