IJCSE International Journal of Computer Sciences and Engineering Open Access
Research Paper Vol.-7, Issue-7, July 2019 E-ISSN: 2347-2693

Hand Gesture Recognition based on Real-time Indian Sign Language

Rakesh.B.S[1*], Tamilarasan.S[2], Avinash N[3]

[1,2,3]Dept. of CSE, Brindavan College of Engineering, Bengaluru, India

[*]*Corresponding Author: rak.appu@gmail.com, Tel.: 8892655785*

DOI: https://doi.org/10.26438/ijcse/v7i7.181185 | Available online at: www.ijcseonline.org

Accepted: 13/Jul/2019, Published: 31/Jul/2019

Abstract— Indian sign language (ISL) could be a language which is used to employ by hearing and speech impaired individuals to speak with other individuals. In this paper we present system which might recognise hand poses and gestures from the Indian sign language (ISL) in real-time mistreatment grid-based options. Here, we are introducing hand gesture recognition system to recognize the gestures and convert them to a natural language. Gesture recognition can be used to communicate merely through gestures without any physical link with the actual machine. Gesture is converted to text which helps deaf-dumb people to communicate with normal people. The system can be programmed in such a way that it can translate gesture to text. The proposed system involves taking the input through the in-built camera. One of the advantage of the system is that the individual can add new sentences based on their comfort and understanding. The output text is displayed on the screen based on the gesture showed to the camera.

Keywords—Hand guesture recognition, unicode, image processing, webcam

I. INTRODUCTION

A sign language could be a language during which communication between individuals square measure created by visually transmittal the sign patterns to specific meaning [1]. Humans could communicate non-verbally with hand movements carrying sure symbolic meanings a behaviour we wish to abstract, formalise and use for driver-vehicle interaction. Several hand sign languages exist and frequently feature sets context sensitive hand gestures [3]. ISL involves each static and dynamic gestures, single as well as double bimanual gestures, additionally to the present the hands concerned in gesturing might have advanced motion [4]. Prominent techniques embody utilizing the motion history info related to gestures, motion capturing gloves and laptop vision combined with completely different gloves [6].

Using gesture recognition, an individual will purpose at the monitor screen and use gesture to pick use totally different applications within the device. Image process is typically used for gesture to pick and use totally different applications within the device. Image Process is typically used for gesture recognition because it provides options like pattern recognition, texture understanding, content-based retrieval, compression and even more. One cannot continuously notice Associate in nursing interpreter to translate these gestures once required. To facilitate this communication, a possible answer was enforced which might translate hand poses and gestures from ISL to period. It includes of Associate nursing android smartphone camera to capture hand poses and gestures, and a server to method the frames received from the smartphone camera. The aim of the system is to implement a quick and correct recognition technique [12]. All input pictures area captured by net camera. As per the period of time Indian Sign Language (ISL) Recognition, it makes use of net server interaction which needs the system to be connected to the web. In the absence of the network association, the system won't work. One in every advantage of the system is that the individual will add new sign languages supported their comfort and understanding. The output text is displayed on the screen supported the gesture showed to the camera.

Gesture recognition has been a very interesting problem in Computer Vision community for a long time. In this paper we are introducing Hand Gesture Recognition, which will display messages based on the input gestures. We have also used Unicode to print the text messages in different languages on the python shell. Gesture recognition can be used to communicate merely through gestures without any physical link with the actual machine. These gestures are generally used by deaf-dumb people in order to express their thoughts. Using gesture recognition, a person can point at the computer screen and use gesture to select and use different applications in the device. Image processing is usually used for gesture recognition as it provides features like pattern

recognition, texture understanding, content-based retrieval, compression and many more. Convert that segmented image into binary, apply feature extraction on the binary image, for extraction of the features the techniques used are distance transformation. All input images are captured by web camera. As per the Real-time Indian Sign Language (ISL) Recognition [1], it makes use of web server interaction which requires the system to be connected to the internet .In the absence of the network connection, the system won't work. One of the advantage of the system is that the individual can add new sign languages based on their comfort and understanding. The output text is displayed on the screen based on the gesture showed to the camera.

In the rest of this paper, Section II contain the related work, Section III contain the methodology. Section IV contain the module implementation, Section V result, and Section VI contains conclusion.

II. RELATED WORK

In the research related to Android devices, authors have researched on developing android application for sign language translation. They use the KNN model for detecting the hand signals and the Viola – James model for object detection [2].

With the development of mobiles and handheld devices, it has become much easier to create such systems. The system we have proposed is based on mobile phones which are portable and available to everyone. There are some applications on Android based on this concept but the accuracy reached is not as anticipated. Also, these applications tend to exhaust the space and RAM of the mobile. This paper proposes an android based sign language recognition system for American Sign Language (ASL). The system translates the sign language into text from the images captured from the smart phone camera. The image database on which training takes place is stored on cloud. The accuracy obtained by this system is 89.54% [2].

A lot of research has already been done on gesture recognition using conventional techniques like body part tracking, different color glove based tracking etc. however the use of Kinect like depth sensors has been adopted for gesture recognition in the recent past and it has been growing in popularity ever since. A very robust system for sign language recognition was implemented in using skeleton tracking through the Custom applications provided by Microsoft as part of their SDK for Kinect. The authors' dataset consists of about 50 samples from 2 users each; they achieve a classification accuracy of about 97%. However, the authors' approach fails in case of sign languages gestures that involve different finger movement since the skeleton tracking is done for the entire hand and not for individual fingers [4].

More sophisticated and viable approach for gesture recognition is by using depth images. This paper has greatly influenced our work since we have used low level features to achieve above 90% accuracy. On all of the 8 gestures sequences they had considered in their dataset. However, this technique makes use of only low level features and doesn't quite explore high level features like optical flow characteristics. The use of depth sensing technology is fast gaining acceptance and recognition [4].

Many researchers used vision based approaches for recognizing hand gestures. They used several approaches for image processing such as Gaussian filter, sobel filter, Canny edge detection, color segmentation, skin filtering palm cropping etc. and they used several classifiers like Artificial Neural Network, Genetic Algorithm, Hidden Markov Model [6].

In this paper, the steps that we have used for recognizing different hand gestures are Color Based Hand Segmentation, Median filter for smoothing, and finally Support Vector Machine as a proper classifier. Thus, accurate result was obtained. This system can be used to control the smartphone without the need to touch it. With this system, we only have to make a gesture in front of the camera so that it performs the appropriate action. It could also serve to deaf people to communicate with others [6].

We investigated deep learning technologies for the purpose of hand gesture recognition in automotive context with three-dimensional data from time-of-flight infrared sensors in order to provide new means of controls for driver assistance systems. Comparing our approaches with related work, we state that our lightweight implementations suit mobile computing and feature reasonable accuracy [7].

Future work may examine the generalisation capability with larger datasets. In addition, we may combine our convolutional architecture with the recurrent layer and search for improvements in generalisation performance. To assess transfer learning capabilities, future experiments may try to transfer knowledge from our hand gesture symbolism into other hand sign languages. Given more computational resources, models with larger parameter spaces may perform slightly better, but such a comparison remains for future research. In general, future research may perform uniform comparisons across the whole zoo of hand gesture recognition systems and their respective datasets that emerged in the last years [8].

III. METHODOLOGY

A. Image Acquisition

For any vision framework, Image Acquisition is the progression simply after which we can go ahead with picture preparing. The application utilizes the frontal camera of the Smartphone for constant edge catching and a concurrent presentation on the screen .

B. Image Processing

In the image-processing step, we aim to sample color at first, then we make a binary representation of the hand, after that we have to get N biggest contours and dismiss contours not representing the hand, then contours are described with convex polygons and finally we filter out irrelevant polygon

C. Feature extraction

After detecting the hand we can see the extracted features. Binary image of the hand is obtained which shows a particular sign

D. Gesture recognition

Finally when the whole process is complete the application will be then converted into its recognized character or sentences from the sign or gesture.

Using an Android smartphone, gestures and signs performed by the person using ISL are captured and their Frames are transmitted to the server for processing. To make the frames ready for recognition of gestures and hand poses, they need to be pre-processed. The pre-processing first involves face removal, stabilisation and skin colour segmentation to remove background details and later morphology operations to reduce noise. The hand of the person is extracted and tracked in each frame.

For recognition of hand poses, features are extracted from the hand and fed into a classifier. The recognised hand pose class is sent back to the Android device.

In classification of hand gestures, the intermediate hand poses are recognised and using these recognised poses and their intermediate motion, a pattern is defined which is represented in tuples.

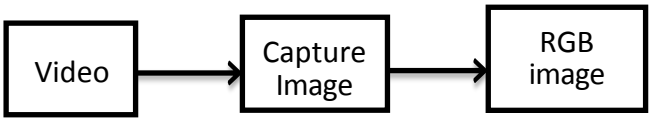
Each ISL gesture is classified based on its count value and by using few logical conditions. The gesture one to five is recognized correctly. The gesture four and five can be recognized directly but the classification is needed for the gesture of zero, one, two, three, six, seven, eight, and nine. For gesture one and six the count of finger is 1, Shows the classification of count 1 into ISL 'one' and 'six'.

To classify these two gestures the image is vertically divided into two quadrants then the number of active pixel in each quadrant is calculated based on which the gesture is classified as one or six. The remaining gestures are also classified by applying logic to the finger count.

IV. MODULE IMPLEMENTATION

A. Reading Image

Fig 4a: Reading Image



The RGB images Captured from the webcam. RGB value should be converted to gray scale. The RGB represents the red, green, blue which determines the color of the image pixel. Each of the RGB having pixel values in between 0-255.

B. RGB to Grayscale

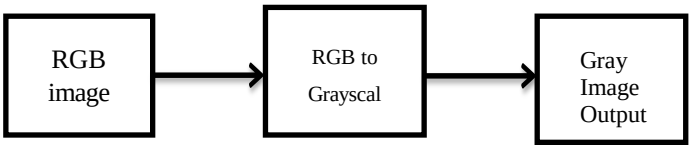
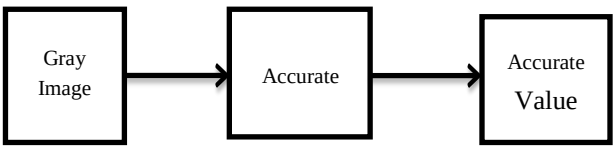


Fig 4b: RGB image to Grayscale conversion

An RGB image is converted into gray scale image. We convert this RGB image to Gray because editing is easy when the image is in Gray Scale format. For converting the color image into grayscale, we find the average and replace the RGB pixel. The formula is I=(R+G+B)/3. When the image is converted to Gray Scale it exists in matrix format. In gray scale image, the value of each pixel represents an amount of light.

C. *Thresholding*



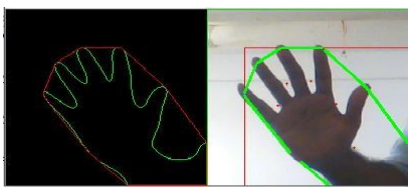


Fig 4 c: Adaptive Gaussian Thresholding, Threshold image.

Thresholding is a method used for converting an image to binary image. Under Thresholding there are three types: (i) Normal Thresholding (ii) Adaptive mean Thresholding (iii) Adaptive Gaussian Thresholding. In our project we are using the Adaptive Gaussian Thresholding and Otsu's Thresholding. Both the algorithms run at a time and it takes the best output.

Adaptive Gaussian Thresholding is used because it is used to find the edges in depth or for accurate values. Otsu's Thresholding involves iterating through all the possible threshold values and calculating a measure of spread, And for the pixel levels each side of the threshold, i.e., the pixels that either fall in foreground or background.

D. Contours :

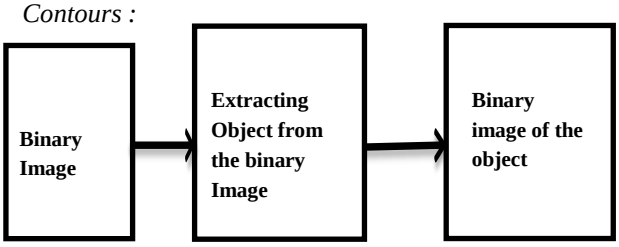


Fig 4 d: Binary image Contours

It is a curve joining all continuous points having same colour or intensity. In the binary image, the object colour is represented as white and background is made as black. Contours find the white object from black background from the binary image input. Contour training is the technique or a method which is applied to digital image to

Extract their boundary. The contour pixels are small subset of total number of pixels that represents a pattern.

V. RESULTS

Having segmented the hand region from the live video sequence, we will make our system to count the fingers that are shown via a camera/webcam. The output is produced based on the gradient formed on the input screen. For each gradient we are displaying message in English on the output screen. We have also worked on displaying messages in other languages which includes Hindi and Kannada on the python shell. Messages can also be altered and displayed based on the user requirements.

Fig 5a: Gradient points, b: Output message in Kannada, c: message in Hindi

For the above gesture, we are printing "Please help me" text on the screen. On the Python shell, we have made it possible to print the message in three different languages which includes Hindi English and Kannada in Unicode. The accuracy what we got in the above results is 96%.

VI. CONCLUSION

In this paper we are introducing Hand Gesture Recognition, which will display messages based on the input gestures. All input images are captured by web camera. The proposed system doesn't require to be trained every time. For each gradient a message is displayed in English on the output screen and other languages that include Hindi and Kannada on python shell. Messages can also be altered and displayed based on the user requirements. One of the advantage of the system is that the individual can add new languages based on their comfort and understanding. The output text is displayed on the screen based on the gesture showed to the camera.

REFERENCES

[1] Joyeeta Singha, Karen Das "*Recognition of Indian Sign Language in Live Video*", IJCA Transaction, Vol.70,Issue.19,**pp.17-22,2013**.

[2] Sakshi Lahoti, Shaily Kayal, Sakshi Kumbhare, Ishani Suradkar, Vikul Pawar1 S. Willium, "*Android based American Sign LanguageRecognition System with Skin Segmentation and SVM*", IEEE Transaction, IEEE Transaction,**pp.1-6, 2018.**

[3] Nico Zengeler, Thomas Kopinski, Uwe Handmann "*Hand Gesture Recognition in Automotive Human–Machine Interaction Using Depth Cameras*", MDPI Transaction, **pp.1-28, 2012**.

[4] Anant Agarwal, Manish K Thakur "*Sign Langauage Transaction using Microsoft Kinect* ", IEEE Transaction, **pp.181-185.**

[5] Zaher Hamid Al-Tairi, Rahmita Wirza Rahmat, M. Iqbal Saripan, Puteri Suhaiza Sulaiman, *"Skin Segmentation Using YUV and RGB Color Spaces"*,KIPS Tranaction,**pp.283-299.**
[6] Houssem Lahiani, Mohamed Elleuch, Monji Kherallah, *"Real Time Hand Gesture Recognition System forAndroid Devices"*, IEEE Transaction,**pp.591-596.**
[7] Prajwal Paudyal, Ayan Banerjee, and Sandeep K.S. Gupta, "SCEPTRE: a Pervasive, Non-Invasive, and Programmable Gesture Recognition Technology",Impact Transaction,**pp.1-12.**
[8] Dipali Rojasara, Nehal Chitaliya, *"Real Time Visual Recognition of Indian Sign Language using Wavelet Transform and Principle Component Analysis",IJSCE* Transaction,Vol.4,Issue.3,**pp.17-20.**
[9] *Pooja Kiranalli, Dr. S. R. Gengaje, "Real time Indian Sign Language Number Recognition System",*IJRTER Transaction,Vol.2, Issue.6;**pp.200-205.**
[10] Kumud Tripathi, Neha Baranwal and G. C. Nandi, *"Continuous Indian Sign Language Gesture Recognition and Sentence Formation",IMCIP* Transaction, **pp.523-529.**
[11] Kartik Shenoy, Tejas Dastane, Varun Rao, Devendra Vyavaharkar, "Real-time Indian Sign Language (ISL) Recognition", IEEE Transaction,2018
[12] Kartik Shenoy, Tejas Dastane, Varun Rao, Devendra Vyavaharkar, "Real-time Indian Sign Language (ISL) Recognition",IEEE Transaction,2018,**pp.1-9**

Authors Profile

Mr.Rakesh B S, I completed BE (ISE) and MTech (SE) from VTU. Currently working as Assistant Professor in the department of Computer Science and Engineering, Brindavan College of engineering, Bangalore. I published more than 10 papers in International conferences and Journals respectively. My research area is Networking, Cloud Computing, IOT, and Image Processing.

S.Tamilarasan: He is received the B.E(CSE) degree from Madras University, Chennai, Tamilnadu, India, M.E(CSE) degree from Anna University, Chennai, India, Currently doing doctoral degree in Centre for Information Technology and Engineering, Manonmaniam Sundaranar University, Tirunelveli, Tamil Nadu, under the guidance of Dr.P.Kumar, Assistant Professor, Information Technology and Engineering, Manonmaniam Sundaranar University, Tirunelveli, Tamil Nadu. Presently I am working as Associated Professor, Department of Computer Science and Engineering, Brindavan College of engineering, Bangalore.

***Specialization*:**
Mobile computing, Advanced Data Structure, Design and analysis of algorithm, Computer networks,

Research Area:
His interesting research field is Cognitive Radio Network, Mobile wireless Ad-Hoc Networks.

Mr. Avinash. N, I completed BE (ISE) and MTech (CSE) from VTU. Currently working as assistant professor in the department of computer science and engineering, Brindavan College of engineering, Bangalore. I published more than 20 papers in international conferences and journals respectively. My research area is image processing and machine learning.

