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Sign Language Recognition for Deaf & Dumb

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Abstract— One of the most precious gifts of nature to the human breed is the ability to express himself by responding to the events occurring in his surroundings. Every normal human being sees, listens and then reacts to the situations by speaking himself out. But there are some less fortunate ones who are deprived of this valuable gift. Such people, mainly the deaf and the dumb, rely on some sort of sign language for communicating their feelings to others. The deaf, dumb and the blind follow similar problems, when it comes to the use of computers. In the era of advanced technologies, where computers, laptops and other processor based devices are an integral part of day to day life, efforts are required to be done for making the disables more independent in life. Our aim is to design a human computer interface system that can recognize language of the deaf and dumb accurately. The recognition procedure of gesture P is studied in detail in this paper.

Keywords—ASL (American Sign Language), Edge detection, Gray scale image, HCI (Human Computer Interface), pixels, SLRS (Sign Language Recognition Systems)

I. INTRODUCTION

Sign Language is a non verbal method of communication in which gestures are made using hands. Gestures are an integral part of our day to day communication and some expressions are conveyed by gestures only. Rising of eyebrows, shrugging of shoulders, nodding of head are some commonly used gestures. Sign language is a more organized form than gestures. Various commonly used sign languages are ASL (American Sign Language), BSL (British Sign Language) and ISL (Indian Sign Language). There is no one standard form of sign language and it varies from region to region. We have selected a sample sign language. Since English is the standard language that is used all over the world for computer keyboards, so our sample sign language is based on English vocabulary. There are 26 alphabets in the English vocabulary. Each alphabet is assigned a unique gesture using hands. The gesture may be single hand gesture or double hand gesture. Gestures using both hands can make 210 = 1024 signs. In this project we have used single handed gestures only. From the literature review, it has been observed that some project has been designed that recognizes all but five gestures accurately [1]. Work has been done to improve the recognition rate of these five gestures to 100%.

II. SYSTEM DESIGN

The project is implemented using a simple web camera. Image of the signing hand is acquired and processed using various image processing techniques like gray scaling, edge detection, joining discontinuities and peak detection. After the number of peaks is detected simple if-else rue is applied for recognition. The gestures selected for classification are of alphabets A, D, J, O and P. The idea may be implemented by the chart shown in figure 1.

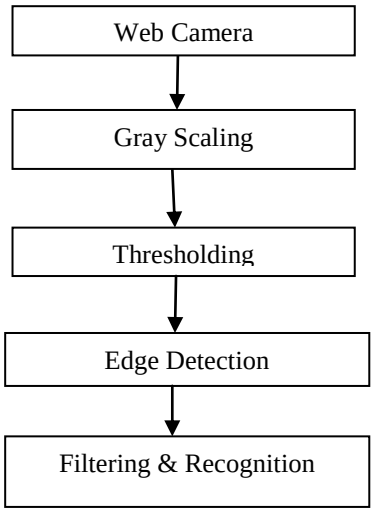


Fig. 1 System Design

A. Camera Initialization & Image Processing

As has been already discussed, the image is acquired using a simple web camera. Image acquisition [2] devices typically support multiple video formats. When we create a video input object, we can specify the video format that you want the device to use. If the video format as an argument is not specified, the video input function uses the default format. The imaqhwinfo function is used to determine which video formats a particular device supports and find out which format is the default. As an alternative, we can specify the name of a device configuration file, also known as a camera file or digitizer configuration format (DCF) file.

Fig. 2 Acquired RGB Image, Gesture 'P'

The acquired image is then converted into gray scale. The edges are detected in the binary image.

B. Gray Scaling & Thresholding

The RGB image is then converted into gray scale image as it occupies lesser space and is easier to deal with.

Fig. 3 Gray Scale Image Gesture 'P'

A gray scale image has equal intensities of all the three colours. So a gray scale image is represented by a single matrix. The gray scale image is then converted into logical image. a logical image is a black and white image in which there are only 2 levels '0'& '1'.

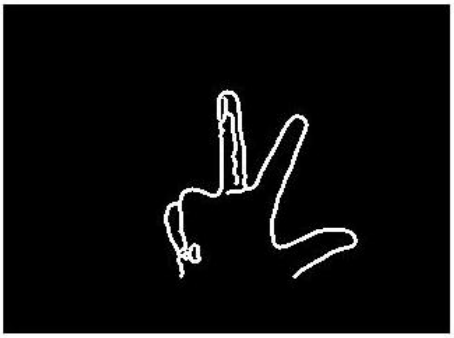


Fig. 4 Black & White Image Gesture 'P'

The edge detection is done on a logical image. The purpose of edge detection in general is to significantly reduce the amount of data in an image, while preserving the structural properties to be used for further image processing.

Canny edge detection was developed by John F. Canny (JFC) [3] in 1986. Even though it is quite old, it has become one of the standard edge detection methods and it is still used in research. The Canny edge detector works on gray scale image. In image processing finding edge is fundamental problem because edge defines the boundaries of different objects. Edge can be defined as sudden or strong change in the intercity or we can say sudden jump in intensity from one pixel to other pixel. By finding the edge in any image we are just reducing some amount of data but we are preserving the shape. The Canny edge detection algorithm is known as the optimal edge detector.

C. Edge Detection & Recognition

Canny, improved the edge detection by following a list of criteria. The first is low error rate. Low error rate means edges occurring in images should not be missed and that there are NO responses to non-edges. The second criterion is that the edge points be well localized. In other words, the distance between the edge pixels as found by the detector and the actual edge is to be at a minimum. A third criterion is to have only one response to a single edge [4]. This was implemented because the first 2 were not substantial enough to completely eliminate the possibility of multiple responses to an edge. Based on these criteria, the canny edge detector first smoothes the image to eliminate and noise. It then finds the image gradient to highlight regions with high spatial derivatives. The algorithm then tracks along these regions and suppresses any pixel that is not at the maximum (non maximum suppression). The gradient array is now further reduced by hysteresis. Hysteresis [5] is used to track along the remaining pixels that have not been suppressed. Hysteresis uses two thresholds and if the magnitude is below the first threshold, it is set to zero (made a non edge). If the magnitude is above the high threshold, it is made an edge. And if the magnitude is between the 2 thresholds, then it is set to zero. The resulting image contains a number of discrete objects. The discontinuities are joined using k- Nearest Neighbour search.

Classification of the recognized gesture may be done by using simple if – then rule. In this program MATLAB if-else condition is being used. Once the gesture has been classified it may be converted into text or speech [6] [7].

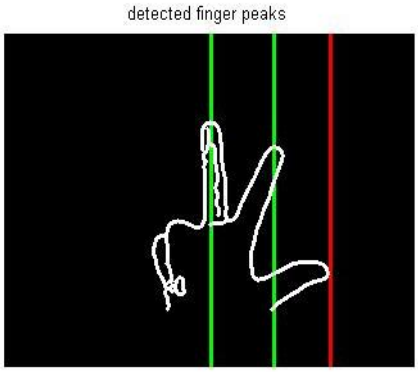


Fig. 5 Detected Peaks Gesture 'P'

The wavplay function [8] may be used to play the audio signal stored on PC- based audio output device. The audio signal can be of four data types.

III. RESULT & CONCLUSION

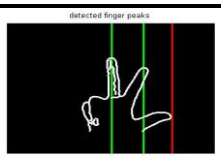
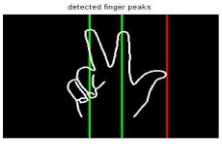
The project is designed for 5 gestures [9]. The recognition rate of all the gestures is improved to perfect 100%. The results are calculated by following some simple rules.

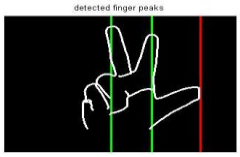
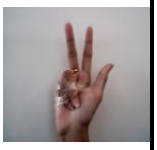
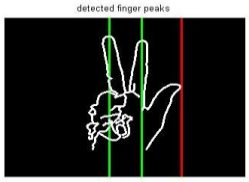
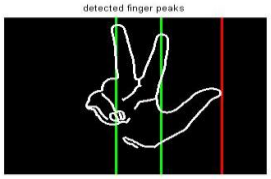
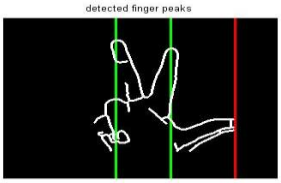
- The gesture is made using right hand only.
- The camera is at a distance of at least 1feet from the camera.
- The background of the image is plain without any external objects.
- The hand is in approximate centre.

In this paper the results of gesture P have been studied in detail. The gesture P is tested on 6 sample images. The recognition rate and time of the gestures made by different persons under different lighting conditions are shown in table 1.

It is shown that the designed project successfully identifies gestures of different hands of different sizes with images captured under different environments but by following the above given rule set.

TABLE I
RECOGNITION RATE AND TIME, GESTURE 'P'

Sr. No.	Sample Image	Recognized Image	Recognition Rate	Recognition Time (sec)
1.			100%	1.58
2.			100%	1.56

3.			100%	1.65
4.			100%	1.55
5.			100%	1.54
6.			100%	1.52
Average			100%	1.57 seconds

The average recognition time is reduced appreciably from the previous works to 1.57 seconds and the average recognition rate is perfect 100%. The recognition time may be further reduced by using less time consuming instructions.

Much is needed for making the lives of the deprived more independent. This is a small step in this direction.

References

[1] Meenakshi Panwar, *Hand Gesture Recognition System based on Shape parameters*, International Conference on Recent Advances in Computing and Software Systems, pp. 80-85, February 2012.

[2] Meenakshi Panwar , P.S. Mehra, *Hand Gesture Recognition for Human Computer Interaction*, IEEE International Conference on Image Information Processing, pp. 1-7, November 2011.

[3] Claudia Nölker and Helge Ritter, *Visual Recognition of Hand Postures*, in Proceedings of international Gesture Workshop on Gesture-Based Communication in Human Computer Interaction, pp. 61-72, July 2002.

[4] M. Ghosh, R. Vijaya , M. Kabra, *Genetics of deafness in India*, The Indian Journal of Pediatrics, vol. 7, number 6, 2004.

[5] Rohit Verma, Ankit Dev, *Vision based Hand Gesture Recognition Using Finite State Machines and Fuzzy Logic*, IEEE International Conference on Ultra Modern Technologies, pp 1-6, October 2009.

[6] Sanjay Meena, *A Study of Hand Gesture Recognition Technique*, Master Thesis, Department of Electronics and Communication Engineering, National Institute of Technology, India, 2011.

[7] R. Sharma, T.S. Huang, *Visual Interpretation of Hand Gestures for a Human-Computer Interaction: A Review*, IEEE Transactions on Pattern Analysis and Machine Intelligence, vol. 19, pp. 677-695, July 1997.

[8] T.T. Swee, A.K. Ariff, S.H. Salleh, Siew Kean Seng, Leong Seng Huat, *Wireless data gloves Malay sign language recognition system*, International Conference on Information, Communications & Signal Processing, pp. 1-4, December 2007.

[9] Aditi Kalsh, N.S Garewal, *Sign Language Recognition System*, International Journal of Computational Engineering Research, pp. 15-21, vol. 3.

