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Gesture recognition for deaf and dumb

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ABSTRACT

Sign language is a means of communication used by individuals with hearing impairment. Other people who don't know sign language find it difficult to understand the gesture formats and communicate back to individual with impairment. Many countries across the world have their own languages of sign such as American Sign Language. The proposed idea here helps non-sign-language speakers to recognize and understand the sign language. Initially, the gestures or the signs are captured and then processed further and the particular features of differentiation are obtained and the end result is displayed to the person who has no knowledge of gestures. And this makes it easy for the normal person to understand the gesture and communicate.

Keywords: Hand gesture, impairment, non-sign language, sign language.

I. INTRODUCTION

The hand gesture recognition is means of communication for the impaired ones but hand gestures is one of the prime methods for communication. Not only as a means of communication for the impaired ones but in many other environment where speech communication is not possible, hand gestures can deliver the messages to achieve the purpose of communication.

Hand gesture is one of best way to communicate for people with disability to speak and communicate with others. A gesture in a sign language is a particular moment of hand with which specific shapes are made out of them. A design for recognizing the sign formats and interpreting them is done. This acts as a means between the impaired ones and the others being successful in conveying the information rendered by the impaired ones to the normal person.

II. PROPOSED SYSTEM

The hand gestures are captured using camera. Captured gestures are checked for occlusion and finer motions to distinguis and perceive legitimate motions and eliminate any deviating discontinuous part at the end. Along with the gesture formats, an additional content conversion is given. In case of hard of hearing, where it is hard to analyze lip reading, the sound information is taken from microphone and is compared with the google dataset. The corresponding outcome is shown as content on the display.Steps involved in "Hand gesture recognition" is given below.

1. Image is captured using web camera.
2. Image processing technique is applied to detect the hands and Gesture and some console based operation are performed.

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a. Edge Detection: Edges are the sharp black shadow surrounding the objects.
b. Threshold Control: for controlling sharpness of edges.
c. Finding Contours, contours are nothing but shadow areas of hand.
d. Set the proper beginning of the contours.
e. Detect Convexity Defect in the picture. Defects are the points which are having thick edges.
f. Detect Convexity Defect ending points for the tip of the hand detection.
g. Draw Circles on the defects obtained.
h. Save the Co-ordinates of the Defects obtained in each areas.

3. Background Subtraction is done for clearing background.

III. METHODOLOGY

Fig 1: Sequence of System Architecture

A. Pre-Processing

Pre-processing is required on every image to enhance the functionality of image processing. Captured images are initially in the RGB format. The pixel values and the dimensionality of the images that are captured are very high. RGB image is converted into Gray image using “rgb2gray” function. Image segmentation technique is used on the Binary image to detect the hand region.

Segmentation is then done to divide image into two regions, background and the foreground of the image. The segmented image has the hand region with the pixel value ‘1’ and the background as the ‘0’. The image is then used as a mask to fetch the hand region from the RGB image by multiplying the black and white image i.e. binary image with the original RGB image. The image is then resized to reduce size of the matrix used for the recognition process. The obtained images are then converted into column matrix for feature extraction.

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B. Feature Extraction

Feature extraction is one of the most significant steps in recognition stage as the size of the data dimensionality is reduced in this particular stage. In feature extraction the image is converted into column matrix, for all the images the column matrix is formed and then combined to form single matrix, then mean of matrix is calculated.

IV.MODULE IMPLEMENTATION

***A.* RGB to Gray Scale Conversion**

Each image captured using camera would be in RGB format. The range of Red is 0 to 255, range of Green is 0 to 255 and range of Blue is also 0 to 255. RGB image is converted into Gray scale, since processing a gray scale image with binary values is easier than RGB values. The formula used 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.

***B.* Edge Detection**

Edge Detection is done to identify the points in a digital image, where the brightness of the image changes sharply, that points are typically organized into a set of curved line segments termed edges. In image processing edge detection is a fundamental tool, also computer vision.

The edges extracted from a 2-D image can be classified as either viewpoint dependent or viewpoint independent. A viewpoint independent edge reflex inherent property of 3-D objects and a view point dependent edge may change as when viewpoint changes.

***C.* Threshold**

Frequently many layers of processing is done. And final decision step is choosen to know about the pixels in an image or to categorically reject those pixels below or above some value while keeping the others.

The OpenCV function cvThreshold() accomplishes these tasks. The basic idea is that in a given array along with a threshold, and then some changes happens to every element of the array depending on whether it is below or above the threshold. The cvThreshold() function handles only 8-bit or floating-point grayscale source images.

***D.* Contour**

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. Hence, the computation amount is reduced as feature extraction algorithm is run in contour instead of a whole pattern as. This contributes to efficiency of feature extraction process.

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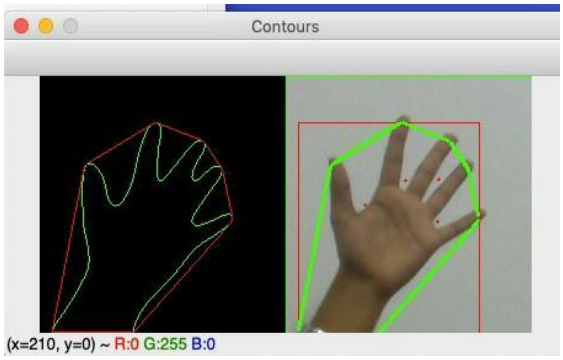

Fig 2: Detected contour of hand gesture

***E.* Convex hull**

The convex hull of hand gesture contour is the convex polygon surrounded by all the convex vertices in gesture contour, as shown in Fig 3, the polygon composed by red curve is the convex hull of hand gesture in the figure, and other is separated convex hull extracted from.

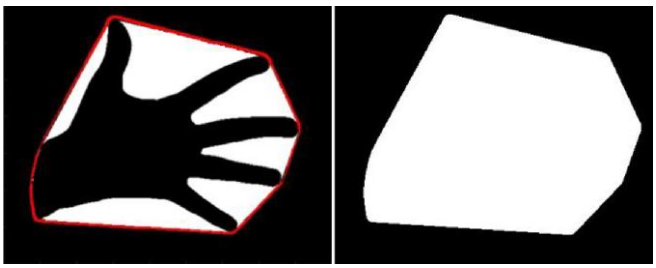

Fig 3: Convex hull of hand gesture

***F.* Convex defect**

The convex defect is defined as the difference between gesture convex hull and contour, they are contained in the convex hull but not hand area. As shown in Fig 5, the white areas ① to ⑥ are the convex defects. The structure of each of the convex defects contains three components: start contour point, end contour point and concave contour point. For example, for convex defect ②, P1 is its start contour point which is the starting point of the defect，P2 is its end contour point which is the termination point of the defect, and P3 is the concave point which is the furthest point away from the convex hull, and the furthest distance is the depth of convex defect.

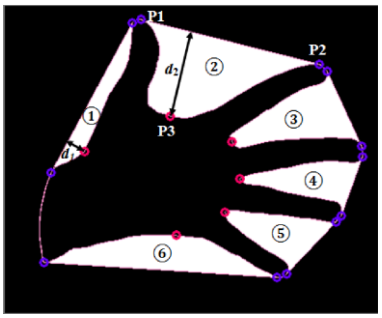

Fig 4: Convex defects of hand gesture

V. RESULT

The result obtained after implementing the depicted modules is shown in figure 5.It displays a default message when the system recognizes that all five fingers are up.

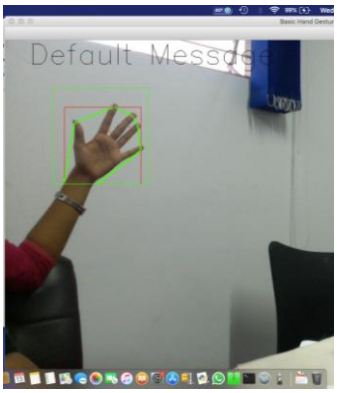

Fig 5: Gesture recognition and message display

VI. CONCLUSION

People with disabilities such as hearing impairment and speech make use of sign language to communicate. Signs, such as hand gestures are now-a-days used in many sign languages. This project mainly helps special persons to communicate easily with the others who have no knowledge of Sign Language. The accuracy of the system depends on the illumination conditions. Under good illumination and plain light colored background nearly 94% accuracy can be achieved.

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