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Gesture recognition for deaf and dumb

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ABSTRACT

Individuals with hearing loss utilise sign language as a form of communication. Other people who don't know sign language have a hard time understanding the gesture formats and communicating with the disabled person. Many countries, such as the United States, have their own sign languages, such as American Sign Language. The suggested solution aids non-sign language speakers in recognising and comprehending sign language. The gestures or signs are first taken, then processed further to extract the specific elements of distinction, and the final output is shown to someone who is unfamiliar with gestures. This makes it simple for the average individual to comprehend and communicate using the gesture.

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

I. INTRODUCTION

Hand gesture recognition is a form of communication for the visually handicapped, although hand gestures are one of the most common ways to communicate. Hand gestures can carry messages to achieve the objective of communication not just for the hearing impaired, but also in many other situations when spoken communication is not feasible.

Hand gestures are one of the most effective ways for persons with disabilities to communicate with others. In sign language, a gesture is a precise instant of hand movement that produces distinct forms. A design for identifying and interpreting sign forms has been completed. This serves as a link between those who are impaired and those who are effective in communicating the information provided by the impaired 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.
    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.

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 perspective dependent or viewpoint independent edges retrieved from a 2-D picture can be categorised. A perspective independent edge reflex is a 3-D object's intrinsic characteristic, while a view point dependent edge may vary as the 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.

These tasks are accomplished using the OpenCV function cvThreshold(). The fundamental principle is that given an array and a threshold, each member of the array undergoes various modifications based on whether it is below or over the threshold. Only 8-bit or floating-point grayscale source pictures are supported by the cv Threshold method.

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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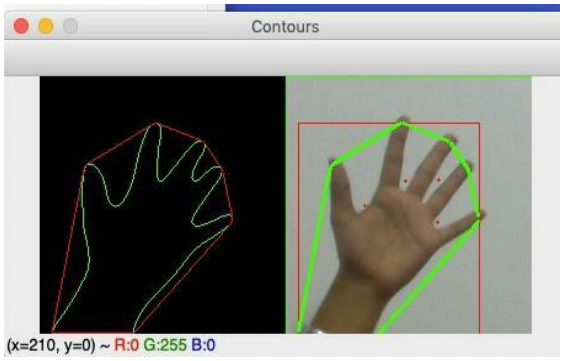

Fig 2: Detected contour of hand gesture

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.

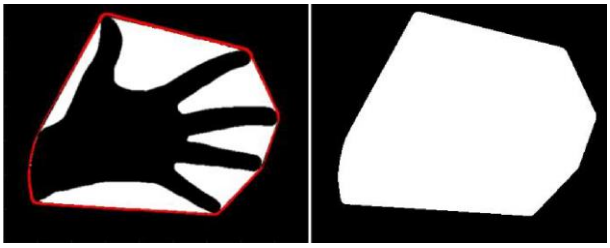

Fig 3: Convex hull of hand gesture

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. Each convex defect is made up of three parts: a start contour point, an end contour point, and a concave contour point. For convex defect 2, P1 is the start contour point, which is where the defect begins, P2 is the end contour point, which is where the defect ends, and P3 is the concave point, which is the farthest point away from the convex hull, and the furthest distance is the depth of the convex defect.

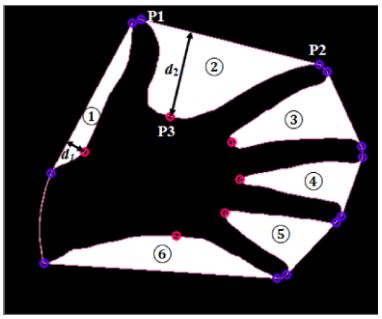

Fig 4: Convex defects of hand gesture

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.

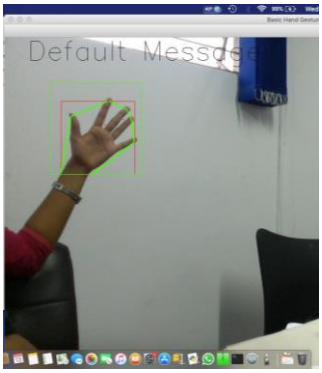

Fig 5: Gesture recognition and message display

VI. CONCLUSION

Sign language is used to communicate by people with impairments such as hearing loss and speech difficulty. Many sign languages currently utilise hand gestures as well as other signs. This initiative primarily aims to make it easier for people with disabilities to communicate with individuals who do not speak Sign Language. The system's accuracy is determined on the lighting conditions. Nearly 94 percent accuracy may be attained with ideal lighting and a basic light coloured backdrop.

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