MODELS AND ROBOTICS SECTION

Srishti 2020

Project Report:

HAND GESTURE RECOGNITION

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I. Abstract:

This project deals with the detection and recognition of hand gestures. Images ofthe handgesturesaretakenusingawebcameraandrecognised according to certain threshold values. Gesture recognition is one of the essential techniques to build user-friendly interfaces. For example, a robot that can recognize hand gestures can take commands from humans, and for those who are unable to speak or hear, having a robot that can recognize sign language would allow them to communicate with it. Hand gesture recognition could help in video gaming by allowing players to interact with the game using gestures instead of using a controller. However, such an algorithm needs to be more robust to account for the myriad of possible hand positions in three-dimensional space. It also needs to work with video rather than static images. That is beyond the scope of ourproject.

II. Overview:

DistanceTransform:Thedistancetransformisanoperator normally only appliedto
binary images. The result of the transform is a grayscale image that looks similar to
the input image, except that the intensities of points inside foreground regions are
changed to show the distance to the closest boundary from eachpoint.

Contours:Contoursaresequencesofpointsdefininga line/curve in animage. Contourmatchingcanbeusedtoclassifyimageobjects.

Database:Containstheimagesofvarioushandgestures.

Moments:Imagemomentsareusefultodescribeobjects after segmentation.Simple properties of the image, which are found via image moments, include area (ortotal intensity), its centroid and information about its orientation.

Ratio of the two distance transformed images of the same size = (No of pixels whose difference is zero or less than a certain threshold) / (Total number of pixels in the distance transformed image)

III. Design:

Step1: User input a picture of the hand to be tested through the Webcamera.

Step 2: The image is converted into gray scale and smoothed using a Gaussian kernel.

Step 3: Convert the gray scale image into a binary image. Setathresholdsothatthe
pixels that are above a certain intensity are set to white andthosebelowaresetto
black.

Step 4: Find contours, then remove noise and smooth the edges to smooth big
contours and melt numerous small contours.

Step 5: The largest contour is selected as a target.

Step 6: The angles of inclination of the contours and also the location of the centerof
the contour with respect to the center of the image are obtained through the
bounding box information around the contour.

Step 7: According to certain threshold values of the aspect ratio and counter area, image is recognised and caption is provide according to the result.

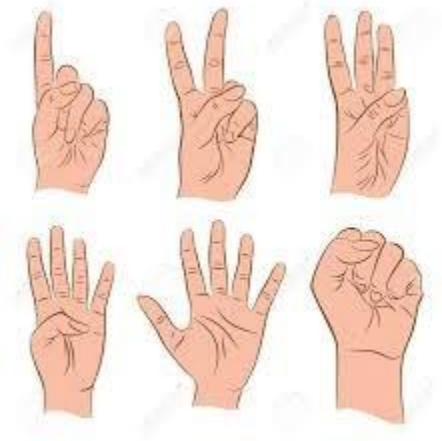
Step 8: The results are transferred to the bot through ardunio.

IV. Constraints:

1. The picture of the hand must be taken against a dark background
2. The program recognizes a limited number ofgestures.

V. InputGestures:

In our experiment, we will be identifying limited number of gestures, which is
shown asbelow.



VI. Results:

In the above case, we can see the query image on the left handsiderecognisebytheprogram.

VIII.Conclusion:

Based on our observation, we can conclude that the results mainly depend on:

1. Threshold, while converting the gray image to the binary image andfinding
contours. For example found that uneven lighting across the picture of the hand
caused the algorithm to draw contours around the darkened areas in addition to the
contour around the hand. Changing the threshold prevented that from happening.

2. The threshold for the Ratio test while matching the distance transformedimages.

3. The background, which must preferably be black to get accurateresults.

XI.SomeMain OpenCV Functions used in theprogram:

1. To find the number of Contours in the image

intcv2.findContours(...)

2. To compute the Convex Hull and Convexity Defects of theHull

cv2.convexityDefects(. . .)

3. To find bounding box's height, width and

centercv2.boundingRect(. ..)

4.To Find the Counter Area

cv2.contourArea(…)

5. To show images

cv2.imshow(...)

XV: OutsideSources

1. The hand gesture images were taken from Google Images.
2. https://youtu.be/uEd2B7fS8Eg3
.
https://github.com/vishwajeetsinghrana8/OpenCV/blob/master/Hand_Gesture/Hand_Gesture_Ex2.py
4.https://www.youtube.com/playlist?list=PLkMYhICFMsGajeARsY7N1t1jhbtMb1poL