Recognizing Gesture of an Object in an Image

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1. INTRODUCTION

Object recognition is concerned with determining and identifying an object from a set of known labels. As one of the most challenging task in computer vision research is to tell a story from a single image or a sequence of images, object recognition has been studied for more than four decades. Significant works have been done in order to develop representation schemes and algorithms focussing at recognizing objects in images taken under different conditions such as viewpoint, illumination, and occlusion. Areas with limited scope such as handwritten digits, fingerprints, faces, and road signs, substantial success has been achieved.

The main objective of object recognition is, to build a system which can tell specific identity of a system. The contributed factors in the problem of object recognition are: relative pose of an object to a camera, lighting variation, and difficulty in generalizing across objects. It also deals with the regularities of images, taken under different lighting and pose conditions, are extracted and recognized. This is the aspect that we are going to focus upon in the current work. The problem of object gesture recognition deals with dividing an image into subparts depending on certain features such as boundaries, contour, colour, intensity or texture pattern, geometric shape or any other pattern. The different methods used in the object recognition are discussed below.

1.1 Image Segmentation

Dividing an image into distinct regions, each region is characterized unique feature such as intensity, colour etc., is known as the segmentation. Furthermore, it indicates the process of dividing a digital image into multiple segments like sets of pixels. Image segmentation may be defined as a process of assigning pixels to homogenous and disjoint regions which form a partition of the image that share certain visual characteristics with various applications like that in multimedia.

1.2 The Hough Transform

The Hough Transform was first devised in 1962 as a means of detecting the paths of high energy particles. It has been applied to many different image processing applications and has evolved immensely. This technique transforms the complex patters of pixels present in an image domain into compact feature of a chosen parameter space. The transformation helps in mapping many points in the image space with single points in the parameter space. This means that searching for complex patterns of pixels is simplified by working in the parameter space and that the technique is robust to some loss of data due to occlusion and other sources of noise.

1.3 Edge Detection

Edges define the boundaries between regions in an image. It detects the edges of the objects. It helps in object recognition and image segmentation. Edge detection produces an edge map which contains important information about the image. There are many ways to perform edge detection for example Gradient based edge detection and Laplacian based edge detection. There are various other popular edge detection techniques available, for example Sobel Edge Detection, Prewitt Edge Detection, Robert Edge Detection, Canny Edge Detection etc. However, Canny's Edge Detection algorithm performs better than Sobel and Prewitt Operators. The Canny Edge Detector is widely considered as the standard Edge Detection algorithm in image processing.

2. PROPOSED METHOD

The work proposed here deals with both shape detection and colour labelling on objects in images. The method used here is L*a*b colour space along with the Euclidean distance to tag, label, and determine the colour of objects in images. Lab colour space is a colour opponent space with dimensions L for lightness and *a* and *b* for the colour opponent dimensions, based on nonlinearly compressed coordinates. The L*a*b colour space includes all perceivable colours, which means that its gamut exceeds those of the RGB and CMYK colour models.
The proposed method is divided into two parts – Labelling the image and Defining the colour labelling and shape detection process.

2.1 Labelling the Image

Step 1: Initializing a colour dictionary that specifies the mapping of the colour name (the key to dictionary) to the RGB tuple (the value of the dictionary)
Step 2: Conversion of RGB colour space to the L*a*b colour space
Step 3: Defining the label method, this requires 2 arguments: the shape we want to compute and the contour regions of the image
Step 4: Constructing mask for contour regions, here 2 steps involved:

- i) The foreground region of the mask is set to white, and the background is set to black
- ii) The region within the mask will be computed

Step 5: Mean or average is computed for each of the L*, a*, and *b* channels of the image for only masked regions
Step 6: Euclidean distance is calculated between each known colour and the average colour, and then the colour name with the smallest Euclidean distance is returned.

2.2 Defining the Colour Labelling and Shape Detection Process

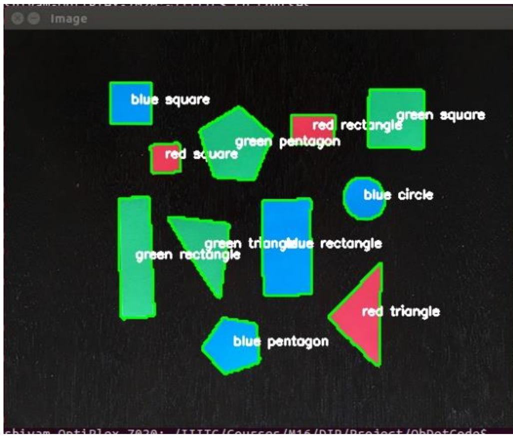
Step 1: Loading the image from disk and then creating a resized version, also keeping the track of the information of the original height.
Step 2: Resizing the image, so that our contour approximate is more accurate for shape identification.
Step 3: Applying Gaussian smoothing to the resized image, converting to grayscale and L*a*b, and finally thresholding to get the shapes in the image.

At last using the contour, we can detect the shape of the object, followed by its colour. Finally the contours of the various shapes are drawn after restoring them by multiplying them with the aspect ratio and the name of the shape and labelled colour on the image

3. OBSERVATION & RESULTS

The implementation was executed in parts. The code converts the input image to binary. This binary image is then processed to determine object boundaries. The code was executed for above input image. The different polygons were identified correctly. The algorithm was also successful in identifying the colour.

Reference Case



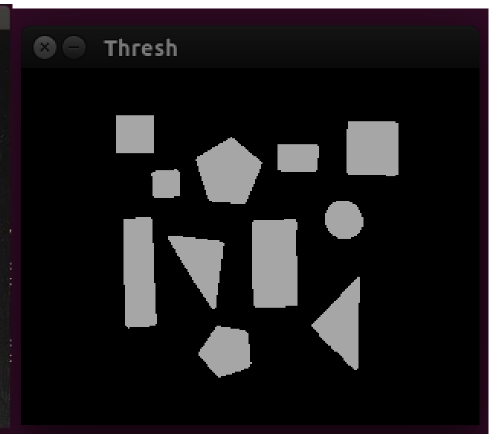


Fig. 1a Detection Image

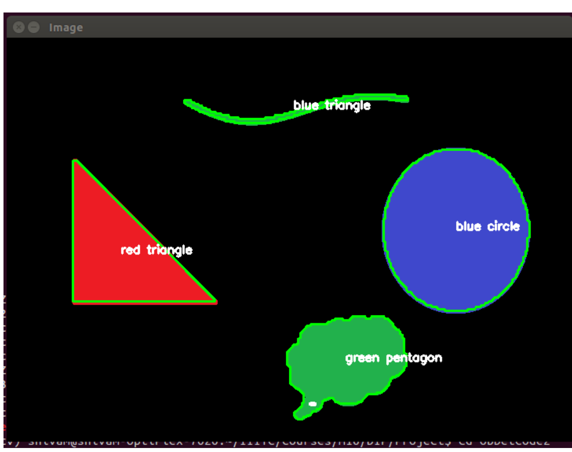
Fig. 1b Threshold Image

The reference query image (shown above) included the following components

S. No.	Shapes	Colors
1	Square	Blue, Green and Red
2	Circle	Blue
3	Rectangle	Green, Blue and Red
4	Triangle	Green and Red
5	Pentagon	Blue and Green

With this query image, the shapes are regular and the meta-data is defined within the dataset. Therefore, the shape detection and colour labelling has accuracy of **100%.**

Test Case:



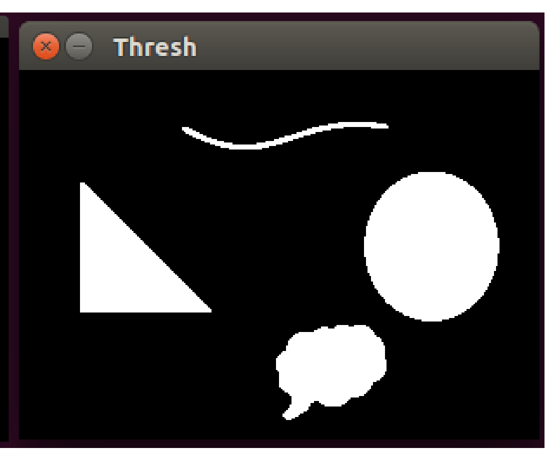


Fig. 2a Detection Image

Fig. 2b Threshold Image

S. No.	Shapes	Colours
1	Open curve	Green
2	Circle	Blue
3	Cloud Shape	Green
4	Triangle	Red

In the table given above, the shapes no. 1 and 3 are *irregular* and for which the contour data is not defined within our meta-data in the shape detection module. There the detection made here is erroneous, and with the accuracy of **50 %.**

4. CONCLUSION

The problem of recognizing object from background is consists of detecting the edge and subsequently segmenting the image. The problem of object recognition involves generating discriminative features of the image and comparing with the features in the database. To recognize the objects with regular shape, a geometry based relationship can be defined. This does not involve extracting feature vector and subsequent classifier based learning. In the current work, only the regular shapes are being detected with 100 % accuracy, whereas the second test case, we are able to have only 50 % accuracy. The current implementation is not able to identify the open contour images. It is also established that the limitation of the data size poses a big problem that can be removed by upgrading our data set. In the problem discussed here, geometric relationship in standard polygon was used to detect the shape.

5. REFERENCES

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