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Shape Recognition Based On Features Matching Using Morphological Operations

Shikha Garg[1], Gianetan Singh Sekhon[2]
[1](Student, M.Tech Department of Computer Engineering, YCOE, Punjabi University, Patiala, India)
[2](Assistant Professor, M.Tech Department of Computer Engineering, YCOE, Punjabi University, Patiala, India)

Abstract: This paper presents the implementation of method of shape recognition among different regular geometrical shapes using morphological operations. Many algorithms have been proposed for this problem but the major issue that has been enlightened in this paper is over segmentation dodging among different objects. After an introduction to shape recognition concept, we describe the process of extracting the boundaries of objects in order to avoid over segmentation. Then, a shape recognition approach is proposed. It is based on some mathematical formulae. Our new algorithm detects the shapes in the following cases when (i) There are distinct objects in the given image. (ii) The objects are touching in the given image. (iii) The objects are overlapping in the given image. (iv)One object is contained in the other in the given image. Then with the help of boundaries concentrate and shape properties, classification of the shapes is done.

Keywords: Edge detection, geometrical shapes, morphological operations, over segmentation, Shape recognition.

I. Introduction

In an image, shape plays a significant role. Shape of an image is one of the key information when an eye recognizes an object. Shape of an image does not change when colour of image is changed. Shape recognition finds its applications in robotics, fingerprint analysis, handwriting mapping, face recognition, remote sensors etc [6]. In pattern recognition shape is one of the significant research areas. Main focus of the pattern recognition is the classification between objects.

In a computer system, shape of an object can be interpreted as a region encircled by an outline of the object. The important job in shape recognition is to find and represent the exact shape information. Many algorithms for shape representation have been proposed so far.

Many methods for 2D shape representation and recognition have been reported. Curvature scale space (CSS), dynamic programming, shape context, Fourier descriptor, and wavelet descriptor are as the example of these approaches [8]. There are two methods for shape recognition, area based and boundary based technique. In area based technique, all pixels within the region of image are taken into consideration to get shape representation. Common area based technique uses moment descriptors to depict the shape. Whereas boundary based technique focuses mainly on object boundary. Boundary based technique represents shape feature of object more clearly as compared to area based technique. It is fast in processing and needs less computation than area based technique. Due to fast processing and easy computation it is widely used in real time and practical applications. In this paper we consider just the boundary based technique.

In the previous work of shape recognition, object detection approaches based on color/texture segmentation or image binarization and foreground extraction is proposed, which can be used in this case. Other shape detection solutions are based on edge-detection, sliding-windows or generalized Hough transforms. The identified image objects are then recognized by their shapes. The focus of this paper is shape recognition by edge detection using morphological operations. In this paper the problem of over segmentation among different objects has been taken into consideration for shape recognition. The different objects in the given image are processed one by one and then they are clustered together to form the output image. This process is executed in two stages: firstly, the image is read in from the user and objects which are touching one another are segmented. Then we will match the features of the current object with the preloaded features in the database or we can say training set for recognition.

II. Materials and methods

The computation of proposed method can be briefly summarised in 2 steps (1) Avoidance of over segmentation among different objects like circle, rectangle, square etc with the use of morphological operations (2) Labelling the objects after recognition of various objects within the image.

2.1 Over segmentation avoidance

The proposed method is trying to prevent the over segmentation and segment some overlapping areas to extract the boundaries of various objects within the image. For this, read the RGB image in from the user and convert the RGB (coloured) image to gray scale and then to binary image. Invert the binary image in order to speed up the time of processing. Then morphological operation is implemented so that all the objects are eroded from all the sides and then the boundaries of small radius are enhanced along the edges of the objects.

```
se = strel('disk', 1);
dummy1=imerode(dummy,se);
```

SE = strel('disk', R,) creates a flat, disk-shaped structuring element, where R specifies the radius. R must be a nonnegative integer. Here the value of R is 1. Imerode performs binary erosion; otherwise it performs gray scale erosion. If SE is an array of structuring element objects, imerode performs multiple erosions of the input image, using each structuring element in SE in succession.

2.2 Recognition and labelling of objects

In this algorithm when the objects are being segmented from each other, the final stage is to identify the shape of the objects. This is done by using filtering technique. Some properties like centroid and corners of the objects are needed to predict the shapes of varying objects. Then with these mathematical parameters, objects of input image are matched with the preloaded features of the objects in the database or we can say training set and thus we can recognize the shape of the objects.

CIRCLE	TRIANGLE	SQUARE
➢ Number of corners = 0 ➢ Absolute difference b/w length and breadth < 25 ➢ Sensitivity Factor = 0.24	➢ Number of corners = 3 ➢ Sensitivity Factor = 0.24	➢ Number of corners = 4 ➢ Absolute difference b/w length and breadth < 10 ➢ Sensitivity Factor = 0.24

RECTANGLE	POLYGON
➢ Number of corners = 4 ➢ Absolute difference b/w length and breadth > 10 ➢ Sensitivity Factor = 0.24	➢ Number of corners > 4 ➢ Absolute difference b/w length and breadth < 10 ➢ Sensitivity Factor = 0.2

Table.1 filters used to distinguish objects

III. Experiments

We have performed numerous experiments using the described shape recognition approach. The proposed technique has been tested on various image datasets and satisfactory results have been obtained. A high recognition rate, of approximately 95 %, is achieved by our method. It represents a better rate that those of many other object recognition approaches.

An indexed image consists of an array and a colormap matrix. The pixel values in the array are direct indices into a colormap. An indexed image uses direct mapping of pixel values to colormap values. The color of each image pixel is determined by using the corresponding value of X as an index. As RGB image is having an index value of 255 therefore we set this parameter to a scalar between 250 and 0 and in loop this scalar value go on decrementing with a value 5.As this scalar value matches with the index value of object ,the particular object is identified. The image is then converted in the binary form, then the binary image is processed using some morphological operations, to eliminate the over segmented area and retain only the important image regions.

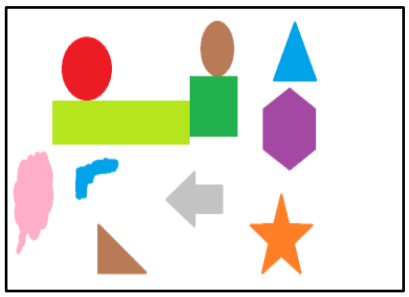

Fig.1Image containing several objects

A shape recognition example is described in the next figures. Thus, in Fig.2 there is a displayed image containing objects which are segmented. Each object is marked with the obj_i value in the picture, $i = 2\ldots, 12$.

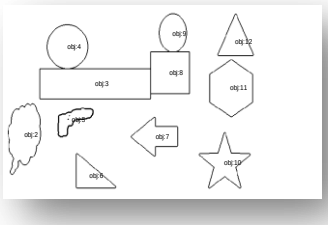

Fig.2 segmented objects

The connected components of the enhanced binary image are detected, thus the image foreground, containing the main objects, being extracted. The feature extraction process is then applied on the detected shapes. The obtained shapes are then classified using the presented shape recognition algorithm. The shape names corresponding to the image from Fig. 1 are represented in Fig. 3. As one can see in that figure, each object is labelled with the name matched with its features. The finalrecognitionresultsare,circle{obj4,obj6},square{obj8},rectangle{obj3},triangle{obj5,obj12},polygon{obj11}.

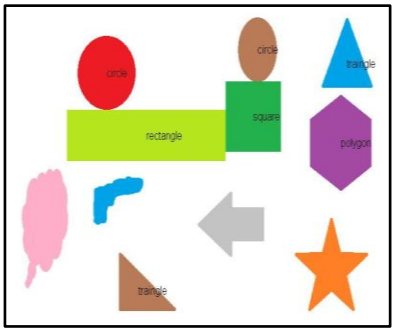

Fig.3 The resulted labelled objects

IV. Conclusion

In this study, a new method of shape recognition is proposed which takes into account the problem of over segmentation. By integrating the structural features like distance measure and centroid, the proposed method extracts the structural information of shapes. Based on those properties, various shapes can be recognized. The identification of the appropriate name of shape clusters automatizes the classification method, which represents a very important thing. That means our recognition technique can be used successfully for very large sets of images, containing a high number of shapes.

Experiments have shown that this method produces accurate and fast results with different images provided. The results of this provided recognition technique can be applied successfully in important domains, such as object recognition and segmentation.

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