

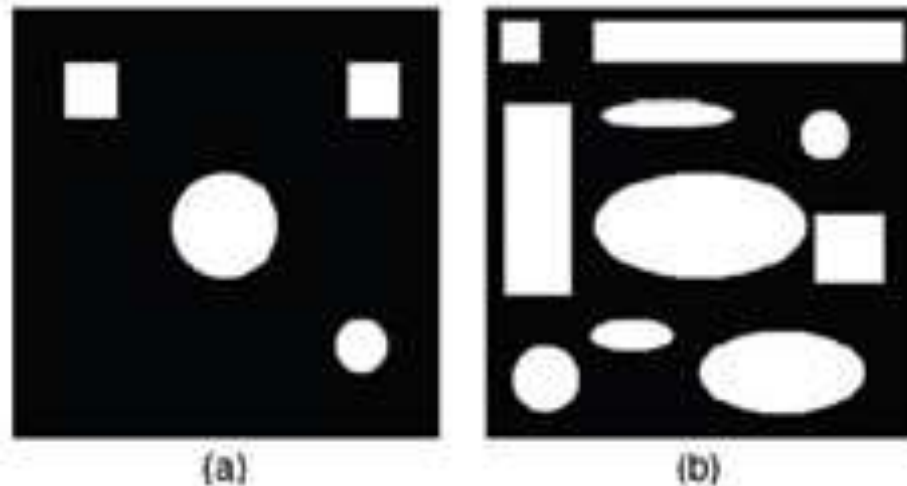
CSE3018 CONTENT BASED IMAGE AND VIDEO RETRIEVAL LAB
EXERCISE - 9

DATE: 06.10.2021

SHAPE BASED FEATURES

I.

1. Load test image TPTest1.png and display its contents.



Q.

1-6 ---- Use Image(a)

Q. No. 7 ---- Use Image(b)

No.

```
J = imread('TPTest1.png');  
imshow(J)
```

- 2 Use **bwboundaries** to display the boundaries of the objects in the test image.

(Note - Convert the image into Binary using **J=im2bw(J,graythresh(J));**)

```
|[B,L] = bwboundaries(J);  
figure; imshow(J); hold on;  
for k=1:length(B),  
    boundary = B{k};  
    plot(boundary(:,2),boundary(:,1),'g','LineWidth',2);  
end
```

1. Use **bwlabel** to label the connected regions (i.e., objects) in the test image, pseudocolor them, and display each of them with an associated numerical label.

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```
[L, N] = bwlabel(J);
RGB = label2rgb(L, 'hsv', [.5 .5 .5], 'shuffle');

figure; imshow(RGB); hold on;
for k=1:length(B),
    boundary = B(k);
    plot(boundary(:,2), boundary(:,1), 'w', 'LineWidth', 2);
    text(boundary(1,2)-11, boundary(1,1)+11, num2str(k), 'Color', 'y', ...
        'FontSize', 14, 'FontWeight', 'bold');
end
```

Question 1 What is the value of N returned by **bwlabel**? Does it make sense to you?

Use regionprops to extract the following binary features for each object in the image (top left square, top right square, small circle, big circle): area, centroid, orientation, Euler number, eccentricity, aspect ratio, perimeter, and thinness ratio.

5. Organize the feature values and object names in a table (see Table 18.5), for easier comparative analysis.

TABLE 18.5 Table for Feature Extraction Results

Object	Area	Centroid (row, col)	Orientation (degrees)	Euler number	Eccentricity	Aspect ratio	Perimeter	Thinness ratio
Top left square								
Big circle								
Small circle								
Top right square								

```
stats = regionprops(L, 'all');
temp = zeros(1,N);
for k = 1:N
    % Compute thinness ratio
    temp(k) = 4*pi*stats(k,1).Area / (stats(k,1).Perimeter)^2;
    stats(k,1).ThinnessRatio = temp(k);

    % Compute aspect ratio
    temp(k) = (stats(k,1).BoundingBox(3)) / (stats(k,1).BoundingBox(4));
    stats(k,1).AspectRatio = temp(k);
end
```

Question 2 Do the results obtained for the extracted features correspond to your expectations? Explain.

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Question 3 Which of the extracted features have the **best** discriminative power to help tell squares from circles? Explain.

Question 4 Which of the extracted features have the **worst** discriminative power to help tell squares from circles? Explain.

Question 5 Which of the extracted features are ST invariant, that is, robust to changes in size and translation? Explain.

Question 6 If you had to use only one feature to distinguish squares from circles, in a ST-invariant way, which feature would you use? Why?

6. Plot the 2D feature vectors obtained using the area and thinness ratio of each object. Repeat steps 1–6 for a different test image, Test3.png.

```
areas = zeros(1,N);
for k = 1:N
    areas(k) = stats(k).Area;
end

TR = zeros(1,N);
for k = 1:N
    TR(k) = stats(k).ThinnessRatio;
end

cmap = colormap(lines(16))
for k = 1:N
    scatter(areas(k), TR(k), [], cmap(k,:), 'filled'), ...
        ylabel('Thinness Ratio'), xlabel('Area')
    hold on
end
```