VIT
Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1956)

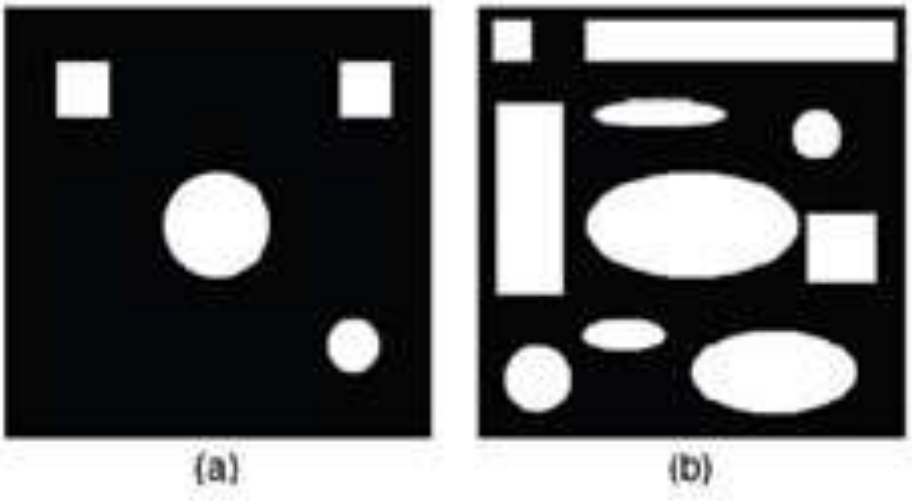
**CSE3018 CONTENT BASED IMAGE AND VIDEO RETRIEVAL LAB**
**EXERCISE - 8**

**DATE: 1.04.2021**

## FEATURE EXTRACTION AND SHAPE ANALYSIS

**I.**

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




Q. No. 1-6 ---- Use Image(a)
Q. No. 7 ---- Use Image(b)

```
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 | Thiness ratio |
|---|---|---|---|---|---|---|---|---|
| Top left square | | | | | | | | |
| Big circle | | | | | | | | |
| Small circle | | | | | | | | |
| Top right square | | | | | | | | |

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```
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.

***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.

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```
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
```