# Assignment_1
# Feature Extraction Part

## Question 1

Describe the following terms:

1- Pattern
2- pattern recognition
3- Feature Vector
4- Texture

Objective:
To represent and describe information embedded in a pattern in other forms that are more suitable.
Benefits:
- Easier to understand
- Require fewer memory, faster to be processed
- More "ready to be used" for classification process.

## Question 2

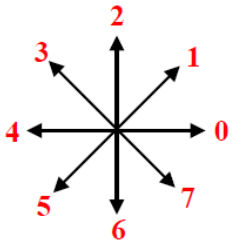
is among the most widely used techniques for boundary shape description. The boundary curve is approximated via a sequence of connected straight line segments of preselected direction and length. Every line
segment is coded with a specific coding number depending on its direction

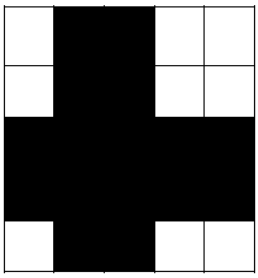
1. Why is invariance to geometrical transformations useful for pattern recognition?
2. How to make LBP scale invariance? Explain your answer by example.
3. What are the objectives of pattern description process? and what are the benefits?
4. What does the Chain code mean?
5. Mention some topological features that give a global description of a region.
6. what do the texture features mean?

texture is an feature that can help to segment images into regions of interest and to classify those regions. Texture gives us information
about the spatial arrangement of the colors or intensities in an image.

## Chain code:

1. You are given the 8-directional chain code and the object below, where black is the object pixels.



   a. Represent the boundary of the object with an eight-directional chain code clockwise from the upper left pixel.
   b. Which technique will make the code invariant to the choice of start point? Demonstrate this by starting at the lower right pixel of the object.
   c. Which technique will make the code rotation invariant? Demonstrate this by rotating the object $\pi/2$ counterclockwise and starting at one of the same object points as above.

2. Figure-1 below shows the resampling result of a particular shape and 4- and 8-directional chain codes.

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a. Starting from point A, in the clockwise direction, show the chain codes based on 4 and 8-connectivities.
b. Show the starting point invariant code based on 8-connectivity and explain why it has this invariance.

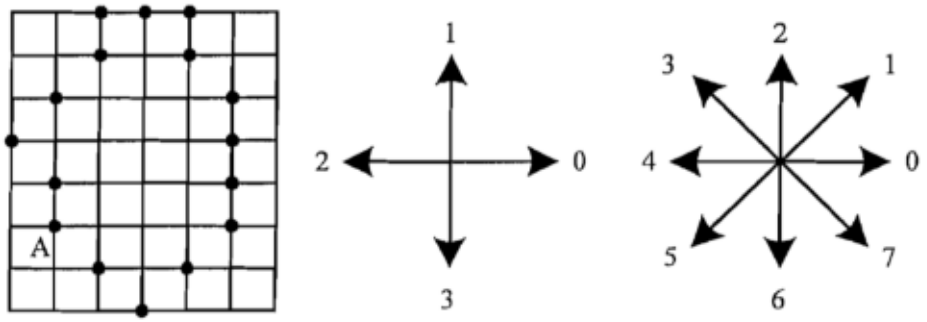


Figure-1

**GLCM:**

1. Compute the grey-level co-occurrence matrix (GLCM) for the image given in Fig-2 with the relative distance $d = 2$ and relative orientation/rotational angles as $\theta = 90$ between the pixel pairs. After that, compute energy, entropy, contrast, and homogeneity.

| | | | | | |
|---|---|---|---|---|---|
| 1 | 0 | 2 | 0 | 3 | 1 |
| 2 | 0 | 2 | 1 | 1 | 0 |
| 2 | 1 | 3 | 1 | 1 | 1 |
| 2 | 3 | 1 | 3 | 3 | 3 |
| 0 | 1 | 3 | 1 | 2 | 0 |
| 1 | 1 | 2 | 4 | 3 | 2 |

Fig-2

2. Compute the grey-level co-occurrence matrix (GLCM) for the image given in Fig-3 with the relative distance $d = 1$ and relative orientation/rotational angles as $\theta = 0$ between the pixel pairs. After that, compute energy, entropy, contrast, and homogeneity.

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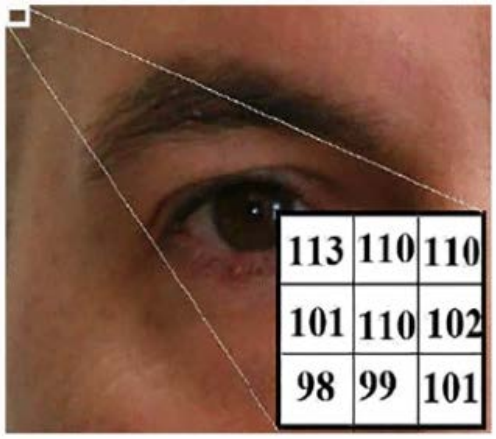
| | | | | | |
|---|---|---|---|---|---|
| 4 | 5 | 6 | 3 | 5 | 4 |
| 4 | 5 | 4 | 8 | 5 | 3 |
| 4 | 7 | 7 | 7 | 2 | 7 |
| 3 | 7 | 5 | 5 | 3 | 2 |

Fig.3

**LBP:**

1. Compute LBP of the following region of the image? Is this uniform LBP or not? Explain your answer.




2. Compute LBP image of the following block (9 × 9 pixels)? After that, compute LBP histogram to show the feature vector.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 160 | 56 | 200 | 98 | 78 | 150 | 215 | 96 | 150 |
| 115 | 160 | 201 | 78 | 59 | 178 | 207 | 58 | 125 |
| 201 | 190 | 210 | 56 | 63 | 150 | 255 | 125 | 164 |
| 64 | 35 | 84 | 65 | 87 | 145 | 255 | 48 | 167 |
| 96 | 35 | 79 | 195 | 155 | 55 | 255 | 79 | 120 |
| 78 | 150 | 64 | 184 | 148 | 89 | 45 | 56 | 211 |
| 12 | 45 | 32 | 78 | 49 | 62 | 28 | 35 | 45 |
| 150 | 78 | 32 | 45 | 168 | 44 | 26 | 56 | 65 |
| 14 | 89 | 32 | 98 | 184 | 58 | 78 | 150 | 23 |

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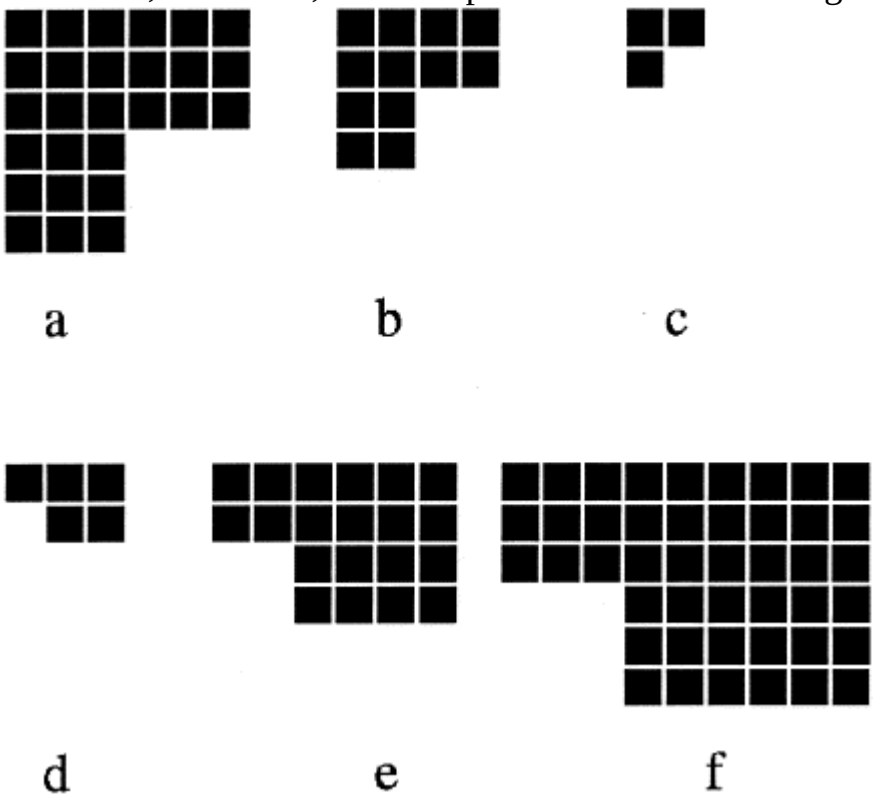
**Regional Features:**

1. Compute the Area, Perimeter, and Compactness of the following objects:




*Best wishes*
*Dr. Sondos Fadl*