

Duration: 3hrs

[Max Marks:80]

N.B. : (1) Question No 1 is Compulsory.

(2) Attempt any three questions out of the remaining five.

(3) All questions carry equal marks.

(4) Assume suitable data, if required and state it clearly.

1 Attempt any FOUR.

[20]

- a Specify formulas for computing Euclidian distance, City-block distance and Chess-board distance in digital images. Draw the locus of each them.
- b Justify/contradict: Salt-pepper noise in a digital image can be better removed by a median filter rather than an averaging filter.
- c State what is the cause of the 'Ringing effect' when a digital image is filtered in frequency domain. How can the effect be minimized?
- d Explain with a diagram what are support vectors in a SVM. Do they affect the classification process? If yes, how?
- e Illustrate with an example what is grey level co-occurrence matrix in texture analysis.

2 a Given a grey scale image as follows:

[10]

|   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |
| 2 | 1 | 2 | 1 | 7 | 4 | 1 | 2 |
| 1 | 1 | 0 | 1 | 5 | 4 | 0 | 1 |
| 1 | 1 | 6 | 6 | 6 | 5 | 1 | 0 |
| 1 | 1 | 5 | 4 | 6 | 7 | 1 | 0 |
| 1 | 1 | 3 | 2 | 2 | 2 | 0 | 0 |
| 1 | 1 | 2 | 1 | 1 | 1 | 0 | 0 |

- i. Draw Histogram of the image.
  - ii. Perform histogram equalization on the image.
  - iii. Draw transformation function.
  - iv. Draw output image histogram.
- b Describe the Canny Edge Detection method step-by-step. Support your answer with appropriate diagrams.

[10]

- 3 a For the 2x2 transform matrix [10]

$A = \frac{1}{\sqrt{2}} \begin{bmatrix} \sqrt{3} & 1 \\ -1 & \sqrt{3} \end{bmatrix}$  and a sub-image  $U = \begin{bmatrix} 2 & 3 \\ 1 & 2 \end{bmatrix}$  compute the image transform and the basis images.

- b Write an expression for a two-dimensional DCT. Form a 4x4 DCT matrix and compute the DCT of the following sub-image. [10]

$$I = \begin{bmatrix} 1 & 2 & 2 & 1 \\ 2 & 1 & 2 & 1 \\ 1 & 2 & 2 & 1 \\ 2 & 1 & 2 & 1 \end{bmatrix}$$

- 4 a Explain the Hit-and-Miss transform in Morphology. Explain how morphology can be used for boundary detection. [10]

- b Differentiate between shape and region descriptors. State their examples. Explain signatures in detail. [10]

- 5 a For the given image, perform region based segmentation by split and merge technique. Illustrate the splitting technique with a quad tree graph. Use the Predicate  $P \geq 10$  for splitting and merging. [10]

|    |    |    |    |    |    |    |    |
|----|----|----|----|----|----|----|----|
| 13 | 12 | 13 | 12 | 11 | 12 | 11 | 12 |
| 13 | 13 | 63 | 63 | 61 | 11 | 12 | 11 |
| 11 | 12 | 63 | 62 | 61 | 62 | 12 | 12 |
| 13 | 13 | 62 | 63 | 62 | 61 | 13 | 13 |
| 12 | 11 | 62 | 63 | 62 | 11 | 12 | 11 |
| 62 | 62 | 63 | 61 | 61 | 62 | 13 | 13 |
| 62 | 61 | 61 | 62 | 13 | 12 | 13 | 11 |
| 61 | 62 | 63 | 11 | 12 | 11 | 12 | 12 |

- b Explain smoothing and sharpening filters in frequency domain. [10]

- 6 a Explain the need of good classifiers in object recognition. List different classifiers. Explain the Bayesian classifier in detail. [10]

- b Explain the K-means clustering algorithm with a suitable example. [10]

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