2054

M.E. (Computer Science and Engineering)

Second Semester

CS-8201: Digital Image Processing

Time allowed: 3 Hours

Max. Marks: 50

NOTE: *Attempt five questions in all, including Question No. I which is compulsory and selecting two questions from each Unit.*

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1. **Attempt the following: -**
   - (a) What are the components of an image processing work station?
   - (b) Differentiate between statistical and syntactic pattern recognition.
   - (c) What do you understand by Unitary transform?
   - (d) What is the need of file format? List various image file formats.
   - (e) What do we need different colour models?

   (5×2)

UNIT-I

2. (a) Define 4-connectivity, 8-connectivity and m-connectivity. What are the advantages of m-connectivity over 4-connectivity Consider the image segment:

3	4	1	2	0
0	1	0	4	2 (p)
2	2	3	1	4
(q)3	0	4	2	1
1	2	0	3	4

   Let V = {2,3,4}. Compute the lengths of the shortest 4-, 8-, and m-path between p and q. if particular path does not exist between these two points, explain why?

   (5)

   (b) What is meant by Image transform and its need? List various properties of Fourier transform. Apply DFT to the following sequence:

   {2, 4, 6, 1)

   (5)

3. (a) Name various image enhancement techniques. Discuss the significance of convolution and correlation processes in image enhancement? Determine the convolution of $x(m,n)$ with $h(m,n)$ where $x(m,n)$ and $h(m,n)$ are as follows:

$x(m,n)$			$h(m,n)$	
4	5	3	1	0
3	2	1	0	-1
1	0	-1		

   (5)

   (b) When do we prefer frequency domain filtering? Explain correspondence between spatial and frequency domain filters by taking the example of High Pass Filter.

   (5)

4. (a) What are the three basic redundancies that can be identified in digital images? How these redundancies can be eliminated and why? (3)

(b) For the image shown below, compute the degree of compression that can be achieved using a) Huffman coding of pixel values b) run-length coding assuming 2 bits to represent the pixel values and 3 bits to represent the run length (7)

3	3	3	2
2	3	3	3
3	2	2	2
2	1	1	0

UNIT-II

5. (a) What is the meaning of a linear operator? Is Sobel a linear operator? Sobel operator uses two masks, Hx and Hy to process the image for edge detection. Discuss what is measured by these masks and why two masks are required. (5)

(b) Consider two grey level images with bi-modal histogram depicting several objects on background. The histogram of the first image is wide and shallow, whereas of the second image is narrow and deep. How is the error in the area of the segmented affected by the choice of the threshold? In which image the area of segmented objects is more sensitive to threshold selection? (5)

6. (a) The 8-directional chain code of the image is given by

(2,4), 0,7,7,7,7,7,5,5,5,3,2,2,1,1,1,1,1,1,1

where (2,4) provide the column and row axes of the initial point respectively. Decode the chain code and draw the decoded object in a 12x12 grid. (5)

(b) What is the use of erosion and dilation operations in Binary image processing? Write the steps of thinning an example binary image. (5)

7. (a) Define the term object recognition. Name various object recognition methods. Describe how patterns are used to recognize real life objects or entities? (5)

(b) A process generates binary images of square shapes. Develop an algorithm to check whether any image contains square or not. If yes, whether it is a solid square or has a hole? (5)

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