

C7-R4 : DIGITAL IMAGE PROCESSING AND COMPUTER VISION

NOTE :
 1. Answer question 1 and any FOUR questions from 2 to 7.
 2. Parts of the same question should be answered together and in the same sequence.

Total Time : 3 Hours

Total Marks : 100

1. (a) Differentiate between Image Enhancement and Image Restoration.
 (b) Explain different frequency domain filters used in image processing.
 (c) Use the hit-or-miss transform to identify the locations of the following shape pixel configuration in the given image below using the two structuring elements B_1 and B_2 .

0 1 0	0 0 0 0 0 0 0 0 0 0 0	
1 1 1	0 0 1 0 0 0 0 0 0 0 0	1
0 1 0	0 0 1 0 0 1 1 1 1 0 0	1 1 1
Shap	0 1 1 1 0 0 0 0 0 0 0	1
	0 0 1 0 0 0 0 1 1 0 0	B_1
	0 0 0 0 1 0 0 1 1 1 0	1 1
	0 0 0 1 1 1 0 0 1 0 0	
	0 0 0 0 1 0 0 0 0 0 0	1 1
	0 0 0 0 0 0 0 0 0 0 0	B_2

Image A

- (d) Perform the Haar wavelet transformation for the following 1-D image.
 [9 7 3 5]

Write short notes on the following :

- (e) JPEG compression
 (f) Prewitt edge detection
 (g) Hole filling

(7x4)

2. (a) Write an algorithm to one-pixel thick m-path to a 4-paths.
 (b) Computer the opening and closing operation on 5×5 image given the structural element 3×3 .

0	0	0	0	0
0	1	1	1	0
0	1	1	1	0
0	1	1	1	0
0	0	0	0	0

Image I

0	1	0
1	1	1
0	1	0

Structure Element S

(c) Explain how piecewise linear transformation can be applied on an image.

(6+6+6)

3. (a) Apply bit plane compression and decompression to the following image.

180	1	80	33	201	28
120	224	160	33	67	144
224	160	180	11	133	144

(b) An 8 Grey level image is given in the table below. Perform Histogram equalisation and draw Histograms of original and equalized images.

Grey Levels	0	1	2	3	4	5	6	7
Frequency of occurrence	100	90	300	450	800	1110	850	714

(c) What do you mean by dilation and erosion operation ? Justify whether these are invertible operations or not.

(6+6+6)

4. (a) Explain different color models - RGB, CMYK and HIS.

(b) Compute the gradients of the image performing the convolution of Sobel Kernels S_x in x -direction and S_y y -direction with the 5×5 image I.

0	0	10	10	10
0	0	10	10	10
0	0	10	10	10
0	0	10	10	10
0	0	10	10	10

Image I

1	0	-1
2	0	-2
1	0	-1

S_x

-1	-2	-1
0	0	0
1	2	1

S_y

(c) Find Discrete Fourier Transform (DFT) of $x(n) = [2 \ 3 \ 4 \ 4]$

(6+6+6)

5. (a) Justify the statement "Huffman coding is a lossless compression technique".
 (b) Explain parallel projection with suitable diagram. (10+8)
6. (a) What is the difference between smoothing and sharpening techniques ?
 (b) What is transformation ? Explain translation, rotation, scaling and shear.
 (c) Explain optical flow based motion estimation. (6+6+6)
7. (a) Discuss the advantages and disadvantages of global and local histogram equalization.
 (b) Explain clustering based image segmentation technique.
 (c) The following figure shows a 3-bit image of size 5-by-5 image in the square, with x and y coordinates specified, a Laplacian filter and a low-pass filter.

$x \backslash y$	0	1	2	3	4		
0	3	7	6	2	0	Laplacian filter	Low-pass filter
1	2	4	6	1	1	0 1 0	0.01 0.1 0.01
2	4	7	2	5	4	1 -4 1	0.10 0.56 0.10
3	3	0	6	2	1	0 1 0	0.01 0.1 0.01
4	5	7	5	1	2		

Compute the following :

- (i) The output of a 3×3 mean filter at (2, 2).
 (ii) The output of a 3×3 median filter at (2, 2).
 (iii) The output of the 3×3 Laplacian filter is shown above at (2, 2).
 (iv) The output of the 3×3 low-pass filter is shown above at (2, 2). (6+6+6)

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