

SEVENTH SEMESTER B.Tech. (E & C) DEGREE END SEMESTER EXAMINATION NOV 2017 SUBJECT: DIGITAL IMAGE PROCESSING (ECE - 437)

TIME: 3 HOURS

MAX. MARKS: 50

- Instructions to candidates
 - Answer ANY FIVE questions.Missing data may be suitably assumed.
- 1A. A certain X- ray imaging geometry produces a blurring degradation that can be modelled as a convolution of the sensed image with the spatial, circularly symmetric function.

$$h(x, y) = \frac{x^2 + y^2 - 2\sigma^2}{\sigma^4} e^{-\frac{x^2 + y^2}{2\sigma^2}}$$

Assuming continuous variables, show that the degradation in the frequency domain is given by the following expression.

$$H(u,v) = -8\pi^2 \sigma^2 (u^2 + v^2) e^{-2\pi^2 \sigma^2 (u^2 + v^2)}$$

- 1B. Define linear filters. List the advantages and disadvantage of linear filters. Discuss how non-linear filter overcomes the disadvantages of linear filter.
- 1C. Explain fundamental steps in digital image processing with a neat diagram.

(5+3+2)

- 2A. Explain region based image segmentation. Discuss parametric active contour models with its internal and external energy minimization technique
- 2B. Given input histogram $x_i = \{0, 1, 2, 3\}$ with input probability $p(x_i) = \{0.25, 0.25, 0.25, 0.25\}$ and specified histogram is $p(v_i) = \{0, 0.5, 0.5, 0\}$. Estimate the histogram specification
- 2C. Explain how first and second order derivatives is used for spatial image enhancement with a suitable example.

(5+3+2)

3A. Show that the radon transform of the Gaussian shape.

$$f(x, y) = A \exp(-x^2 - y^2)$$
 is $g(\rho, \theta) = a\sqrt{\pi} \exp(-\rho^2)$

- 3B. With a neat diagram explain analysis and synthesis filters of wavelet transformation.
- 3C. Show that sobel and pewit operator gives isotropic result only for horizontal and vertical edges and for edges oriented at +/- 45.

(5+3+2)

4A. Find the transform of mapping the pixels from x to y using Histogram specification. Given that $x_i = yi = 0, 1, 2, 3, 4, 5, 6, 7$ and the input probability density function

$$p_r(x_i) = \begin{cases} \frac{x_i}{12} & i = 0, 1, 2, 3\\ \frac{|7 - x_i|}{12} & i = 4, 5, 6, 7 \end{cases}$$

The output probability density function is:

$$p_s(y_i) = \frac{y_i}{28}$$

4B. Write the result of averaging filter of 3 X 3 mask for given sub image.

1	4	5	8	
0	1	14	11	
0	8	7	9	
1	2	0	3	

4C. Explain the application of image processing in detection of infrastructure damage caused by earthquake.

(5+3+2)

5A. A Gaussian low pass filter in the continuous frequency domain has the transfer function.

$$H(u,v) = Ae^{-(u^2+v^2)/2\sigma^2}$$

Show that the corresponding filter in the spatial domain has the following form

$$h(t, z) = A2\pi\sigma^2 e^{-2\pi^2\sigma^2(t^2 + z^2)}$$

- 5B. With a neat diagram explain inter frame coding system.
- 5C. Explain coding redundancy. Write the coding and decoding algorithm for arithmetic coding technique

(5+3+2)

6A Mention the advantages and disadvantages of Arithmetic coding with Huffman coding. Encode the message GATES BILL, given the following coding model.

Symbol	Sp	А	В	E	G	I	L	S	Т
Probability	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.1

- 6B. Explain 4,8 and m-adjacency with a suitable example
- 6C. Explain application of image processing in medical domain.

(5+3+2)