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05SCS/05SCE143

First Semester M.Tech. Degree Examination, Dec. 07 / Jan. 08
Digital Image Processing and Computer Vision

Time: 3 hrs. Max. Marks:100

Note : ***Answer any FIVE full questions.***

1 a. Discuss the fundamental steps in digital image processing. **(10 Marks)**

b. Consider the image segment shown :

	3	1	2	1	(q)
	2	2	0	2	
	1	2	1	1	
(P)	1	0	1	2	

Let v = {0, 1} and compute the lengths of the shortest 4 –, 8 – and m – path between p and q. if a particular path does not exist between these two points explain why. **(05 Marks)**

c. Discuss first order derivatives for the detection of edges in an image. **(05 Marks)**

2 a. Explain three basic types of functions used frequently for image enhancement. **(10 Marks)**

b. Explain how noise reduction can be accomplished by blurring with linear and non linear filtering. **(05 Marks)**

c. Two images f(x, y) and g(x, y) have histograms h_f and h_g. Give the conditions under which you can determine the histogram of

i) f(x, y) + g(x, y) ii)f(x, y) – g(x, y) iii)f(x, y) × g(x, y) iv)f(x, y) ÷ g(x, y)

In terms of h_f and h_g . Explain how to obtain the histogram in each case. **(05 Marks)**

3 a. Explain important properties of the 2 – dimensional Fourier transform. **(10 Marks)**

b. With the help of transfer function, explain how high pass filter is applied to sharpen the image. **(10 Marks)**

4 a. Explain Bandreject, Bandpass and notch filters for periodic noise removal. **(10 Marks)**

b. Discuss an approach that incorporates both the degradation function and satistitcal characteristics of noise into the restoration process. **(10 Marks)**

5 a. Derive an expression convert

i) RGB to HSI ii) HSI to RGB. **(10 Marks)**

b. i) Compute the Haar transform of the 2 × 2 image.

$$F = \begin{bmatrix} 3 & -1 \\ 6 & 2 \end{bmatrix}$$

ii) The inverse Haar transform is $F = H^{-1} TH^{-1}$, where T is the Haar transform and H^{-1} denotes the matrix inverse of Haar transformation matrix H. Find H_2^{-1} for Haar transformation matrix H_2 and use it to compute the inverse Haar transform of the result in(i). **(10 Marks)**

6 a. Discuss three general techniques for compressing the amount of data required to represent an image. **(10 Marks)**

b. Explain in detail the two primitive operations Dilation and Erosion which are fundamental to morphological processing. **(10 Marks)**

7 a. Explain different techniques for detecting the three basic types of gray level discontinuities in a digital image. **(10 Marks)**

b. The following pattern clauses have Gaussian probability density functions :

$W_1 = \{ (0, 0)^T, (2, 0)^T, (2, 2)^T, (0, 2)^T\}$ $W_2 = \{ (4, 40)^T, (6,4)^T, (6, 6)^T, (4, 6)^T\}$

i) Assume that $P(W_1) = P(W_2) = ½$ and obtain the equation of the Bayes decision boundary between these two classes.

ii) Sketch the boundary. **(10 Marks)**

8 Write short notes on :

a. Sampling and quantization c. Hit or miss transformation

b. Image compression standards d. Region based segmentation **(20 Marks)**

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