

Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)



VI SEMESTER B.TECH (COMPUTER SCIENCE AND ENGINEERING) END SEMESTER EXAMINATIONS, MAY/JUNE 2016

SUBJECT: PROGRAM ELECTIVE I - DIGITAL IMAGE PROCESSING [CSE 320]

REVISED CREDIT SYSTEM

11/05/2016

Time: 3 Hours

MAX. MARKS: 50

Instructions to Candidates:

- ✤ Answer ANY FIVE FULL questions.
- Missing data, if any, may be suitably assumed.
- 1A. What are effects of reducing gray level resolution and spatial resolution of an image? Explain any three image resampling methods using interpolation. 4M
- 1B. What are the different types of adjacencies? Take an example and explain each. 3M
- 1C. With a neat diagram explain power law and piecewise linear transformation functions. 4M
- 2A. Explain the process of histogram matching technique in a continuous domain and give the steps to implement the same. Suppose that a 3 bit image has the intensity distribution given by pdf $P_r(r)$. Obtain the intensity distribution and processed image after matching the input histogram to the target histogram given by $P_z(z)$ specified below. 6M

r	0	1	2	3	4	5	6	7
P _r (r)	0	0.1	0.1	0.3	0	0	0.4	0.1
$P_z(z)$	0	0.1	0.2	0.4	0.2	0.1	0	0

- 2B. Describe the process of spatial filtering of an image using convolution and correlation. Where exactly do you use these operations? 2M
- 2C. Derive a second order filter using Laplacian operator and use the same to show, how to sharpen an image. 2M

3A. Prove the validity of the following equations. (F[.] represents Fourier transform) 3M

(i)
$$F[f(x,y)(-1)^{x+y}] = F(u - \frac{M}{2}, v - \frac{N}{2})$$

(ii) F(u, v) = F(u + M, v + N)

- 3B. To realize filtering in frequency domain, how do you compute cutoff frequency? Provide transfer functions for Ideal, Butterworth and Gaussian filters to cutoff high frequency components. What causes ringing effect in an Ideal LPF?
 4M
- 3C. How can you use illumination-reflectance model to develop a frequency domain procedure for improving the appearance of an image? 3M
- 4A. Explain the process of detecting lines using Hough transform. What is the limitation of using equation of line in slope intercept form, how it is overcome? 5M
- 4B. Derive an expression to find in-between class variance for optimal thresholding. 5M
- 5A. Explain the process of feature extraction in an image using morphological reconstruction by dilation. Consider an image containing text information and it is required to fill the holes if any, in the characters. Propose an automatic method using morphological reconstruction to achieve this task.
- 5B. For a hand written optical character recognition application, it is required to thin a character and also to remove any unwanted spurious information. Propose two morphological methods to achieve these two tasks.
 4M
- 5C. Explain image segmentation using region growing method. 2M

6A. A 1024×1024 8-bit image with 5.3 bits/pixel entropy is to be Huffman coded. 5M

- (i) What is the maximum compression that can be achieved?
- (ii) Will it be obtained?
- (iii) If a greater level of lossless compression is required, what else can be done?
- (iv) Use the LZW coding algorithm to encode the 7-bit ASCII string "aaaaaaaaaaaa". Let 97 be ASCII of 'a'. Assume that first 255 entries in dictionary are used up.
- 6B. With proper mathematical expressions, describe four types of order statistic filters. 2M
- 6C. Describe a model of image degradation/restoration process.

3M