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MMTE-003

M.Sc. (MATHEMATICS WITH APPLICATIONS IN COMPUTER SCIENCE)
M.Sc. (MACS)

00535

Term-End Examination

December, 2011

MMTE-003 : PATTERN RECOGNITION AND IMAGE PROCESSING

Time : 2 hours *Maximum Marks : 50*

Note : *Attempt **any five** questions. All questions carry **equal** marks. Use of calculator is **not** allowed.*

1. (a) Propose a gray level slicing algorithm capable of producing the 4-th bit plane of an 8 - bit monochrome image. **4**

(b) Assume that the histogram of an image is Gaussian **6**

$$pr(r) = \frac{1}{\sqrt{2\pi}\sigma} e^{-\frac{(r-m)^2}{2\sigma^2}}$$

Which transformation function would you use for histogram equalization ?

2. (a) Briefly explain the following : **4**

(i) Unsharp marking

(ii) High boost filtering

(iii) High frequency emphasis filtering. Give application of each of these filtering techniques.

(b) Given an image $f(x,y)$ with Fourier transform F(u,v) obtain the fourier transform of $(-1)^{x+y}. f(x,y)$. 3

(c) Given that the 2-D Fourier Transform is real and even, obtain the constraints on the image characteristics. 3

3. (a) (i) In Image restoration, how are the noise parameters estimated ? 6

(ii) Assume that the noise is estimated as exponential, with mean μ and variance σ^2. How will you estimate the parameter 'a' of pdf of exponential noise ?

(b) Explain the functioning of an adaptive, local noise reduction filter. 4

4. (a) Show that Sobel masks can be implemented by one pass of differencing mask of the form $[-1\ 0\ 1]$ (or its vertical counterpart) followed by a smoothing mask of the form [1 2 1] (or its vertical counterpart). 5

(b) (i) Explain the Hough transform for edge linking. 5

(ii) Why is the normal representation of line preferred ? Obtain the normal representation of the line $y = -2x + 1$

5. (a) Describe both spatial and frequency domain enhancement techniques. 4

(b) Describe briefly the watershed segmentation Algorithm. 3

(c) Define image segmentation. Discuss region based segmentation in detail. 3

6. (a) The following pattern classes have Gaussion probability density function 5
W_1 : { $(0, 0)^T$, $(4, 0)^T$, $(4, 4)^T$, $(0, 4)^T$} and W_2 : { $(6, 6)^T$, $(8, 6)^T$, $(8, 8)^T$, $(6, 8)^T$}. Assume $p(w_1) = p(w_2) = ½$. Obtain the equation of Baye's decision boundary between these two classes.

(b) Define Principal Component Analysis. Derive the transformation matrix used for transformation where the data belongs to $\mathbf{R}^d$. Interpret the transformation and its significance. 5