Ref. No. Ex/PG/CSE/T/116A/2024

Master of Computer Science & Engg. 1st Year 1st Sem. Examination, 2024

Image Processing

Full marks: 100 **Time: 3 hours**

Attempt any five questions

1. a) Obtain the matrix equation for image rotation, scaling and translation. Also indicate the utility of homogeneous co-ordinate. 6
   b) Discuss the significance of reflectivity of a scene point and sensitivity of capturing device in the formation of digital image. 4
   c) Why city-block and chess-board distances are called d_4 and d_8 respectively? 4
   d) Why do we need intensity interpolation in geometrical transformation? Explain a two dimensional linear interpolation. 6

2. a) Show that two dimensional Fourier Transform kernel is separable and symmetric. 5
   b) What is image enhancement? 3
   c) Define a linear spatial filter. When will it be separable? Explain the advantage of such separable filter? 8
   d) What is image averaging? Mention its pros and cons. 4

3. a) Why do we perform intensity stretching? Write down the code snippet/pseudo-code to linearly stretch the intensity values of a grayscale image to the range $[v_{min}, v_{max}]$. 2+6
   b) Compare logarithmic and exponential stretching. 4
   c) How max and min filter can be used to approximate median filter? 4
   d) Write down the expression for 2D Gaussian Kernel. Mention its specialties? 4

4. a) Suppose, illumination is little bit different at different points of the scene being captured. Describe a suitable filtering scheme to negate the effect of such varying illumination. 6
   b) Why is image sharpening done? Write down the expression for an isotropic derivative operator. How can it be utilized in image sharpening? 7
   c) We want to transform an image so that the intensity distribution of the transformed image matches with a target distribution. Write down the algorithm for the same. 7
5. a) Consider a bilateral filter where Gaussian kernels are being used. Discuss the impact of the scale of the individual kernels. 6

[Turn over

b) In case of similarity based region extraction, discuss the desired conditions that the regions should satisfy. 4
c) Describe Marr-Hildreth Edge detector. 7
d) What is the purpose of using Hough Transform? 3

6. a) Describe the non-maxima suppression and hysteresis thresholding processes adopted in Canny's edge detection technique. Also mention the purposes of using those processes. 8
b) What is the basic principle of OTSU algorithm for threshold selection? 3
c) An image contains two types of regions. One type of regions is quite large w.r.t other. What will be the nature of feature histogram of the image? How can it be made fairly bimodal? 4
d) What is the utility of superpixel in image segmentation? In SLIC algorithm, how is the cluster centres chosen and why is it so? 5

7. a) What are the problems of chain code and what measures you may take to address the issues and also to make it rotation invariant? 5
b) Define medial axis and distance transform. 4
c) Given a binary image consisting of number of objects. Write down the code snippet/pseudo-code to label the components. 6
d) Describe the steps for vector quantization. 5

8. a) Describe the steps for obtaining LBP based descriptor. 3
b) What is RLE? How does it help in compression? 4
c) How is psycho-visual redundancy exploited in JPEG compression? 4
d) How does the cell level histogram of oriented gradient formed? 6
e) Mention the use of RGB, CMY, YIQ and HSV models? 3