USN | | | | | | | | | | |

Seventh Semester B.E. Degree Examination, July/August 2022

Image Processing

Time: 3 hrs.   Max. Marks:100

Note: Answer any FIVE full questions, selecting at least TWO questions from each part.

PART – A

1 a. With a neat block diagram, explain the fundamental steps in digital image processing.
(10 Marks)
   b. Explain image formation in the human eye.   **(06 Marks)**
   c. List four applications of image processing.   **(04 Marks)**

2 a. With a suitable diagram, explain how an image is acquired using Single Sensor and Linear Sensor Strip.   **(08 Marks)**
   b. Find D_4, D_8 and D_m for the following 2D section with $V = \{1, 2\}$ between p and q.

$$
\begin{array}{ccccc}
5 & 4 & 3 & 1 & 1\,(q) \\
5 & 4 & 0 & 2 & 0 \\
3 & 2 & 0 & 2 & 4 \\
2 & 1 & 1 & 3 & 5 \\
(p)\,1 & 3 & 5 & 1 & 3
\end{array}
$$
(06 Marks)

   c. Find the Euclidean, City-block and Chess board distances between the pixels p(3, 4) and q(2, 6).   **(06 Marks)**

3 a. Consider the 2 × 2 transform A and the image U given below:

$$
A = \frac{1}{2}\begin{bmatrix} \sqrt{3} & 1 \\ -1 & \sqrt{3} \end{bmatrix} \qquad U = \begin{bmatrix} 2 & 3 \\ 1 & 2 \end{bmatrix}
$$

Calculate the transformed image V and the basis images. Check the transformed image V using the basis images and U.   **(10 Marks)**
   b. Construct 4 × 4 DFT matrix and show it is unitary.   **(10 Marks)**

4 a. Write H matrix and obtain Haar transform matrix for N = 8.   **(10 Marks)**
   b. Determine 4 × 4 Slant transform matrix. List its properties. **(10 Marks)**

PART – B

5 a. Explain the following image enhancement techniques, highlighting the area of application.
   (i)   Intensity level slicing
   (ii) Power-law transformation
   (iii) Bit-plane slicing   **(10 Marks)**
   b. For a given 4 × 4 image having gray levels between [0, 9]. Perform histogram equalization and draw the histogram of image before and after equalization.

$$
\begin{bmatrix}
2 & 3 & 3 & 2 \\
4 & 2 & 4 & 3 \\
3 & 2 & 3 & 5 \\
2 & 4 & 2 & 4
\end{bmatrix}
$$
(10 Marks)

6 a. With the help of a block diagram, explain the homomorphic filtering approach for image enhancement. **(10 Marks)**

b. Discuss various mean filters and order statistics filters in image restoration system. **(10 Marks)**

7 a. Explain the following noise models:
(i) Erlang Noise
(ii) Rayleigh Noise
(iii) Impulse (Salt and Pepper) Noise **(06 Marks)**

b. Derive an expression of the linear degradation model in presence of additive noise. **(08 Marks)**

c. Explain Weiner Filtering method of restoring images. **(06 Marks)**

8 a. Explain the RGB colour model and develop the procedure for converting RGB to HSI model. **(10 Marks)**

b. Explain in detail Pseudo Colour Image Processing. **(10 Marks)**

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