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SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

SIXTH SEMESTER B.TECH DEGREE EXAMINATION (S), AUGUST 2023
ELECTRONICS AND COMMUNICATION ENGINEERING
(2020 SCHEME)

Course Code : 20ECT352

Course Name: Digital Image Processing

Max. Marks : 100 **Duration: 3 Hours**

PART A

(Answer all questions. Each question carries 3 marks)

1. What is meant by "Neighbours of a Pixel"?
2. Suppose an image of dimension 4 x 6 inches has 400 dots per inch in each direction. How many samples are required to preserve the information in the image?
3. Sketch the sequence $x(n_1, n_2) = \delta(n_1 + n_2 - 1)$.
4. Write the Walsh basis for N= 4.
5. With necessary illustration explain histogram equalization.
6. What is power law transformation in image processing?
7. List out and explain the different causes of image degradation.
8. Describe the various classification of noises in image.
9. What is 'Adaptive Huffman code'?
10. Draw the block diagram for transform-based image-coding scheme.

PART B

(Answer one full question from each module, each question carries 14 marks)

MODULE I

11. a) Explain with neat diagram the working principle of 'Vidicon'. (6)
    b) Define the terms Mach band effect, brightness, contrast, hue and saturation with respect to a digital image. (8)

OR

12. a) With neat diagram explain the elements of visual perception. (7)
    b) What are the different image file formats available? Explain briefly. (7)

MODULE II

13. a) Compute the inverse 2D DFT of the transform coefficients given by (10)

$$F[k, l] = \begin{bmatrix} 16 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

b) List out and explain the properties of SVD. (4)

OR

14. a) Compute the DCT matrix for N= 4. (10)

b) Compute the basis of the KL transform for the input data $x_1 = (4, 4, 5)^T$, $x_2 = (3, 2, 5)^T$, $x_3 = (5, 7, 6)^T$ and $x_4 = (6, 7, 7)^T$. (4)

MODULE III

15. a) With neat diagram explain homographic filter. (7)

b) Explain any two image sharpening techniques. (7)

OR

16. a) Explain briefly the image arithmetic techniques available in image enhancement. (10)

b) What is the value of the central pixel if it is smoothed by a 3 x 3 box filter?

$$\begin{bmatrix} 1 & 2 & 3 \\ 2 & 4 & 5 \\ 3 & 4 & 3 \end{bmatrix}$$ (4)

MODULE IV

17. a) A blur filter is given by

$$h(m,n) = \begin{bmatrix} 0 & 0.05 & 0.05 & 0 \\ 0.15 & 0.1 & 0.1 & 0.15 \\ 0 & 0.1 & 0.1 & 0 \\ 0 & 0.1 & 0.1 & 0 \end{bmatrix}$$ (10)

Find the deblur filter using Wiener filter approach with $\sigma_x^2 = 200$ and $\sigma_w^2 = 100$.

b) A photograph is taken out of a side window of a car moving at a constant velocity of 80km/hr. Why is it not possible to use an inverse filter in general to restore the blurring in this image? (4)

OR

18. a) What is the difference between image restoration and image enhancement? What do they have in common? (4)

b) Find the power spectral densities of Wiener filter. (10)

MODULE V

19. a) Explain Hough transform and Active contour. (10)

b) What are 'blocking artifacts' in DCT based image-compression scheme? (4)

OR

20. a) Explain the different edge detection techniques. (10)
    b) Why is zig-zag scanning preferred in JPEG standard? (4)

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