53 (EC 714) DIPR

2021

(Held in 2022)

DIGITAL IMAGE PROCESSING

Paper : EC 714

Full Marks : 100

Time : Three hours

The figures in the margin indicate full marks for the questions.

Answer ***any five*** *questions.*

1. A band limited continuous image is sampled with sampling frequency ω_x and ω_y. Write the mathematical expression of the sampled image. Draw the frequency domain representation of the image and explain the effect of Aliasing. How can the continuous image be reconstructed from the sampled image ? 5+10+5=20

Contd.

2. *(a)* Write the mathematical expression of two-dimensional convolutions. A (10×10) image is convolved with (7×7) kernel. What would be the dimension of the convolved image ? 2+2=4

(b) Perform one-dimensional convolution of the following sequences : 6

$$x1(n) = [1 \underset{\uparrow}{} \; 7 \;\; 3 \;\; 4];$$

$$x2(n) = [2 \underset{\uparrow}{} \; 3 \;\; 1 \;\; 4]$$

(c) State *one* spatial filter and *one* frequency domain filtering for noise removal from image. 5×2=10

3. *(a)* Compare advantages and disadvantages of the advantages of the DCT over DFT and DHT. 10

(b) Deduce the expression of Fast Fourier Transform from its DFT representation. Compare computational complexity for both the transformations. 10

4. *(a)* What do you understand about the separability property of a 2D image transform kernel and state its advantage. Using separability property, find the *(i)* DFT and *(ii)* DHT of the image. 4+6=10

(b) Describe the differences between histogram equalization and histogram specification. 6

(c) The following histogram of 3-bit image is equalized. Find out the histogram of the processed image

s=0	s=1	s=2	s=3	s=4	s=5	s=6	s=7
.3	.2	.05	.05	.1	.2	.03	.02

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5. Describe the model of degradation and restoration of an image. What are the disadvantages of inverse filtering ? State the MMSE approach of noise removal. 5+15=20

6. (a) State the application of the image restoration and degradation. Design a mathematical model to describe motion blur. 4+8=12

(b) Describe the types of different image compression techniques. Discuss the DPCM method for image compression. 8

7. Write short notes on : ***(any two)*** 10×2=20

(a) Homomorphic filtering

(b) Wiener filtering

(c) K-L Transform

(d) JPEG.