53 (EC 714) DIPR

2019

DIGITAL IMAGE PROCESSING

Paper : EC 714

Full Marks : 100

Time : Three hours

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

*Answer Q. **1** and **any four** from the rest.*

1. Answer ***all*** the questions : 20

   (a) An 8 bit image has _____ intensity levels. 1

   (i) 8

   (ii) 16

   (iii) 64

   (iv) 256

(b) An image of size 100×100 has 256 different intensity levels. What is the size of the raw image? 2

(c) Which one is not an image enhancement technique? 1

(i) Bit plane slicing

(ii) Histogram equalization

(iii) Quantization

(iv) Contrast streaching.

(d) The benefit of non-uniform quantization is better SNR compared to uniform quantization. *(True/False)* 1

(e) A point (3, 4) is rotated (45°) clockwise. What is the final coordinate? 2

(f) Two sequence $x_1(n)$ and $x_2(n)$ with length 4, undergo circular convolution. The output sequence has a length — 1

(i) 4

(ii) 8

(iii) 7

(iv) None of the above.

(g) Find 2 point DFT of the following sequence $[a\ b]$ 2

(i) $\begin{bmatrix} a+b \\ a-b \end{bmatrix}$

(ii) $\begin{bmatrix} a+jb \\ a-jb \end{bmatrix}$

(iii) $\begin{bmatrix} \overline{a}-b \\ a+b \end{bmatrix}$

(iv) $\begin{bmatrix} a-jb \\ a+jb \end{bmatrix}$

(h) Which of the transform does not have a separable basis? 1

(i) K-L transform

(ii) Fourier transform

(iii) Hadamard transform

(iv) Discrete cosine transform.

(i) Perform Hadamard transform of the following (2×2) image. 2

$$\begin{bmatrix} 48 & 42 \\ 12 & 32 \end{bmatrix}$$

(j) Which of the following filter is used for edge enhancement? 1

(i) High-boost filter

(ii) Winner filter

(iii) Ordinary low pass filter

(iv) Chebyshev high pass filter.

(k) Which of the following is not an image compression technique? 1

(i) Huffman coding

(ii) JPEG

(iii) Homomorphic filtering

(iv) Run-length coding.

(l) Which of the following transformation has the best energy-conservation property? 1

(i) DFT

(ii) DCT

(iii) DHT

(iv) DST.

(m) Histogram specification changes intensity levels in such a way that the image histogram matches with another histogram. *(True/False)* 1

(n) Contrast streaching is an image enhancement technique. *(True/False)* 1

(o) Full form of MRI is _____. 1

(p) Computed Tomography is a non-invasive imaging. *(True/False)* 1

2. (a) Discuss 2D sampling theorem with neat sketch of the spectrum before and after sampling. 10

(b) Discuss the following topics briefly with necessary mathematical interpretations

(i) Nyquist Criteria

(ii) Reconstruction of baseband. 10

3. (a) An image A is filtered with a mark B. Find out the filtered image A and B are given below : 2½×4

$$A = \begin{bmatrix} 12 & 16 & 18 & 38 \\ 16 & \boxed{18} & \boxed{20} & 36 \\ 18 & \boxed{20} & \boxed{24} & 34 \\ 20 & 28 & 32 & 32 \end{bmatrix} \quad B = \frac{1}{4}\begin{bmatrix} 0 & 1 & 0 \\ 1 & 0 & -1 \\ 0 & -1 & 0 \end{bmatrix}$$

Ignore the border points.

(b) Perform convolution of the two following sequence 10

$$x_1(n) = \begin{bmatrix} 1 & 2 & 3 & 4 \\ & \uparrow & & \end{bmatrix}$$

$$x_2(n) = \begin{bmatrix} 1 & 1 & 2 \\ \uparrow & & \end{bmatrix}$$

4. (a) What do you mean by histogram equalization? What are the properties of the intensity transform function must have? 2+3

(b) An (64 × 64) image has the following histogram.

r_k	n_k	$p_r(r_k) = n_k/M.N$
$r_0 = 0$	790	·19
$r_1 = 1$	850	·21
$r_2 = 2$	656	·16
$r_3 = 3$	1023	·25
$r_4 = 4$	81	·02
$r_5 = 5$	329	·08
$r_6 = 6$	245	·06
$r_7 = 7$	122	·03

Find out the histogram of the processed image. 8

(c) State log transform and gamma transform. Mention where are they applied. 5+2

5. (a) What is image degradation? How degradation function can be estimated? 2+12

(b) Discuss shifting and scaling properties of the Fourier transform of a 2D image. 6

6. (a) Describe the algorithm of Fast-Fourier-Transform. 10

(b) Perform FFT of the following sequence. [12 5 6 3 8 4 6] 10

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

(a) Histogram specification

(b) Winner Filter

(c) JPEG

(d) Homomorphic filtering.