53 (EC 714) DIPR

2017

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)* What are the differences between kernal based and non-kernal based transformation ? State the advantages and disadvantages of the two types of transformation. 6

   (b) Write the 1D and 2D equations of forward and inverse transformations of the following : 8
   (i) DFT *(ii)* DCT.

(c) Find the convolution of the two given sequences $x(n)$ and $y(n)$

$$x(n) = [1\ \underset{\uparrow}{0}\ 3\ 4]$$

$$y(n) = [2\ \underset{\uparrow}{5}\ 1\ 2]$$

6

2. (a) Describe separability property of 2D transformations. Explain how it helps to reduce computational complexity. 7

(b) Perform Discrete Fourier Transformation (DFT) of the following 2×2 matrix using seperability property

$$A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}.$$

6

(c) Derive the transformation matrix for (a) translation (b) rotation and (c) scaling. 2+3+2

3. (a) A point (10, 18) is spatially translated by (3, 4) then rotated by 45° and scaled by 2. Find the final coordinate. 4

(b) Reserve the order of the spatial transformations and find the final point. Does this transformation follow the commutative law? 5

(c) What is the Shannon's sampling theorem? Explain how the sampling process is followed for 2D images in the light of Shannon's theorem. Express graphically the sampled signal in spatial as well as in frequency domain. 11

4. (a) Define path, connected component, hole, boundary and interior. 6×1½

(b) Gray level histogram of an image is given below

Gray level	0	1	2	3	4	5	6	7
Frequency	400	700	1350	2500	3000	1500	550	0

Compute the gray level histogram of the output image obtained by enhancing the input by the histogram equalization technique. 7

(c) What do you mean by image sharpening? Explain how edge enhancement is performed by image crispening. 4

5. (a) What is image degradation? Find out the transfer function the minimum mean-square error restoration filter i.e. Wiener filter. 2+10

(b) Explain with example a simple method of super resolution. 8

6. (a) What is Lossy and lossless image compression ? Provide examples of both lossy and lossless compression. 4

(b) Perform Huffman coding for the data source which emitts 8 different symbols. The probabilities of each symbols are as follows :

Symbol	s_0	s_1	s_2	s_3	s_4	s_5	s_6	s_7
Probability	·05	·008	·022	·06	·18	·13	·07	·48

6

(c) Write the steps of JPEG and explain briefly each steps. 10

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

(a) Fast Fourier Transform

(b) K-L transform

(c) Anisotropic diffusion

(d) Homomorphic filtering.
