53 (EC 714) DIPR

2014

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. *(a)* If an image has bandwidth ω_x and ω_y then, as per nyquist criteria, sampling frequencies are _____ and _____.

   (b) Which one is not true regarding quantization ?

   (a) Uniform quantization assures minimum quantization error.

   (b) Non uniform quantization provides better SNR compared to uniform quantization.

(c) In uniform quantization construction Level is exactly in the midpoint between two consecutive decision Level.

(d) Max L'Loyd quantization is a non uniform quantization.

(c) A pixel having coordinate (5, 6) undergoes a shift of [–2, 3]. The new coordinate is _____.

(d) A pixel (2, 3) is rotated by 45°. The new coordinate is _____.

(e) Length of the convolved sequence between two following sequences is _____.

$x_1 = [1\ \underset{\uparrow}{2}\ 3\ 4]$

$x_2 = [\underset{\uparrow}{2}\ 1\ 7\ 3]$

(f) Find out the convolution of the two following sequences

(1) $x_1(n) = [1\ \underset{\uparrow}{2}\ 5]$

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

(g) If the nature of the above convolution is cyclic convolution, then the length of the convolved sequence is _____ .

(h) Which transformation has maximum energy conservation property ?

(i) $H_2 = \begin{bmatrix} 1 & 1 \\ 1 & -1 \end{bmatrix}$. Using Hadamard transformation kernel find H_8.

(j) For an image $\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$ find out covariance matrix using *K-L* transform theory. 10×2=20

2. (a) State the advantages of non uniform quantization over uniform quantization. 4

(b) Explain how decision Level and reconstruction Level is decided in Max-L-Lyod quantizer. 8

(c) What are the practical limitations of Sampling and reconstruction ? 8

3. (a) Explain importance of seperability property. Write the forward and inverse transformation expression of the following transformation for 2D scenario 12

(a) DFT (b) DCT (c) DHT

(b) Write the steps of *K-L* transform. 8

4. (a) Perform FFT of the following sequence

$$[1\ 2\ 5\ 6\ 3\ 4\ 5\ 8]$$ 15

(b) Design mask for first order, second order derivative. 5

5. (a) Name a few popular image enhancement technique and explain their working in brief. 10

(b) Perform histogram equalization for an image which has the following intensity distribution

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

Find the new values of intensity Levels and find the processed histogram. 10

6. *(a)* Explain the working principle of homomorphic filter. 10

(b) Explain what is run length coding in image compression. Prove that in run-length coding, the compression factor is $C = \frac{1 - P^M}{m(1-P)}$, where P is the probability of occurrence of symbol 1 in binary image. M is provided as maximum run length. 10

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

(i) Histogram specification

(ii) Discrete Hadamard transform

(iii) FFT

(iv) Winner filter.