M.E. Sem I (Elect) Dec, 07

Elective - I - Image Processing

Con. 5605–07. BB–7506

(3 Hours) [Total Marks : 100

N.B. : (1) Question No. **1** is **compulsory**.
(2) Attempt any **four** questions out of remaining **six** questions.
(3) Assume **suitable** data if **necessary**.
(4) **Figures** to the **right** indicate **full** marks.

1. Justify the following statements :– 20
   (a) The mean filter is linear but median filter is not.
   (b) Canny edge detector is optimal for step edges corrupted by white noise.
   (c) Run length coding is loss less coding but may not give data compression always.
   (d) Poorly illuminated images cannot be easily segmented.
   (e) The global nature of a histogram limits its applicability to complex scenes.

2. An 8 x 8 image f(x, y) has grey level represented by following equation :– 20
   $f(x, y) = |x - y|$
   for x, y = 0, 1, 2, 3, 4, 5, 6, 7.
   Find the output image obtained by applying 3 x 3 averaging and median filter on the image f(x, y). Note that boarder pixels remains unchanged. Sketch the histogram of an image obtained by adding original image and its contrast reversed image. [The contrast reversed image is one in which the grey level value I of each pixel is replaced by (max I) – I]

3. (a) Consider an image matrix given by :– 10

$$U = \begin{bmatrix} 2 & 3 \\ 1 & 3 \end{bmatrix}$$

   Find the 2-D Discrete Cosine Transform and 2–D Discrete Fourier Transform.

   (b) What is basis image ? How 2–D image signal can be expressed in term of orthogonal set of basis functions ? 10

4. (a) Write the Harr transform matrix of size 8 x 8. 5

   (b) Sketch the butterfly diagram (signal flow graphs) for the flow graph for fast algorithms of above Harr transform. 5

   (c) Explain basic data redundancies. Describe basic compression model used for image compression. 10

5. (a) Explain the importance of image segmentation in following areas :– 10
      (i) Satellite images
      (ii) Biomedical images
      (iii) Robotics.

   (b) Explain hit or miss transform. 4

   (c) Define and explain erosion and dialation for binary images. Use different structuring elements and discuss its applications. 6

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6. (a) Derive the expression for Wiener filter and explain the need of generalized Wiener filtering. **8**

(b) The following six symbols and their probabilities are given in tabular form. Generate Huffman code for them. **6**

Symbol	a_1	a_2	a_3	a_4	a_5	a_6
Probability	0·1	0·4	0·06	0·1	0·04	0·3

(c) Consider the image of 4 x 4 (grey level image) size :– **6**

$$f(x, y) = \begin{bmatrix} 3 & 1 & 2 & 0 \\ 2 & 0 & 3 & 1 \\ 2 & 3 & 1 & 0 \\ 1 & 3 & 0 & 2 \end{bmatrix}$$

Obtain the following moments :–

(i) m(0, 0) (iv) m(1, 1)
(ii) m(1, 0) (v) m(2, 0)
(iii) m(0, 1) (vi) m(2, 1)

7. Write short notes on (any **two**) :– **20**

(a) K–L Transform
(b) Fourier Descriptors
(c) Rotation Invariance of chain Codes
(d) Hotelling transform
(e) LOG and DOG filters
(f) Signature.