C7-R4: DIGITAL IMAGE PROCESSING AND COMPUTER VISION

NOTE:

1. **Answer question 1 and any FOUR from questions 2 to 7.**
2. **Parts of the same question should be answered together and in the same sequence.**

Time: 3 Hours **Total Marks: 100**

1.

a) Explain the Sampling and Quantization of images with the help of suitable examples.

b) Develop a procedure for computing the median of *n* x *n* neighborhood.

c) In an automated assembly application, four classes of parts are to be color coded in order to simplify detection. However, only a monochrome TV camera is available to acquire digital images. Propose a technique for using this camera to detect the four different colors.

d) Under what circumstances is the discrete wavelet transform (DWT) a better choice than a Continuous wavelet transform (CWT)? Are there times when the CWT is better than the DWT?

e) Use the LZW coding algorithm to encode the 7-bit ASCII string "AAAAAAAAAAA".

f) Explain what would happen in binary erosion and dilation if the structuring element is a single point, valued 1. Give reason(s) for your answer.

g) For each of the figures shown, discuss the action taken at point *p* by Step 1 of the skeletonizing algorithm.

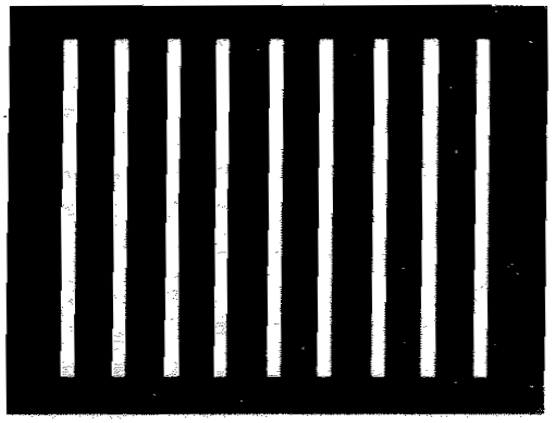
1	1	0	0	0	0	0	1	0	1	1	0
1	*p*	0	1	*p*	0	1	*p*	1	0	*p*	1
1	1	0	0	0	0	0	1	0	0	0	0

(7x4)

2.

a) What is Histogram matching (specification)? Summarize the histogram specification procedure by writing all the steps.

b) The whit bars in the test pattern shown are 7 pixels wide and 210 pixels high. The separation between bars is 17 pixels. What would this image look like after application of (a) A 3X3 arithmetic mean filter, (b) A 5X5 arithmetic mean filter, (c) A 9X9 arithmetic mean filter, (d) Harmonic mean filter, and (e) A max filter?

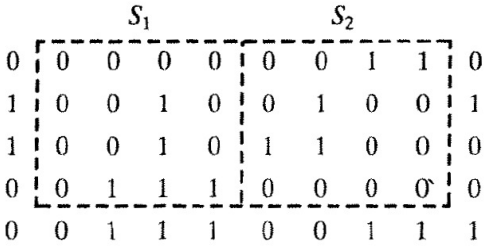


(9+10)

3.

a) Explain (i) Ajacency, (ii) Connectivity, (iii) Regions and (iv) Boundaries relationships between pixels.

b) Consider the two image subsets, S_1 and S_2, shown in the following figure. For $V = \{1\}$, determine whether two subsets are (a) 4-adjacent, (b) 8-adjacent, or (c) *m*-adjacent?

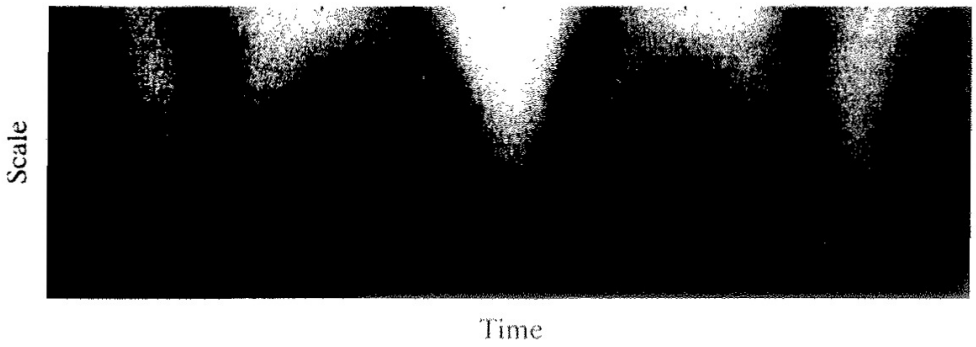


(12+6)

4.

a) Explain Color Models and write a short note on RGB color model.

b) What does the following continuous wavelet transform reveal about the one-dimensional function upon which it was based?



(10+8)

5.

a) A binary image contains straight lines oriented horizontally, vertically, at 45 degrees, and at -45 degrees. Give a set of 5X5 masks that can be used to detect 1-pixel breaks in these lines. Assume that the intensities of the lines and background are 1 and 0 respectively.

b) Explain the concept of thresholding and discuss any one thresholding algorithms.

c) Explain the Sobel and Prewitt masks.

(6+6+6)

6.

a) What are chain codes? How is chain codes used to represent a boundary of an image?

b) Propose a set of descriptors capable of differentiating between the shapes of the characters 0, 1, 8, 6 and Z (Use topological descriptors in conjunction with convex hull)

(8+10)

7. Write short notes on **any three** of the following:

a) Motion estimation

b) Snakes and active contours

c) Multiresolution analysis

d) Camera model and camera calibration

(6x3)