

**GUJARAT TECHNOLOGICAL UNIVERSITY**

**BE SEM-VIII Examination May 2012**

**Subject code: 182006**

**Subject Name: Machine Vision**

**Date: 08/05/2012**

**Time: 10.30 am – 01.00 pm**

**Total Marks: 70**

**Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1** (a) Define Digital Image. Give applications of X-ray and Radio Wave Imaging. **07**  
 (b) What is a histogram? Plot the histograms of dark image, bright image, poor contrast image and high contrast image. Explain the concept of histogram specification. **07**
- Q.2** (a) Explain image sampling and quantization with sketch. **07**  
 (b) Consider the image segment shown in figure 1. **07**  
 Let  $V=\{0,1\}$  and compute the length of the shortest 4, 8 & m-path between pixels p & q. if a particular path does not exist between these two points, explain why.

|      |   |   |      |
|------|---|---|------|
| 3    | 2 | 2 | 1(q) |
| 2    | 2 | 0 | 2    |
| 1    | 2 | 1 | 1    |
| 1(p) | 0 | 1 | 2    |

Figure 1

**OR**

- (b) For a digital image data given in figure 2, apply 3 x 3 Sobel and Prewitt operators and calculate question marked (?) values. **07**

|     |     |     |    |
|-----|-----|-----|----|
| 100 | 160 | 178 | 59 |
| 99  | 130 | 180 | 61 |
| 93  | 145 | 163 | 55 |
| 97  | 111 | 155 | 63 |

|  |   |   |  |
|--|---|---|--|
|  |   |   |  |
|  | ? | ? |  |
|  | ? | ? |  |
|  |   |   |  |

Figure 2. Input Image and output Image

- Q.3** (a) Apply the histogram equalization technique on the image data shown below. **07**  
 4 bits/pixels are used to represent each gray value in the image. Draw histograms of input and resultant output image (after equalization).

|    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| rk | 0  | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11 | 12 | 13 | 14 | 15 |
| nk | 02 | 04 | 06 | 08 | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 26 | 28 | 30 | 32 |

Where,  $rk=k^{th}$  gray level and  $nk=$ number of pixels having  $k^{th}$  gray level.

(b) Explain different low pass filters with their 2D radial cross sections. 07

**OR**

**Q.3 (a)** Schematically represent the following transformations, illustrating the needs for specific applications. 07

1. Negative transformation
2. Logarithmic transformation
3. Power-law transformation
4. Gray-level slicing

(b) Explain different high pass filters with their 2D radial cross sections. 07

**Q.4 (a)** What is image segmentation? Give the procedure to detect an isolated point in an image. 07

(b) Apply following 3 x 3 filters on image given in figure 3. 07

|     |     |     |     |    |
|-----|-----|-----|-----|----|
| 100 | 150 | 89  | 67  | 38 |
| 110 | 148 | 90  | 65  | 40 |
| 115 | 0   | 255 | 138 | 0  |
| 255 | 160 | 95  | 45  | 23 |
| 102 | 155 | 85  | 0   | 30 |

|  |   |   |   |  |
|--|---|---|---|--|
|  |   |   |   |  |
|  | ? | ? | ? |  |
|  | ? | ? | ? |  |
|  | ? | ? | ? |  |
|  |   |   |   |  |

Figure 3. Input Image and output image

Find out gray values at “?” locations in the output image.

1. Geometric mean filter
2. Harmonic mean filter
3. Midpoint filter
4. Alpha-trimmed mean filter with d=4

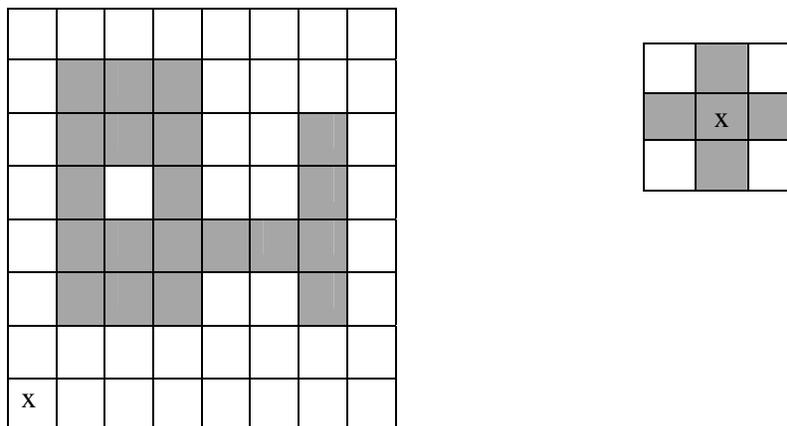
**OR**

**Q.4 (a)** State different line detection masks for detection of horizontal, vertical, +45° and -45° lines. Explain LoG (Laplacian of a Gaussian) and derive its formula. 07

(b) Explain a model of the image degradation/restoration using block diagram. 07

**Q.5 (a)** Explain basic steps for filtering in frequency domain with block diagram. Give MATLAB commands related to this task. 07

(b) Define image Dilation. Give its application. Sketch the result of Dilation of the image data set A using the structuring element B given in figure 4. Origin is defined by ‘x’. 07



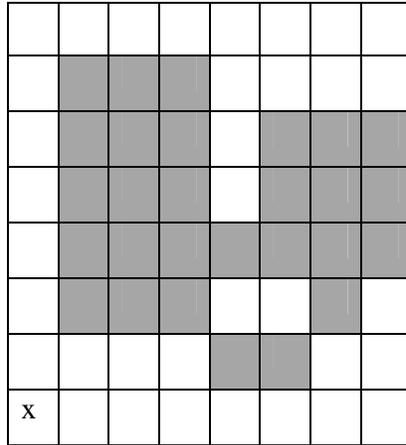
Set A

Structuring Element B

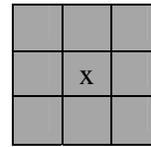
Figure 4

OR

- Q.5 (a)** Sketch the typical PC based Machine Vision systems showing basic components and explain the working of each in brief. **07**
- (b)** Define image Erosion. Give its application. Sketch the result of Erosion of the image data set A using the structuring element B given in figure 5. **07**  
Origin is defined by 'x'.



Set A



Structuring Element B

Figure 5

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