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MINI-044

M.Tech. IN ADVANCED INFORMATION TECHNOLOGY – INTELLIGENT SYSTEMS AND ROBOTICS (MTECHSR)

00484

Term-End Examination

June, 2015

MINI-044 : ARTIFICIAL VISION SYSTEM

Time : 3 hours *Maximum Marks : 100*

Note :

(i) *Section I is **compulsory**.*

(ii) *In Section II, answer any **five** questions.*

(iii) *Assume suitable data wherever required.*

(iv) *Draw suitable sketches wherever required.*

(v) *Italicized figures to the right indicate maximum marks.*

(vi) *Use of calculator is allowed.*

SECTION I

1. Answer **all** the questions. *5×3=15*

(a) What are chain codes ? Give their advantages and disadvantages.

(b) Write a program for computing the 2D DFT of an image.

(c) List out the differences between RGB and HSV colour spaces.

(d) State and explain any non-linear spatial filtering techniques.

(e) Write a short note on Edge Detection Techniques.

2. Give the structuring element and morphological operation(s) required to get Figure 1(b) from Figure 1(a). Pad zeros if required. Indicate the origin of the structuring element. Explain each of the operations using sub-images. If more than one morphological operation is used give full result at the end of each operation : *8+7=15*

0	0	0	0	0	0	0	0
0	1	1	0	0	0	0	0
0	0	0	0	1	0	1	0
0	0	0	0	0	0	0	0

Figure 1(a)

0	1	1	0	0	0	0	0
0	1	1	0	1	0	1	0
0	1	1	0	1	0	1	0
0	0	0	0	1	0	1	0

Figure 1(b)

SECTION II

3. The rectangle in the binary image shown in the Figure 2 is of size m × n pixels.

(a) What would the magnitude of the gradient of this image look like ? Assume that gx and gy are obtained using the Prewitt, Sobel operator. Show all relevant different pixel values in the gradient image. *7*

(b) Sketch the histogram of the edge directions. *3*

(c) Does the zero-crossing method for finding edge location always result in closed contour ? Explain. *4*

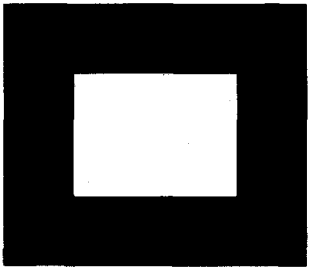

Figure 2

4. (a) Write a program to perform histogram equalization on the following 7-bit, single channel, 8 × 8 image shown in Figure 3. *8*

22	45	61	56	35	61	64	83
33	59	45	70	109	85	69	72
72	59	78	133	145	104	66	53
45	68	70	152	134	106	70	39
67	21	68	144	136	88	68	70
39	55	60	70	77	28	58	55
45	31	64	59	55	51	65	43
57	59	69	68	65	36	38	74

Figure 3

(b) Define Histogram entropy. Write an algorithm to perform histogram entropy in the above figure. *6*

5. (a) Show that if you use two Fourier descriptors (u = 0 and u = 1) to reconstruct a boundary, the result will always be a circle. *8*

(b) Give two boundary shapes that have the same mean and the third statistical moment descriptors, but different second moments. *6*

6. (a) Write a 'C' program for computing the two dimensional DFT of an image. (Assume that the image is already loaded in a two dimensional matrix). 7

(b) Prove that both the continuous and discrete 2-D Fourier transforms are translation and rotation invariant. One can consider the image to be single channel gray scale and of width W and height H. 7

7. In Figure 4, the image is corrupted by noise. The maximum dimension of noise is 2 by 2 pixels. The intensity of noise can be any value from 0 to 255. The noise is never on the border of the black rectangles as shown. Which filtering technique should be used to remove the noise ? Give the minimum size of the filter and explain its operation by taking a sample case. (If required, assume a minimum of 7 pixels separation between two noise clusters). 7+7

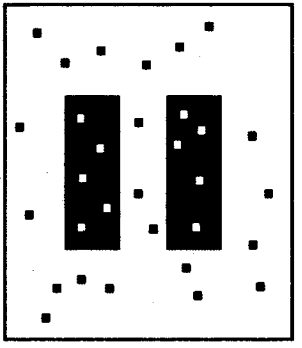

Figure 4 : The image is corrupted by noise

8. In a security system based company, face recognition system needs to be installed. Assume that lighting conditions are appropriate and respective hardware is purchased. Write an algorithm for performing face recognition using PCA. *14*
