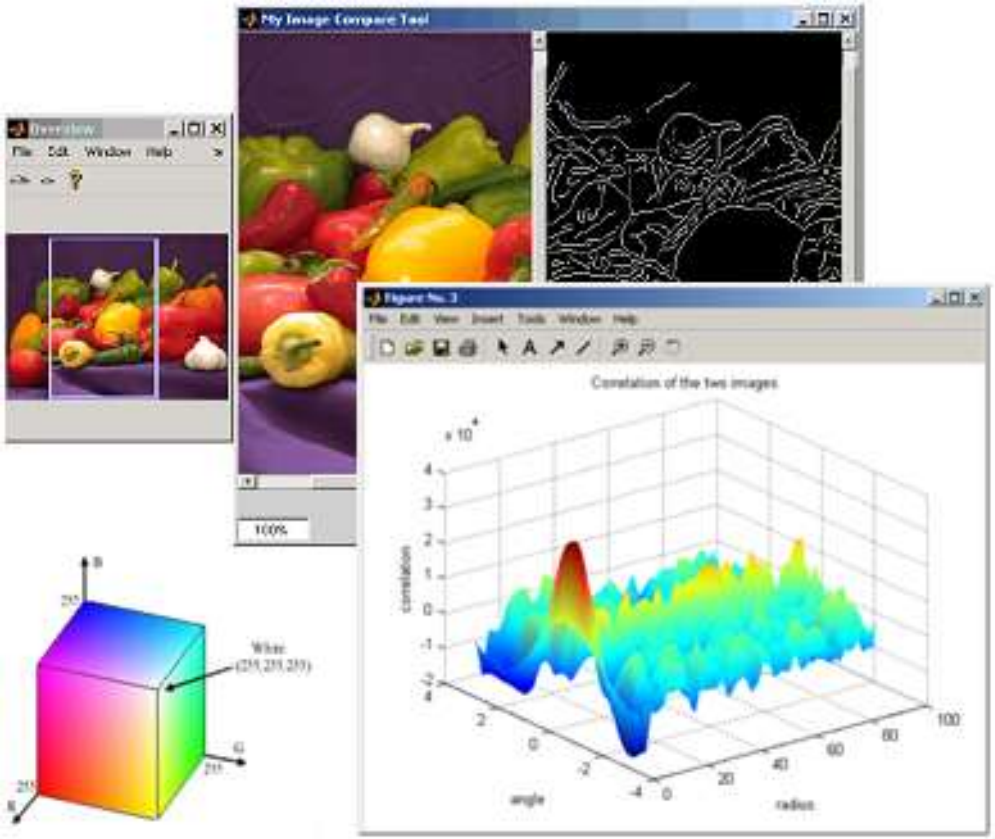
Digital Image Processing



DIGITAL IMAGE PROCESSING

LECTURE -20

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Image Segmentation

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University End Sem Question

1. What are the different steps followed by the complete process of edge map generation?

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2. What is region splitting and merging method? Explain with suitable example

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3. What are the different thresholding methods used for segmentation? Explain.

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University End Sem Question

Ques 4: Compute the magnitude and gradient of the shaded pixel. Apply Prewitt operator.

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1	2	3	4	5
3	4	5	6	7
5	6	7	8	9
7	8	9	10	11
9	10	11	12	13

University End Sem Question

Ques: Consider a problem of detecting edges in the following 5 × 5 image. First pad the boundary by duplicating the pixels at the boundary and then apply the Prewitt operator to the image to obtain the horizontal and vertical gradient maps. Give your answer in two 5 × 5 tables and till two digits after the decimal.

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10	3	2	5	4
11	8	3	1	6
7	5	6	2	7
2	1	9	4	2
2	3	3	0	1

Numerical Question

Ques: Find the strength and the direction of the of the edge of the highlighted pixel. Pixel in Gray are 0 and White are 1.

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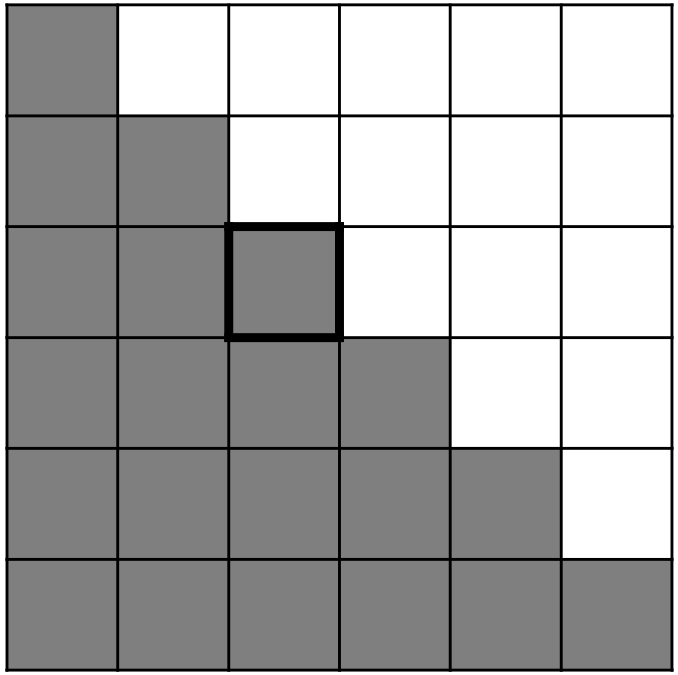

University End Sem Question

Ques: Find the strength & direction of the edge at (2,2) using gradient method. Pixel in Gray have value 0 & in White have value 1.

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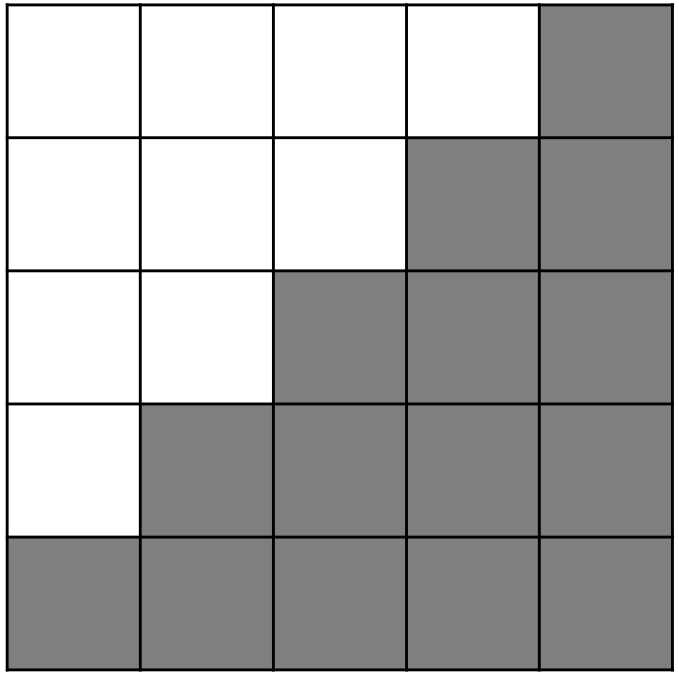

University End Sem Question

Ques: Given a set of five points, use Hough Transform to join the points. A(1,4), B(2,3), C(3,1), D(4,1) and E(5,0). Let m_{min} = -2 and m_{max} = 2

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Give your answer in the following steps:

Step 1: Equations corresponds to the points.

Step 2: Calculation of c (Show your calculations in the following table. Add more rows if required)

m	A (1,4)	B (2,3)	C (3,1)	D (4,1)	E (5,0)

Step 3: Equations of the line on which majority of the points lie.

University End Sem Question

Ques: What is the use of Hough Transformation? Apply Hough Transform to join the following points: (2,0), (2,1), (2,2), and (2,4)

Assume m has range (-0.2,0.2) and interval 0.1. Show all the steps with the help of diagram.

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Numerical Example

Ques: Apply region splitting on the following image. Assume the threshold value ≤ 4.

5	6	6	6	7	7	6	6
6	7	6	7	5	5	4	7
6	6	4	4	3	2	5	6
5	4	5	4	2	3	4	6
1	3	2	3	3	2	4	7
0	0	1	0	2	2	5	6
1	1	0	1	0	3	4	4
1	0	1	0	2	3	5	6

University End Sem Question

Ques: Apply region splitting on the following 8 × 8 image. Threshold is 4 (absolute difference ≤ 4) Show all the steps clearly.

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4	4	4	3	4	4	16	16
4	4	4	3	4	4	18	18
3	3	6	6	4	4	20	20
5	7	6	6	4	4	20	20
8	8	10	10	14	14	14	14
8	8	10	10	14	14	14	14
12	12	12	12	14	14	14	14
12	12	12	12	14	14	14	14

University End Sem Question

Ques: Will pixel (3,3) be detected as an edge pixel if Sobel gradient operator is used? Give the kernel for Sobel operator. Show all your calculations clearly. Use the following to estimate the gradient magnitude. Assume threshold value to be 15.

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$$|d(x,y)| = \sqrt{\left(d_1(x,y)\right)^2 + \left(d_2(x,y)\right)^2}$$

8	8	8	8	8	1
8	9	8	8	8	2
8	9	8	8	2	1
8	9	8	2	2	2
8	8	1	2	1	2
8	1	1	2	2	2

University End Sem Question

Ques: Use Prewitt gradient operator to find out the gradient magnitude and edges of the given images. (Assume appropriate values of the threshold for edge detection). Use the following to estimate the gradient magnitude.

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$$|d(x,y)| = \sqrt{\left(d_1(x,y)\right)^2 + \left(d_2(x,y)\right)^2}$$

Y →

X ↓

8	8	8	8	8	1
8	9	8	8	8	2
8	9	8	8	2	1
8	9	8	2	2	2
8	8	1	2	1	2
8	1	1	2	2	2

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Numerical Question

Ques: Consider the image shown in Fig. Consider the highlighted pixels as seed point coordinates. Show the results of the region-growing algorithm with T = 4.

1	0	7	8	7
0	1	8	9	8
0	0	7	9	8
0	1	8	8	9
1	2	8	8	9

Numerical Question

Ques: Perform the Region Merging algorithm on the following image with T = 3

2	2	2	2	2
2	8	8	8	1
2	8	8	8	1
2	1	1	1	1
2	1	1	1	1

University End Sem Question

Ques: Using region growing technique, divide the following image into regions. Each time takes the topmost leftmost available pixel as seed. Mark the pixels of the first region detected as A, second region as B and so on. Also give the coordinates of pixels taken as seed. Take T = 4 i.e. max - min $\leq$ 4

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5	6	6	6	7	7	6	6
6	7	6	7	5	5	4	7
6	6	4	4	3	2	5	6
5	4	5	4	2	3	4	6
1	3	2	3	3	2	4	7
0	0	1	0	2	2	5	6
1	1	0	1	0	3	4	4
1	0	1	0	2	3	5	6

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University End Sem Question

Ques 5: Which operator detects diagonal edges better than Prewitt operator? Also write operator masks.

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Ques: How can first order derivative help in edge detection? Where can we use second order derivative in edge detection.

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Ques: Explain Point, Line, Edge segmentation with the help of an example.

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Ques: Explain anyone similarity (homogeneity) based segmentation Algorithm with the help of an example.

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University End Sem Question

Ques 6: How the Canny Edge Detection method detects the edge. Explain the complete process.

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Solution:

- Smoothing with Gaussian Filter
- Compute Derivative of filter image
- Find magnitude & orientation of gradient
- Apply Non-Maxima Suppression
- Apply Hysteresis Threshold

University End Sem Question

Ques7: Image segmentation is a process of partitioning an image into multiple segments, or regions. The goal of the image segmentation is to simplify the representation of image into region that is more meaningful and easier to analyse. How region growing works for segmentation. Explain with an example.

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Ques8: How region splitting and merge operation works for image segmentation. Explain with suitable example.

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University End Sem Question

Ques9: The purpose of edge detection in general is to significantly reduce the amount of data in the image, while preserving the structural properties to be used for further image processing. How the canny edge detection reduce the amount of data to preserve the structural properties.

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Thank You