SNS COLLEGE OF TECHNOLOGY

(AN AUTONOMOUS INSTITUTION)

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Department of Biomedical Engineering

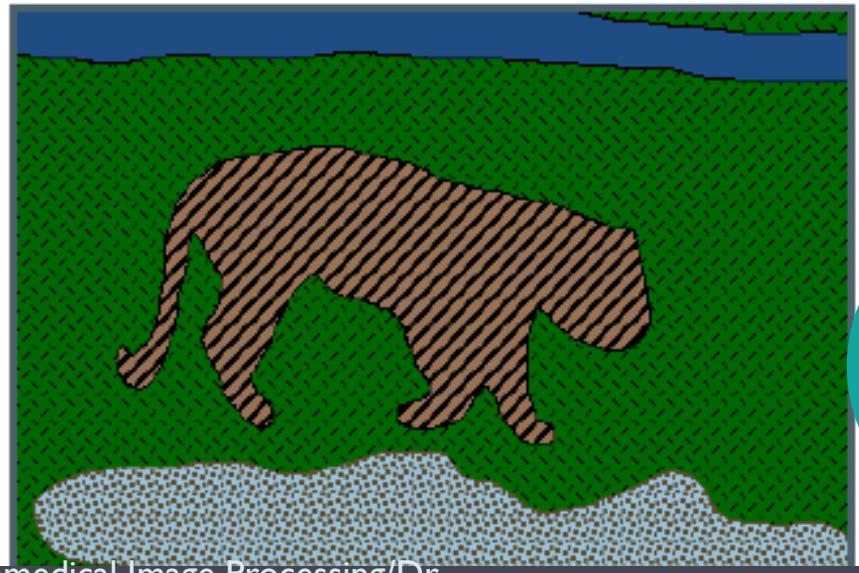
Course Name: 19BMB304 & Biomedical Image Processing

III Year : VI Semester

Unit III –IMAGE RESTORATION AND SEGMENTATION

Topic : Segmentation: Detection of Discontinuities

Image Segmentation



Topic's to be covered

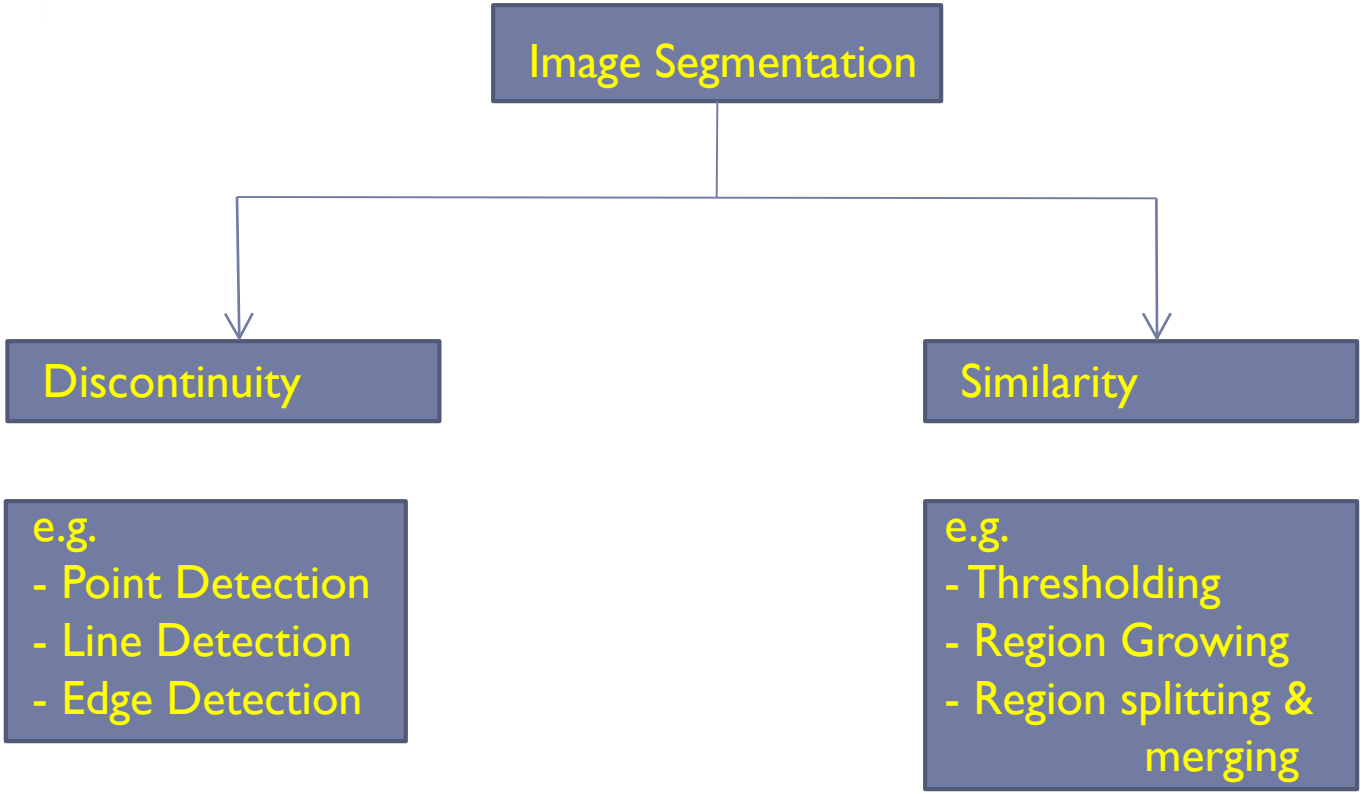
- Introduction to Image analysis and segmentation
- Detection of Discontinuity
  - Point, line, edge and combined detection..
- Edge linking and boundary detection
  - Local processing, hough transform, graph-theoretic technique..
- Thresholding
  - Global thresholding, Optimal thresholding, threshold selection..
- Region oriented segmentation
  - Region growing, Region splitting and merging..

Introduction

- Image analysis:-

  Techniques for extracting information from an image.
- Segmentation is the first step for image analysis.
- Segmentation is used to subdivide an image into its constituent parts or objects.
- This step determines the eventual success or failure of image analysis.
- Generally, the segmentation is carried out only up to the objects of interest are isolated. e..g. face detection.
- The goal of segmentation is to simplify and/or change the representation of an image into something that is more meaningful and easier to analyse.

Classification of the Segmentation techniques



Point Detection

Based on Masking…

-1	-1	-1
-1	8	-1
-1	-1	-1

- Find response R.
- The emphasis is strictly to detect points. That is, differences those are large enough to be considered as isolated points.
- So, compare and separate based on

- Where R = Response of convolution

  T = Non negative threshold value

Point Detection(Example)

Original

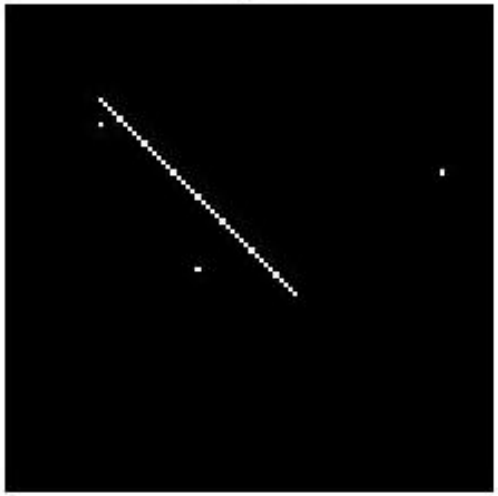
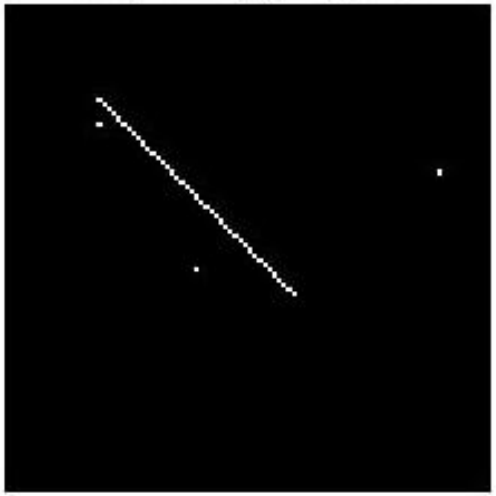
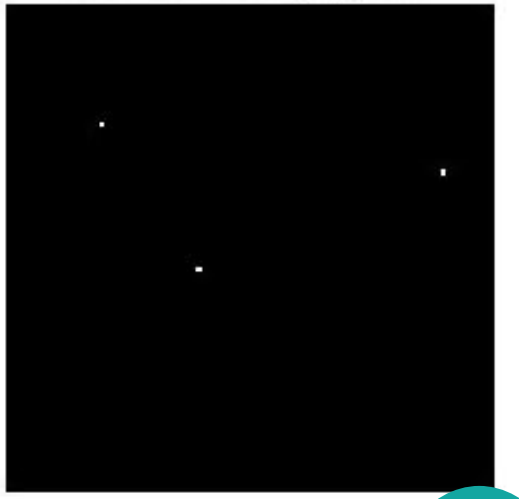


Image after applying mask



Thresholded image by T=8



Line Detection

Horizontal Line

-1	-1	-1
2	2	2
-1	-1	-1

45 degree inclined Line

-1	-1	2
-1	2	-1
2	-1	-1

Vertical Line

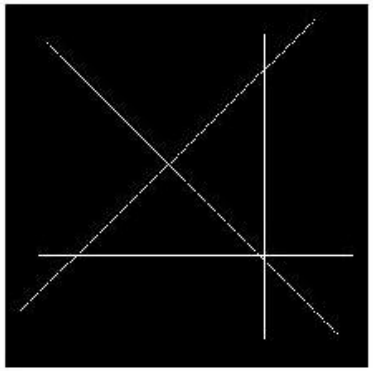
-1	2	-1
-1	2	-1
-1	2	-1

-45 degree inclined Line

2	-1	-1
-1	2	-1
-1	-1	2

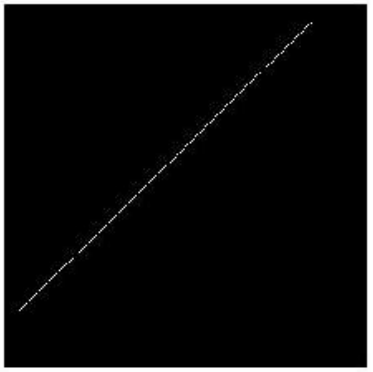
Line Detection(Cont.)

Original Image



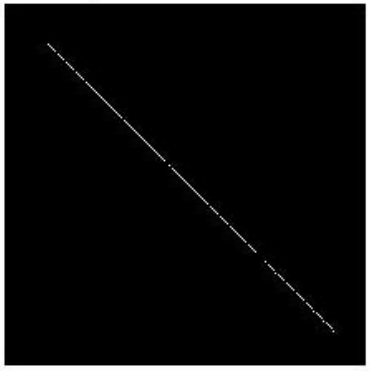
Horizontal line detection

45 degree inclined line detection



Vertical line detection

135 degree inclined line detection



Edge Detection

Robert's Mask

-1	0
0	1

0	-1
1	0

Prewitt

-1	-1	-1
0	0	0
1	1	1

-1	0	
-1	0	1
-1	0	1

Sobel Operator

-1	-2	-1
0	0	0
1	2	1

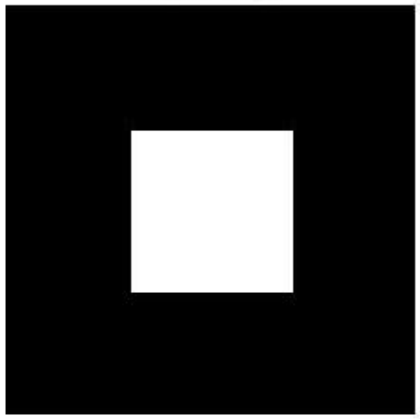
-1	0	1
-2	0	2
-1	0	1

Laplacian

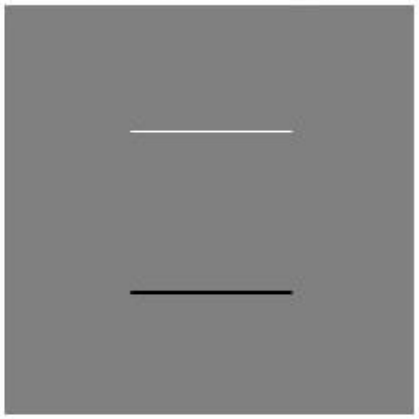
-1	-1	-1
-1	8	-1
-1	-1	-1

Edge Detection(Example)

Original Image

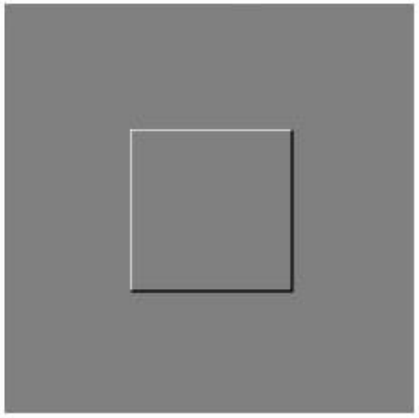


Sobel-Horizontal Edge



Sobel-Vertical Edge

Sobel-Edge



Edge Detection(Example)

Original

Laplacian to unsharped image

After Thresholding by

Combined Detection

- Multimask formulation makes possible development of a method to determine whether a pixel is most likely to be an isolated point or part of a line or an edge.

Combined Detection- Frei and Chen Filter

1	$\sqrt{2}$	1
0	0	0
-1	$-\sqrt{2}$	-1

1	0	-1
$\sqrt{2}$	0	$-\sqrt{2}$
1	0	-1

0	-1	$\sqrt{2}$
1	0	-1
$-\sqrt{2}$	1	0

$\sqrt{2}$	-1	
-1	0	1
0	1	$-\sqrt{2}$

0	1	0
-1	0	-1
0	1	0

-1	0	1
0	0	0
1	0	-1

1	-2	1
-2	4	-2
1	-2	1

-2	1	-2
1	4	1
-2	1	-2

1	1	1
1	1	1
1	1	1

Edge Linking and Boundary Detection

- Intensity discontinuity can be utilized to find boundary.

- The lagging part of boundary detection using intensity discontinuity is that the boundary may not be completely defined because of
  - Noise
  - Breaks in boundary due to non-uniform illumination

- So, after edge detection, edge linking process is carried out to assemble edge pixels into meaningful boundary

Need of Edge Linking

The boundary is not complete in edge detection (bottom figure).

1) Edge Linking – Local Processing

- Analyze every pixel in small neighborhood that has under edge detection.

- For same characteristics (point is on same edge or not), two principal properties used are
  - Strength of response of the gradient operator

$$\left|\nabla f(x,y) - \nabla f(x',y')\right| \le T$$

  - The direction of gradient.

$$\left|\alpha(x,y) - \alpha(x',y')\right| \le A$$

Thank You