
15EEE337 Digital Image Processing

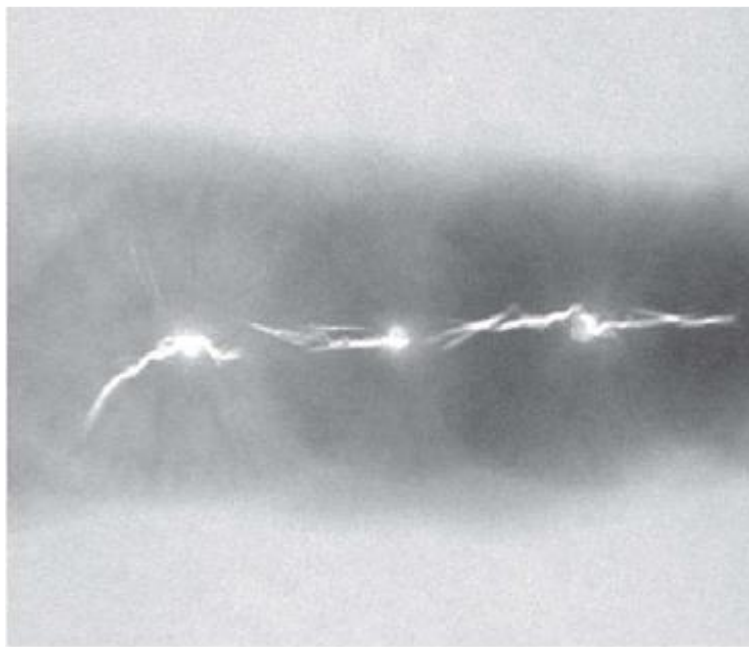
— Sarath T.V. —

Last Lecture

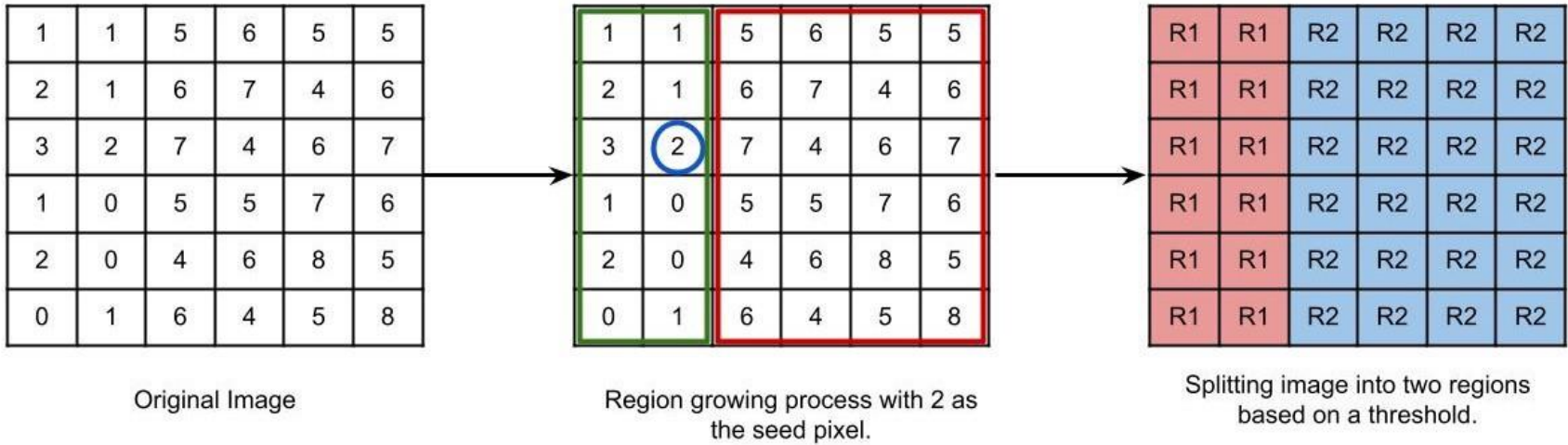
- Hough Transform

Region based segmentation

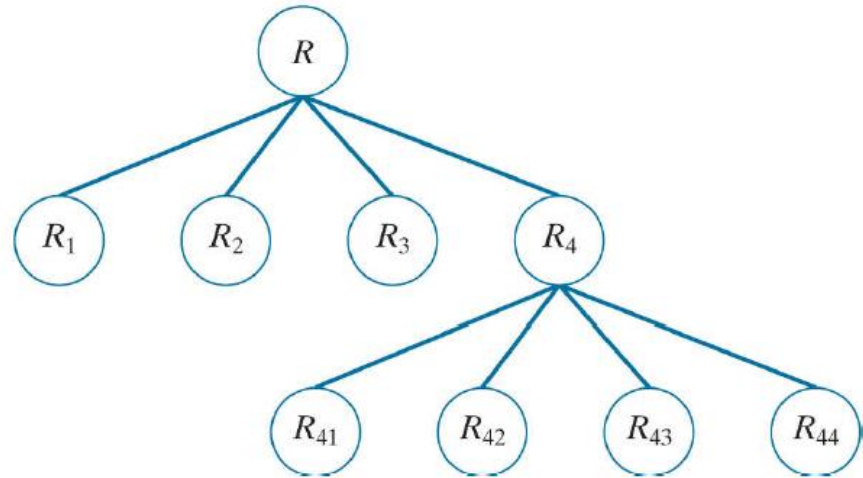
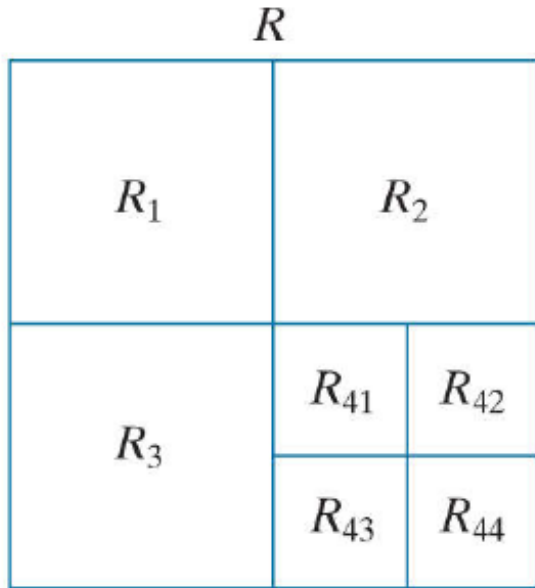
- A region can be classified as a group of connected pixels exhibiting similar properties.
- The similarity between pixels can be in terms of intensity, color, etc. In this type of segmentation, some predefined rules are present which have to be obeyed by a pixel in order to be classified into similar pixel regions.
- Region-based segmentation methods are preferred over edge-based segmentation methods in case of a noisy image. Region-Based techniques are further classified into 2 types based on the approaches they follow.
 - Region growing method
 - Region splitting and merging method



Region Growing Technique



Example Region Splitting and Merging Technique



Region Splitting and Merging Technique

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

Original Image

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

Region splitting into 4 quadrant

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

Classifying a quadrant as a region if it satisfies condition else performing further splitting

$$|Z_{max} - Z_{min}| \leq threshold$$

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

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

5	4	6	6
6	7	6	7
6	6	4	4
5	4	5	4

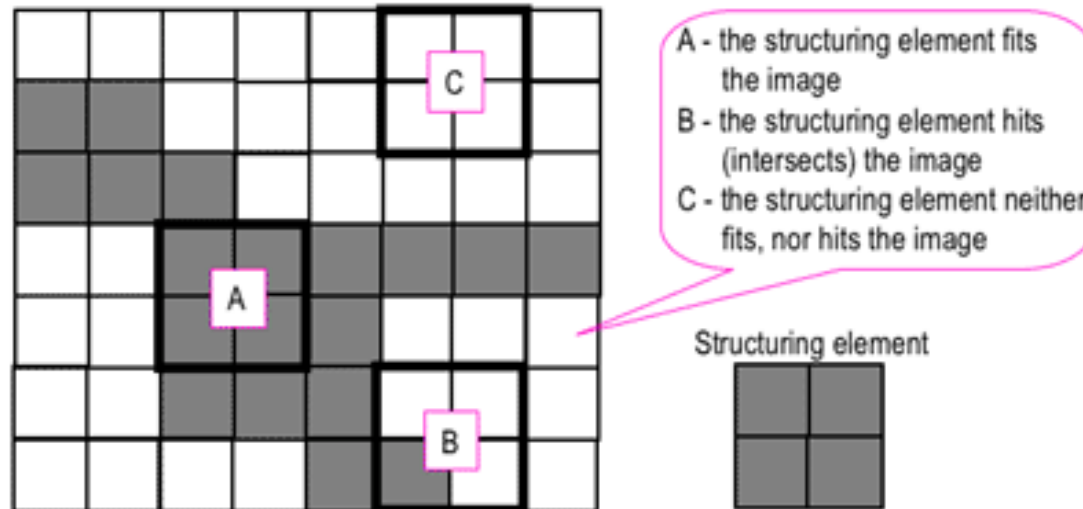
7	7	6	6
5	5	4	7
3	2	5	6
2	3	4	6

7	7	6	6
5	5	4	7
3	2	5	6
2	3	4	6

Morphological operation

- mathematical morphology as a tool for extracting image components that are useful in the representation and description of region shape.
- Structuring Elements; An essential part of the morphological operations
- A matrix that identifies the pixel in the image being processed and defines the neighborhood used in the processing of each pixel
- typically choose a structuring element the same size and shape as the objects you want to process in the input image

- Morphological techniques probe an image with a small shape or template called a **structuring element**. The structuring element is positioned at all possible locations in the image and it is compared with the corresponding neighborhood of pixels. Some operations test whether the element "fits" within the neighborhood, while others test whether it "hits" or intersects the neighborhood.



1	1	1	1	1
1	1	1	1	1
1	1	1	1	1
1	1	1	1	1
1	1	1	1	1



Square 5x5 element

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

Diamond-shaped 5x5 element

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

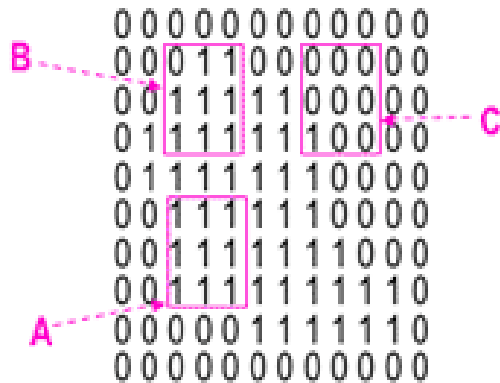
Cross-shaped 5x5 element



 Origin

1	1	1
1	1	1
1	1	1

Square 3x3 element

- When a structuring element is placed in a binary image, each of its pixels is associated with the corresponding pixel of the neighborhood under the structuring element. The structuring element is said to **fit** the image if, for each of its pixels set to 1, the corresponding image pixel is also 1.
- Similarly, a structuring element is said to **hit**, or intersect, an image if, at least for one of its pixels set to 1 the corresponding image pixel is also 1.



$$s_1 = \begin{pmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{pmatrix}$$

$$s_2 = \begin{pmatrix} 0 & 1 & 0 \\ 1 & 1 & 1 \\ 0 & 1 & 0 \end{pmatrix}$$

		A	B	C
fit	s ₁	yes	no	no
	s ₂	yes	yes	no
hit	s ₁	yes	yes	yes
	s ₂	yes	yes	no

A graphic featuring the words "THANK YOU" in a stylized, neon-like font. The word "THANK" is rendered in pink, and "YOU" is in light blue. The text is centered and surrounded by several horizontal lines in pink, yellow, and light blue, some of which are slightly offset, creating a sense of motion or depth. The entire graphic is set against a dark, textured background.

THANK
YOU