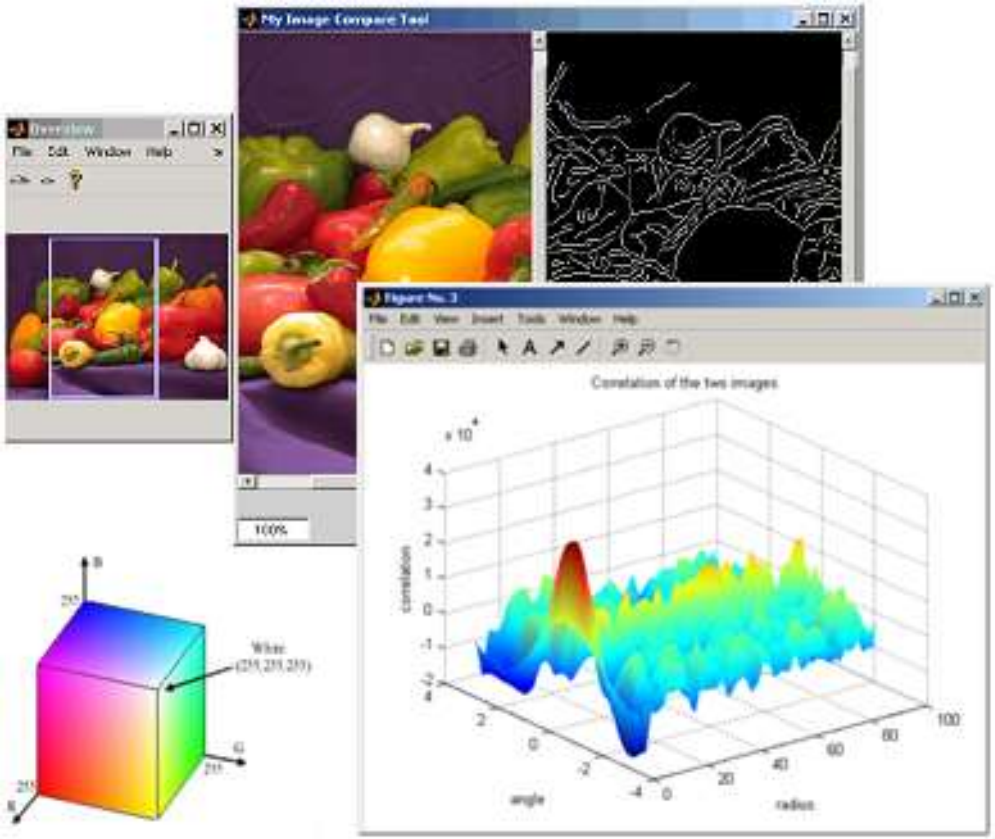
Digital Image Processing



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ECE Department
Gla University Mathura

DIGITAL IMAGE PROCESSING

LECTURE -15

Morphological Operations (Mathematical Equations)

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Morphological Operations

- Dilation $I \oplus S = \{z \mid (\hat{S})_z \cap I \neq \phi\}$
- Erosion $I \Theta S = \{z \mid (S)_z \cap I^c = \phi\}$
- Opening $I \circ S = (I \Theta S) \oplus S$
- Closing $I \bullet S = (I \oplus S) \Theta S$
- Hit or Miss $I \circledast S = (I \Theta S) \cap (I^c \Theta (W - S))$
- Boundary (Internal) $\beta(I) = I - (I \Theta S)$
- Boundary (External) $\beta(I) = (I \oplus S) - \mathrm{I}$

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Morphological Operations

- Region Filling $X_k = (X_{k-1} \oplus S) \bigcap I^c$
- Connected Components $X_k = (X_{k-1} \oplus S) \bigcap I$
- Convex Hull $X_k = (X_{k-1} \circledast S_i) \bigcup I$
- Thinning $I \otimes \{S\} = ((((I \circledast S_0) \circledast S_1) \circledast S_2) \ldots \circledast S_7)$
- Thickening $I \odot \{S\} = \left| (I^c \otimes S) \text{isolated pixel removal} \right|^c$

Morphological Operations (Previous Year Question)

University End Sem Questions

Ques1: An image of size 5 x 4 and structuring element of size 1 x 2 are given below. Apply erosion, dilation operation to find the result.

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1			
1			
	1	1	1
	1		
	1		

1	1

University End Sem Questions

Ques 2: Perform Erosion and Dilation on the image shown in Figure. Use 0 value for padding.

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

0	0	0
1	1	1
0	1	0

University End Sem Questions

Ques 3: Find $A \ominus B$

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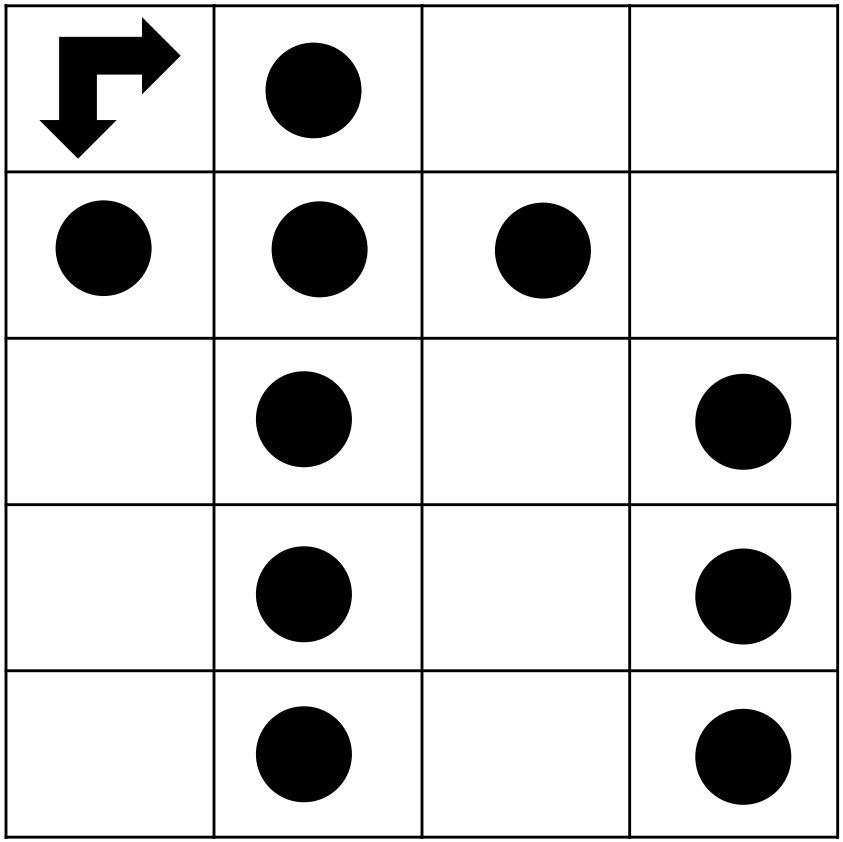
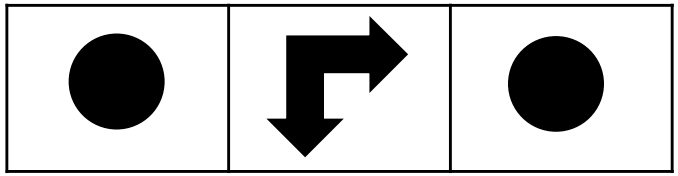
X



B



University End Sem Questions

Ques 4: Binary image X and structuring element B, are given in Figure 1

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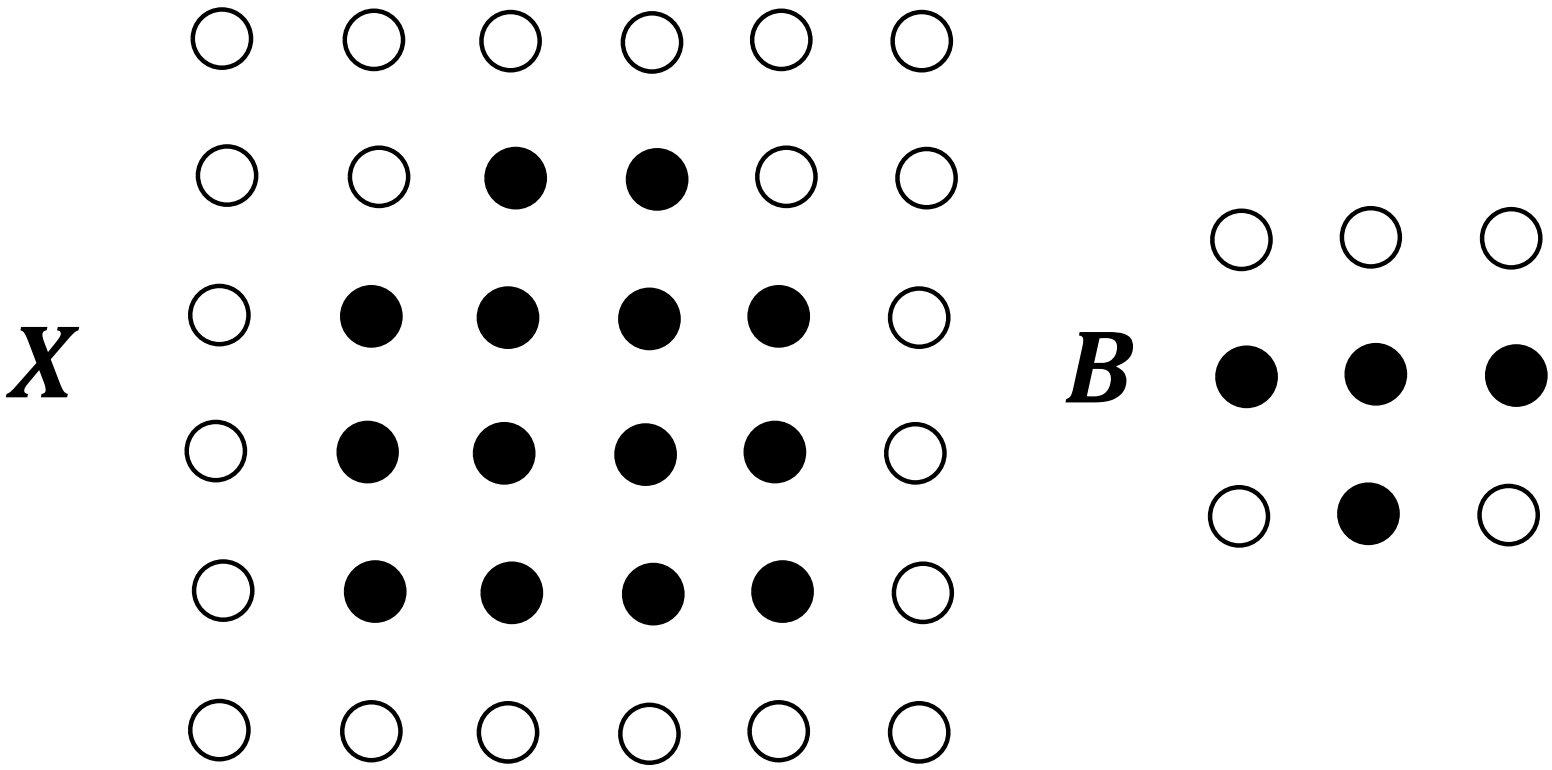

Calculate **Y1 =** $X \ominus B$ where $\ominus$ denotes the morphological erosion operator, and **Y2 =** $X \oplus B$ where $\oplus$ denotes the morphological dilation operator.

University End Sem Questions

Ques 5: Binary image X and structuring element B, are given in Figure 1

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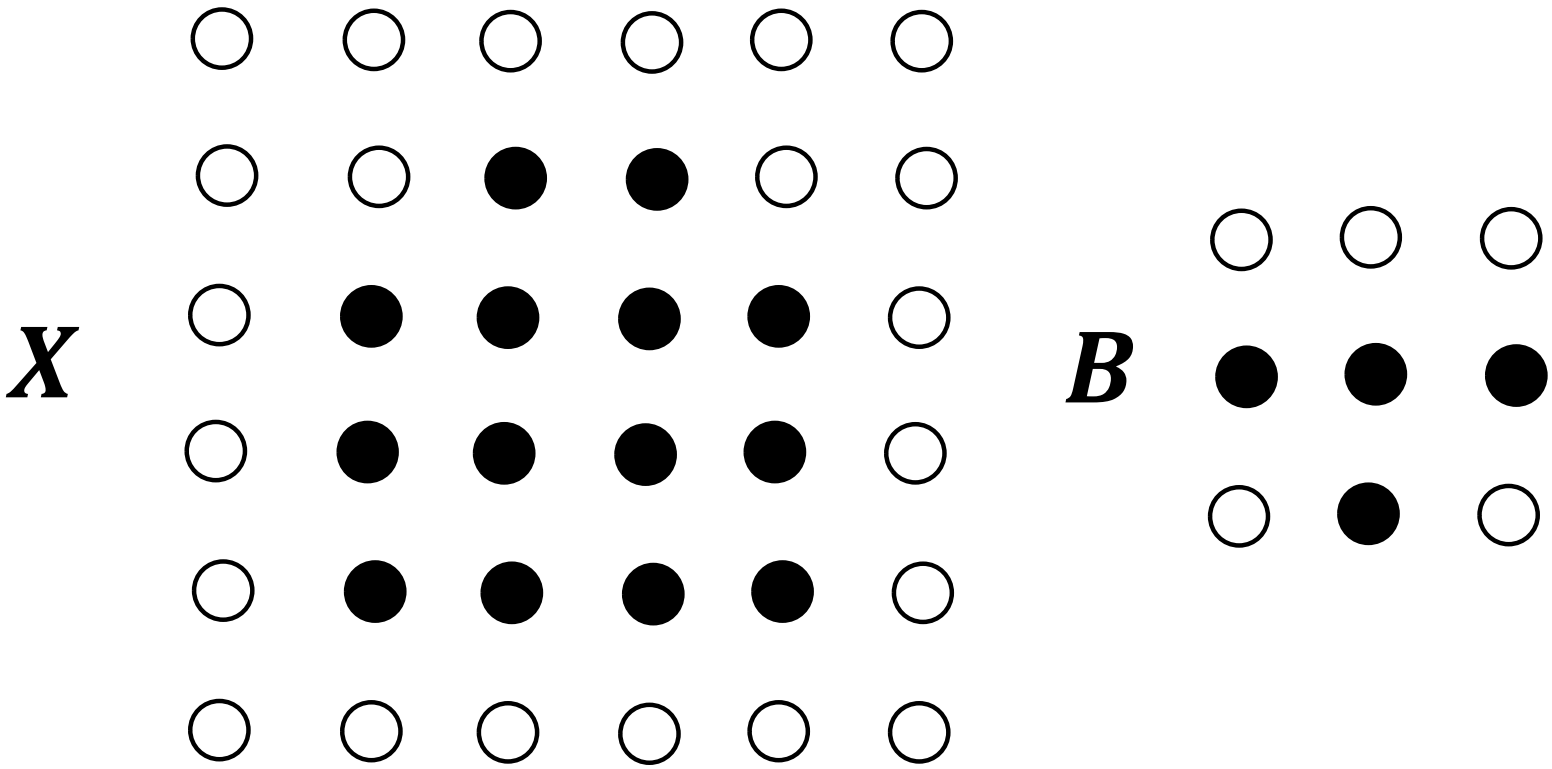

Perform the Hit or Miss transformation. Show all the steps.

University End Sem Questions

Ques 6: Apply the opening operation on the image shown on the left using the structuring element on the right. Show all steps in 8 × 8 grids.

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

	1	
1	1	1
	1	

University Question

Ques 7: There is an image A and structuring element B. Write an apply an algorithm over the given image and structuring element to extract the boundary of the image A. (Gray color represents Logic 1 and white color represents Logic 0)

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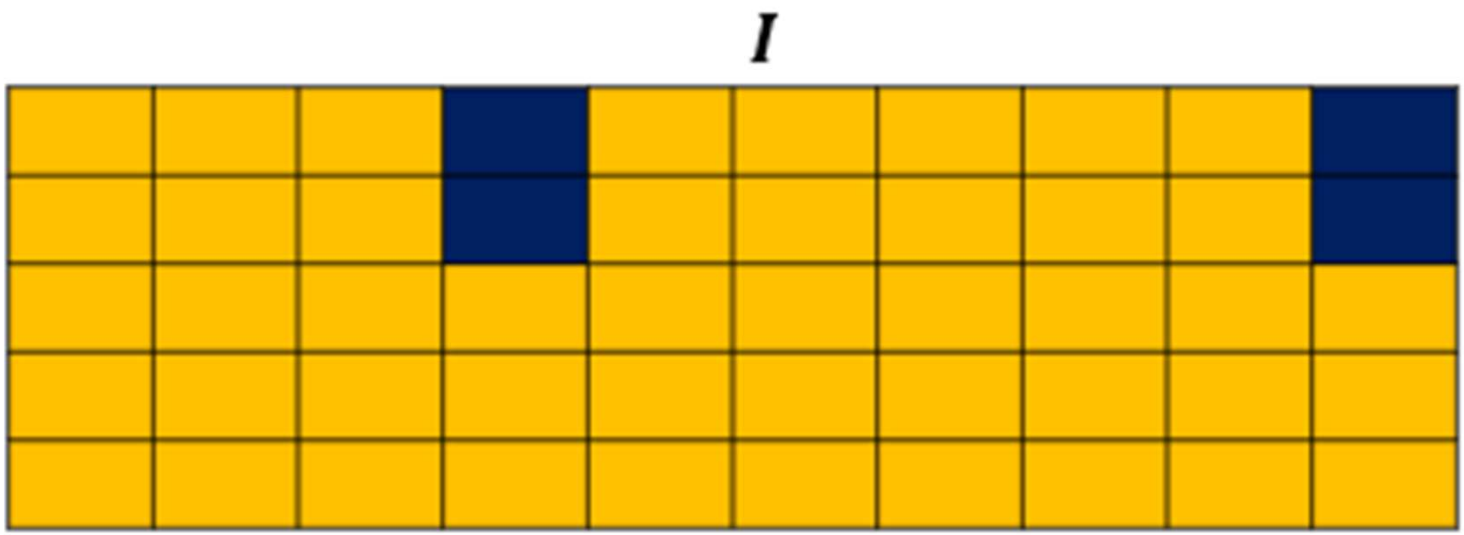

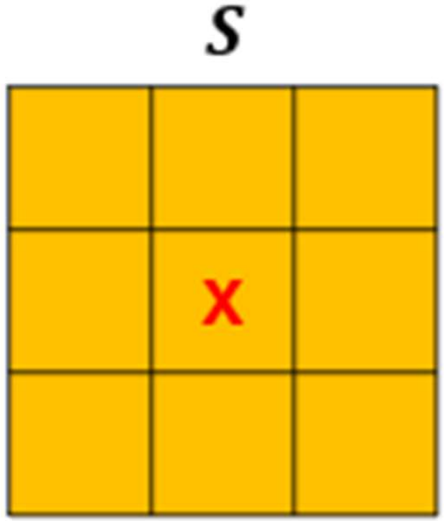

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University End Sem Questions

Ques 8: When do we say the shape is convex? What do you mean by convex hull? Give the basic 3× 3 structuring elements used to find the convex hull.

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Ques 9: Boundary is considered as a sequence of connected points. Explain the boundary following algorithm in detail.

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Ques 10: Explain convex hull with the help of an Example.

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Thank You