FACULTY OF EGINEERING

Digital Image Processing
LECTURE-18

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OUTLINE

❖ **Logic Operations**

❖ **Example of Logical Operations using Masks**

❖ **Neighbourhood Operations**

❖ **Local Enhancement through Spatial Filtering**

❖ **Simple Neighbourhood Operations**

❖ **Local Enhancement through Spatial Filtering**
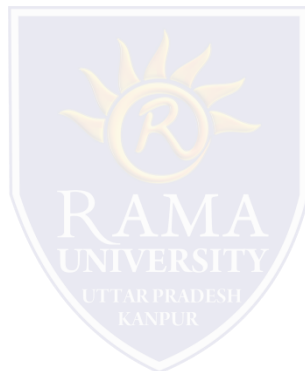
❖ **MCQ**

❖ **References**
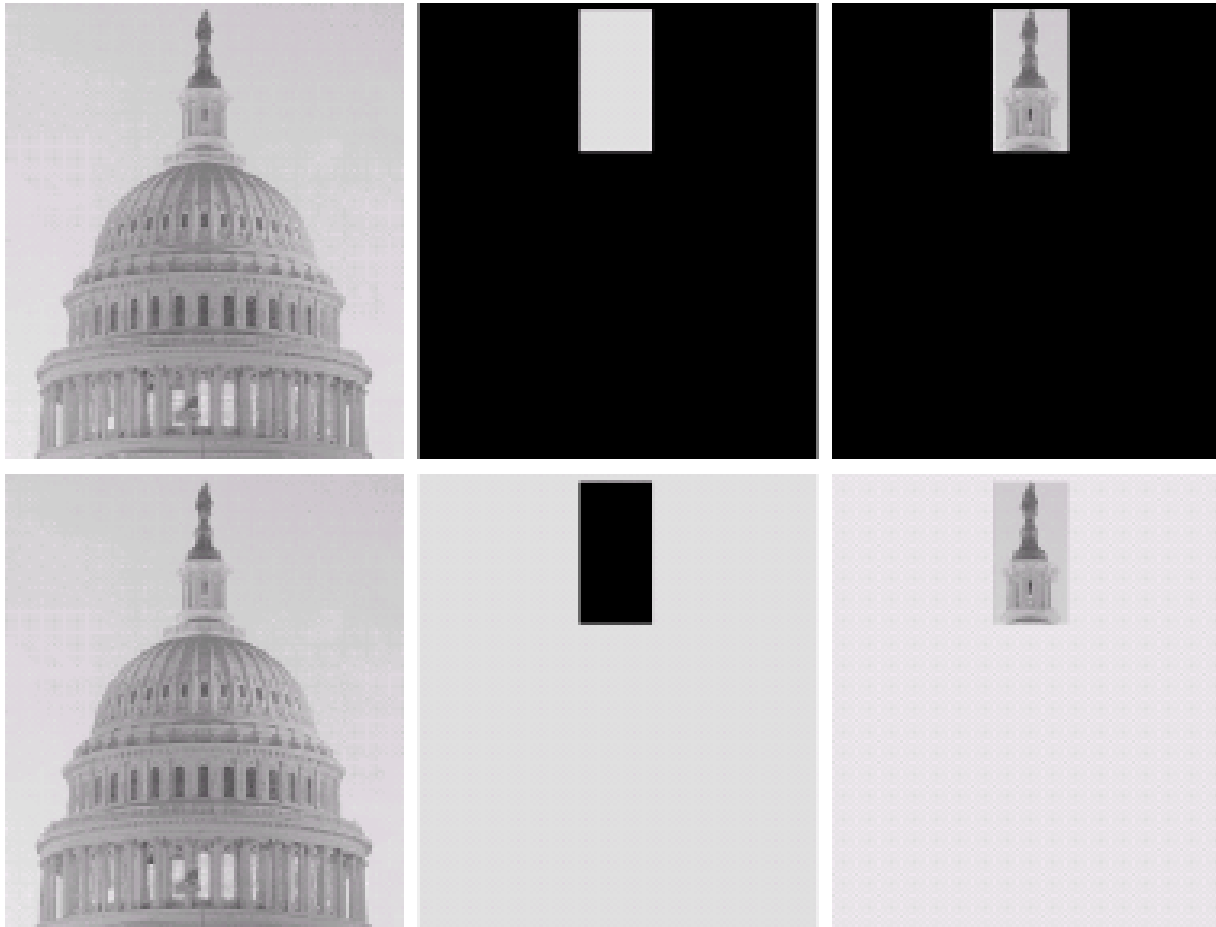
Logic Operations

Logic operation performs on gray-level images, the pixel values are processed as binary numbers

- Light represents a binary 1, and dark represents a binary 0

- NOT operation = negative transformation

Example of Logical Operations using Masks

a b c
d e f

FIGURE 3.27
(a) Original image. (b) AND image mask. (c) Result of the AND operation on images (a) and (b). (d) Original image. (e) OR image mask. (f) Result of operation OR on images (d) and (e).

Neighbourhood operations simply

operate on a larger neighbourhood of pixels

than point operations Neighbourhoods are

mostly a rectangle
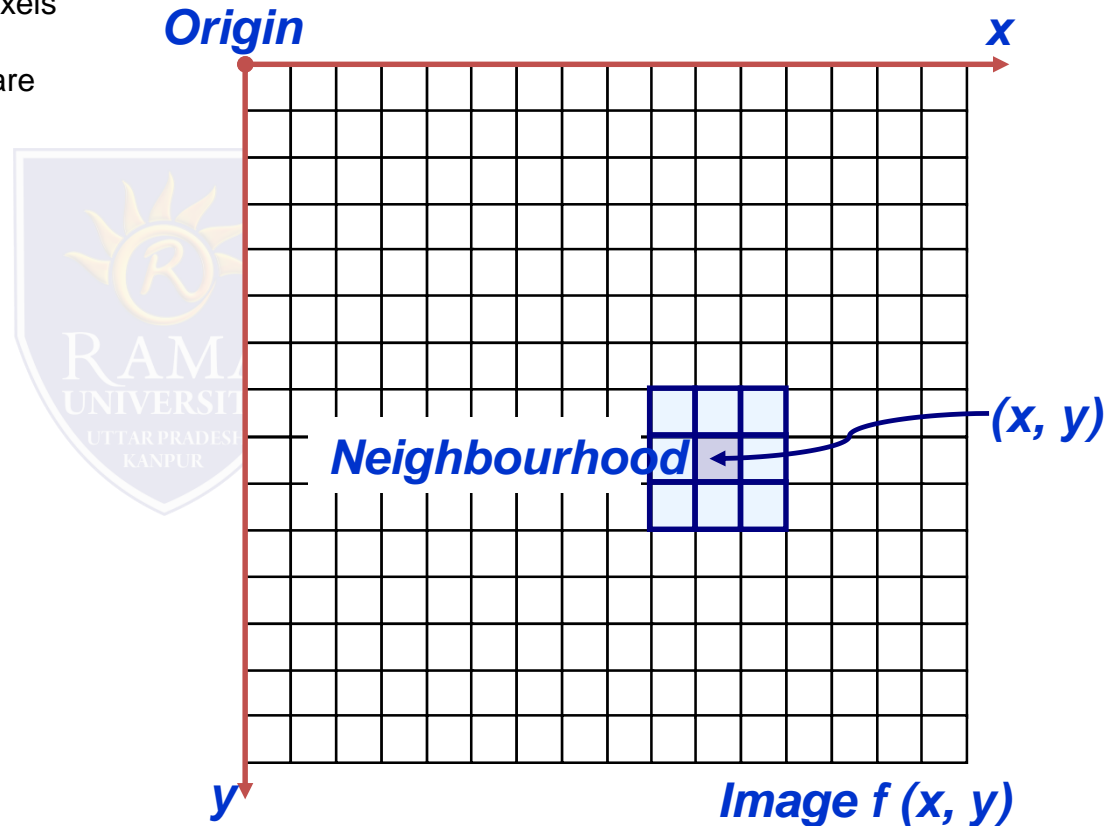
around a central pixel

Any **size** rectangle

and any **shape** filter

are possible

Origin   *x*

Neighbourhood   *(x, y)*

y   *Image f (x, y)*

Local Enhancement through Spatial Filtering

▪The output intensity value at (x,y) depends not only on the input intensity value at (x,y) but

also on the specified number of neighboring intensity values around (x,y)

▪Spatial masks (also called window, filter, kernel,

template) are used and convolved over the entire image for local enhancement (spatial

filtering)

▪The size of the mask determines the number of neighboring pixels which influence the

output value at (x,y)

▪The values (coefficients) of the mask determine the nature and properties of enhancing

technique
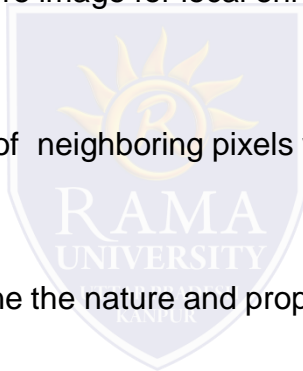
Simple Neighbourhood Operations

•Some simple neighbourhood operations include:

•Min: Set the pixel value to the minimum in the neighbourhood

•Max: Set the pixel value to the maximum in the neighbourhood

•Median: The median value of a set of numbers is the midpoint value in that set (e.g. from the set

[1, 7, 15, 18, 24] 15 is the median). Sometimes the median works better than the average
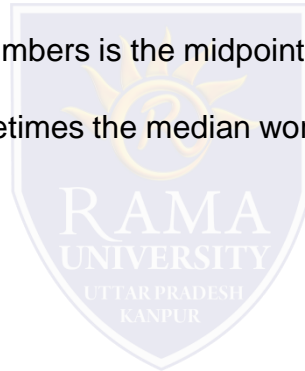
Simple Neighbourhood Operations Example

Original Image

123	127	128	119	115	130
140	145	148	153	167	172
133	154	183	192	194	191
194	199	207	210	198	195
164	170	175	162	173	151

x

y

Enhanced Image

x

y
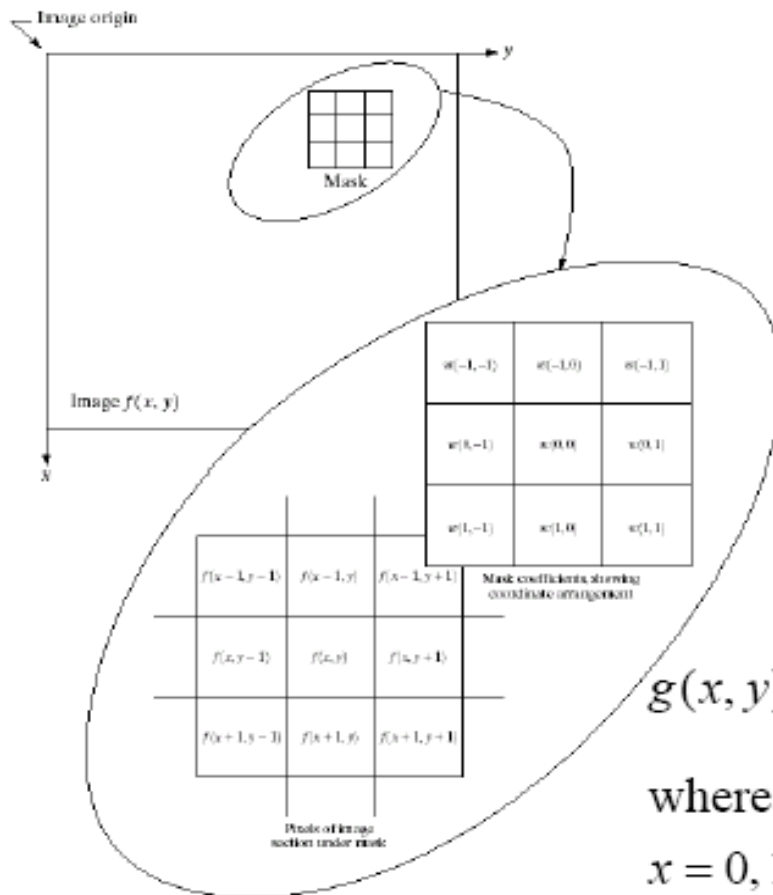
The mechanics of spatial filtering

For an image of size M x N and a mask of size m x n

The resulting output gray level for any coordinates x and y is given by

$$g(x, y) = \sum_{s=-a}^{a} \sum_{t=-b}^{b} w(s,t) f(x+s, y+t)$$

where $a = (m-1)/2, \quad b = (n-1)/2$

$x = 0, 1, 2, \ldots\ldots, M-1, \quad y = 0, 1, 2, \ldots\ldots, N-1,$

1. In contrast stretching, if r1≤r2 and s1≤s2 then which of the following is true?

   a) The transformation function is double valued and exponentially increasing

   b) The transformation function is double valued and monotonically increasing

   c) The transformation function is single valued and exponentially increasing

   d) The transformation function is single valued and monotonically increasing

2. In which type of slicing, highlighting a specific range of gray levels in an image often is desired?

   a) Gray-level slicing

   b) Bit-plane slicing

   c) Contrast stretching

   d) Byte-level slicing

3. Which of the following depicts the main functionality of the Bit-plane slicing?

   a) Highlighting a specific range of gray levels in an image

   b) Highlighting the contribution made to total image appearance by specific bits

   c) Highlighting the contribution made to total image appearance by specific byte

   d) Highlighting the contribution made to total image appearance by specific pixels

4. Which of the following shows three basic types of functions used frequently for image enhancement?

a) Linear, logarithmic and inverse law

b) Power law, logarithmic and inverse law

c) Linear, logarithmic and power law

d) Linear, exponential and inverse law

5. Which expression is obtained by performing the negative transformation on the negative of an image with

gray levels in the range[0,L-1] ?

a) s=L+1-r

b) s=L+1+r

c) s=L-1-r

d) s=L-1+r

References

- https://www.javatpoint.com/digital-image-processing-tutorial

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- Digital Image Processing 2nd Edition, Rafael C. Gonzalvez and Richard E. Woods. Published by: Pearson Education.

- Digital Image Processing and Computer Vision, R.J. Schalkoff. Published by: JohnWiley and Sons, NY.

- Fundamentals of Digital Image Processing, A.K. Jain. Published by Prentice Hall,Upper Saddle River, NJ.