Section - 5 Ans - 3 ⇒

* Linear smoothing filters ⇒

↳ Smoothing linear spatial filter is the average of the pixels contained in the neighborhood of the filter mask.

(i) Mean filtering ⇒

Mean filtering is simply to replace each pixel value in the image with the mean (average) value of its neighbours, including itself.

ii) Gaussian smoothing filters ⇒

i) Gaussian filters smoothens an image by calculating weighted averages in a filter box.

ii) It is used to 'blur' images and remove detail and noise.

* Non-linear smoothing filter ⇒

Non-linear spatial are order-statistic filter whose response is based on ordering the pixels contained in the image area encompassed by the filter.

Non-linear smoothing filter are :-

i) Minimum filter ⇒ The minimum filter selects the smallest value within the pixel values and maximum filter selects the largest value within of pixel values.

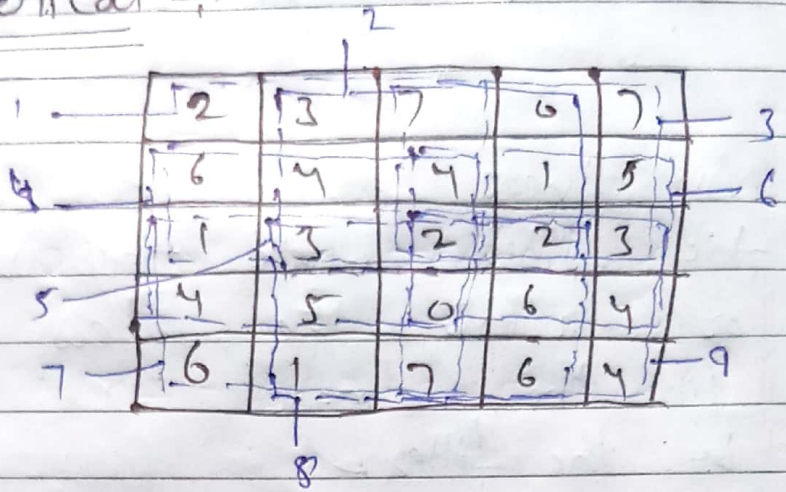
ii) Maximum filter ⇒ Maximum filter is useful for finding the brightest points in an image i.e. it removes salt noise.

iii) Mid point filter ⇒

↳ Mid point filter blurs the image by replacing each pixel with the average of the highest pixel and the lowest pixel within the specified window size.

↳ Midpoint = (darkest + lightest)/2

* Numerical ⇒



(1) Step 1 → Appling 3×3 box filter to the pixel value 4 of box 1.

2	3	7
6	(4)	4
1	3	2

$$\frac{1}{9}[2+3+7+6+4+4+1+3+2] = \frac{32}{9} = 3.5$$

$$\approx 4$$

Step. 2 →

Appling 3×3 box filter to the pixel value 4 of the box 3

3	7	0
4	(4)	1
3	2	2

the pixel value '4' will be replaced by

$$\frac{1}{9}[3+7+0+4+4+1+3+2+2] = \frac{26}{9}$$

$$= 2.8 \approx 3$$

Step 3 ⇒ Pixel value of box 3

7	0	7
4	(1)	5
2	2	3

Pixel value '1' will be replaced by

$$\frac{1}{9}[7+0+7+4+1+5+2+2+3]$$

$$= \frac{31}{9} = 3.4 \approx 3$$

Step 4. → Pixel point 3 of box 4

6	4	4
1	3	2
4	5	0

Value '3' will be replaced by

$$\frac{1}{9}(6+4+4+1+3+2+4+5)$$

$$= \frac{29}{9} = 3.2 \approx 3.$$

Step-5 →

4	4	1
3	(2)	2
5	0	6

Pixel '2' will be replaced by

$$\frac{1}{9}(4+4+1+3+2+2+5+0+6)$$

$$= \frac{27}{9} \Rightarrow 3$$

Step-6 ⇒

4	1	5
2	(2)	3
6	6	4

Pixel value '2' will be replaced by

$$\frac{1}{9}[4+1+5+2+2+3+6+4)$$

$$= \frac{27}{9} \Rightarrow 3$$

step-7 →

1	3	2
4	(5)	0
6	1	7

Pixel value '5' is replaced by

$$\frac{1}{9}[1+3+2+4+5+0+6+1+7)$$

$$\frac{29}{9} = 3.2 \approx 3$$

Step.8 ⇒

3	2	2
5	(0)	6
1	7	6

The pixel value '0' will be replaced by

$\frac{1}{9}(3+2+2+5+0+6+1+7+6)$

$\frac{32}{9} = 3$

Step-9 →

2	2	3
0	(6)	4
7	6	4

The pixel '6' will be replaced by

$\frac{1}{9}(2+2+3+6+4+7+6+4)$

$\frac{34}{9} = 3.7 \approx 4$

Hence, the new pixel values after applying 3×3 box filter on 5×5 matrix of a 3-bit image will be.

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

→

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