Teacher's Signature .....

Median filter:

3 9 11
7 15 8
10 12 9

→ 3 7 8 9 [9] 10 11 12 15

ascending order

center value = 9

DAY 8 (19/08/2023) only coding
DAY 9 (22/08/2023)

morphological operation: image processing technique
only binary & grayscale image
used to manipulate the shape & structure of objects in image
noise reduction, erosion, edge detection, object segmentation

EROSION: shrinking the image

Image:
0 0 0 0 0
0 1 1 1 0
0 1 1 1 0
0 1 1 1 0
0 0 0 0 0

structure element: (can be anything / not static)
0 1 0
1 1 1
0 1 0

output:
0 0 0 0 0
0 0 0 0 0
0 0 1 0 0
0 0 0 0 0
0 0 0 0 0

[exact match] no of zeroes 1's

$A \ominus B$

kernel = np.ones((5,5), np.uint8)
erosion = cv2.erode(image, kernel, iterations=1)

reduces the size of bright regions and enhances dark regions in a binary images. It works by moving a structure element over the image and computing the min. pixel value within the region covered by the kernel.

DINESH

DATE

② Dilation (enlarging/expanding the image)

→ $A \oplus B$

Eg:

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

0	1	0
1	1	1
0	1	0

TOP LEFT
BOTTOM RIGHT

(only/minimum one condition satisfies)
(number of 1's increases)

output:

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

if centre point is matching then also put 1

③ Opening the image

→ erosion followed by dilation (removing noise and small objects from binary img)

opening = cv2.morphologyEx(image, cv2.MORPH_OPEN, kernel)

$A \circ B$

$(A \ominus B) \oplus B$

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

0	1	0
1	1	1
0	1	0

↓ erosion

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

dilation →

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

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EXPERIMENT No.

DINESH

Teacher's Signature

④ closing the image

$A \bullet B$

$(A \oplus B) \ominus B$

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

dialation →

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

← erosion

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

10 marks

⑤ Morphological gradient :- diff b/w dilation and erosion of an image. highlights the edges and boundaries of objects

gradient = cv2.morphologyEx(Image, cv2.MORPH_GRADIENT, kernel)

$(A \oplus B) - (A \ominus B)$ ⇒

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

OUTPUT

DILATION − EROSION

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

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

i) TOP hat − difference b/w input img & opening image (extract the small bright details)

2) BLACK hat − difference b/w closing i/p image & input image. (extract the small dark details)

DATE

TOP HAT → Input - open
↓ A ○ B

$A - (A \ominus B) \oplus B$

BLACK HAT
↳ closing - Input
$(A \oplus B) \ominus B - A$

Top:

0 0 0 0 0		0 0 0 0 0		0 0 0 0 0
0 1 1 1 0	−	0 0 1 0 0	=	0 1 0 1 0
0 1 1 1 0		0 1 1 1 0		0 0 0 0 0
0 1 1 1 0		0 0 1 0 0		0 1 0 1 0
0 0 0 0 0		0 0 0 0 0		0 0 0 0 0

BLACK:

0 0 0 0 0		0 0 0 0 0		0 0 0 0 0
0 1 1 1 0		0 1 1 1 0		0 0 0 0 0
0 1 1 1 0	−	0 1 1 1 0	−	0 0 0 0 0
0 1 1 1 0		0 1 1 1 0		0 0 0 0 0
0 0 0 0 0		0 0 0 0 0		0 0 0 0 0

EXPERIMENT No.

DATE

DINESH