Marwadi University	**Marwari University** **Faculty of Technology** **Department of Information and Communication Technology**	
Subject: Digital Signal and Image Processing(01CT0513)	**Aim:** Simulate Dilation, Erosion, Opening and Closing Operation on Images.	
Experiment No: 11	**Date:**	**Enrollment No: 92200133030**

Aim: Simulate Dilation, Erosion, Opening and Closing Operation on Images.

Theory:-

- Dilation, erosion, opening, and closing are morphological operations used in image processing to manipulate the shape and size of objects in an image.

Dilation:-

- Dilation expands the boundaries of objects in an image by adding pixels to the object's boundaries. It is achieved by sliding a structuring element over the image and assigning the maximum pixel value within the neighborhood of each pixel.

Erosion:-

- Erosion shrinks the boundaries of objects in an image by removing pixels from the object's boundaries. It is achieved by sliding a structuring element over the image and assigning the minimum pixel value within the neighborhood of each pixel.

Opening:-

- Opening is an erosion operation followed by a dilation operation. It is used to remove noise and small objects from the image while preserving the larger objects' shapes.

Closing:-

- Closing is a dilation operation followed by an erosion operation. It is used to close small gaps and holes within objects while preserving the overall object shapes.

Programm:-

```
import cv2
import numpy as np
image_path = "./Images.jpg"
image = cv2.imread(image_path, 0)
if image is None:
    raise FileNotFoundError(f"The image '{image_path}' could not be loaded. Check the file path.")
kernel = np.ones((5, 5), np.uint8)
erosion = cv2.erode(image, kernel, iterations=1)
dilation = cv2.dilate(image, kernel, iterations=1)
opening = cv2.morphologyEx(image, cv2.MORPH_OPEN, kernel)
closing = cv2.morphologyEx(image, cv2.MORPH_CLOSE, kernel)
cv2.imwrite("erosion.jpg", erosion)
cv2.imwrite("dilation.jpg", dilation)
cv2.imwrite("opening.jpg", opening)
cv2.imwrite("closing.jpg", closing)
print("Images saved: 'erosion.jpg', 'dilation.jpg', 'opening.jpg', 'closing.jpg'")
```

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Output:-

Original Image	Erosion Image	Dilation Image
		
Opening Image	**Closing Image**	
		

Conclusion :-