

Morphological Processing

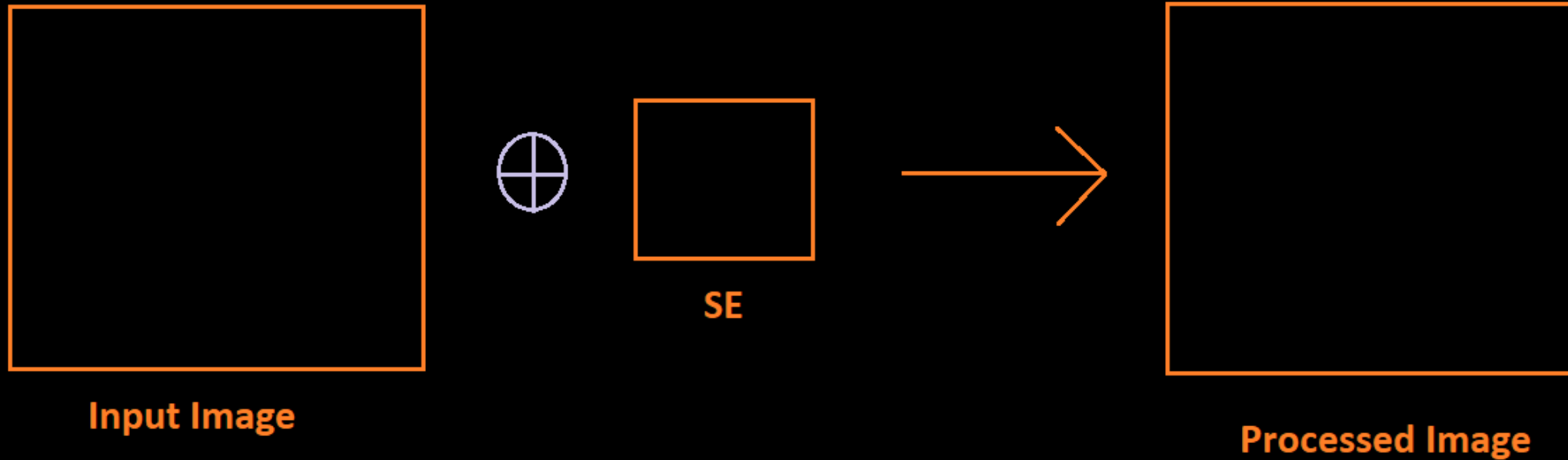
Topics to be covered

- Concept of Morphological Operations
- Dilation
- Erosion
- Morphological Filtering
 - Opening
 - Closing
- Image Gradient

Morphological Processing

Morphological processing OR operations are used to extract geometrical information from image by transforming images through well defined kernels known as structuring element (SE). The size and shape of SE is very important for successful application of morphological operation.

Typical Morphological Processing System

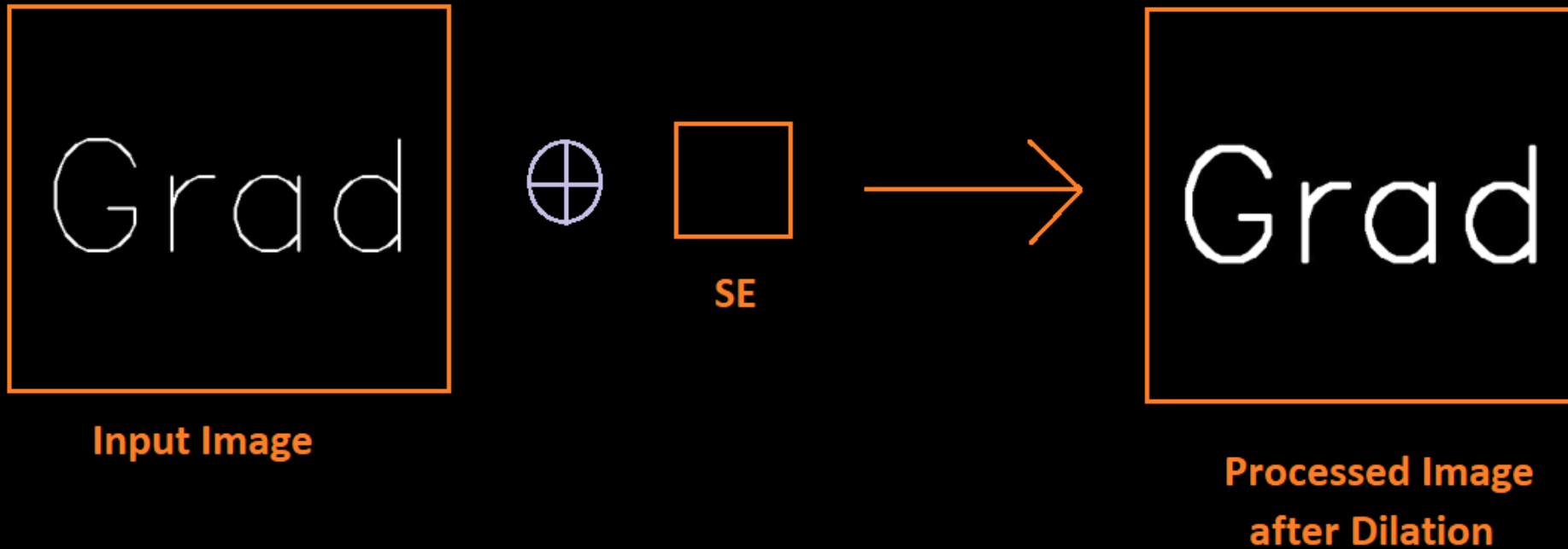


Dilation

Morphological Process which is used to thicken the objects in the image is called Dilation.

The amount and direction of the thickness depend on the size and shape of the structuring element (SE).

Dilation With Square Shaped Structural Element





Input Image

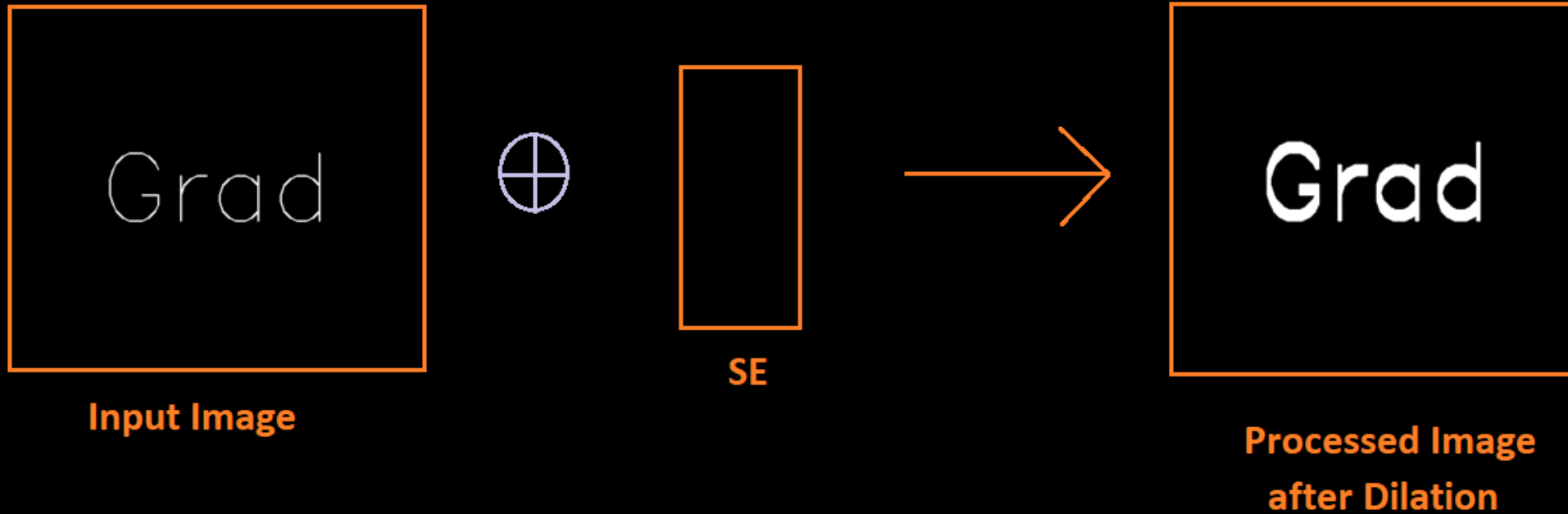


SE



**Processed Image
after Dilation**

Dilation With Rectangular Shaped Structural Element

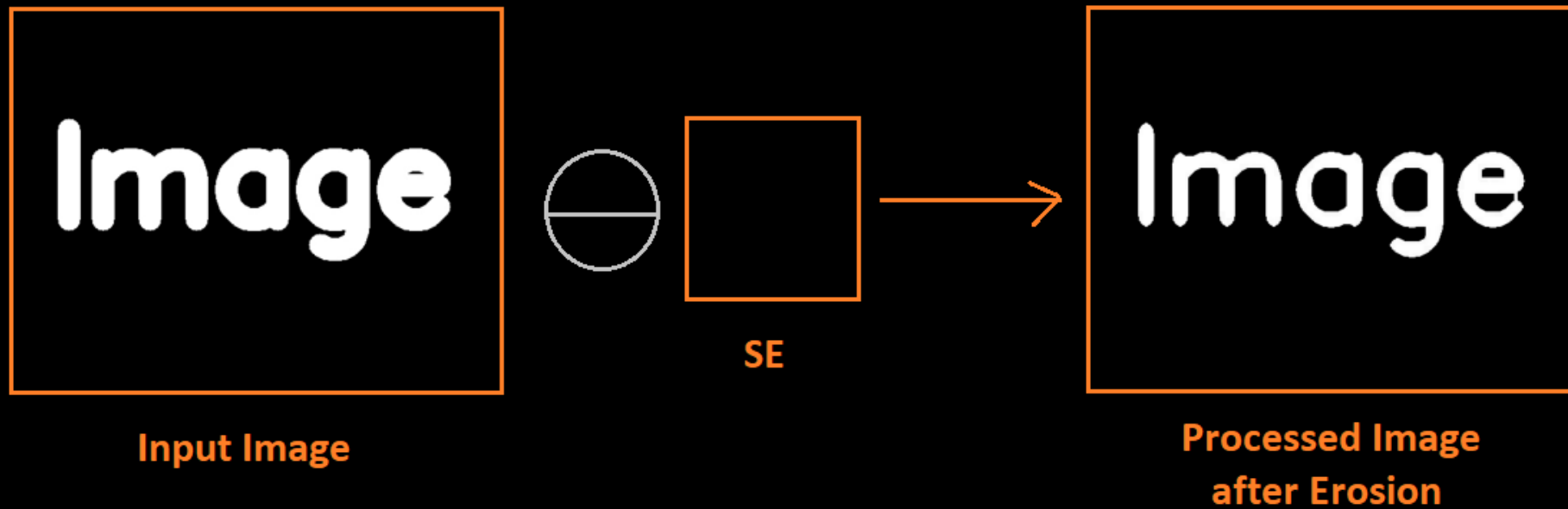


Erosion

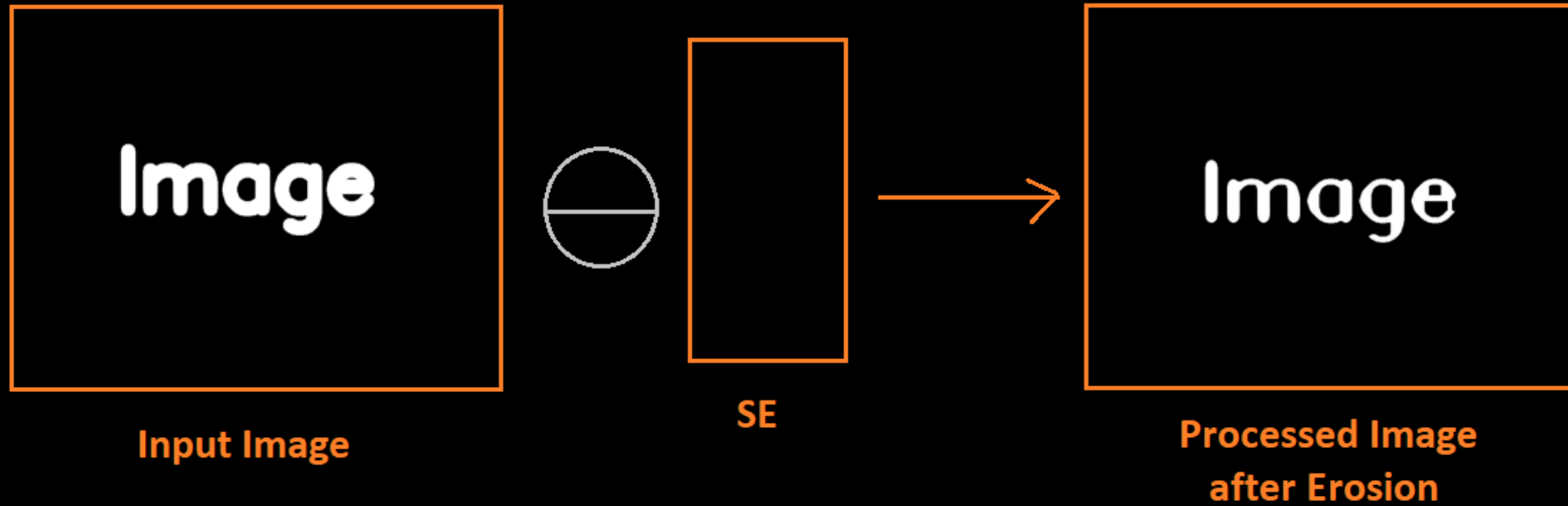
Morphological Process which is used to shrink the objects in the image is called Dilation.

The amount of shrinkness depends on the size and shape of the structuring element (SE).

Erosion With Square Shaped Structural Element



Erosion With Rectangular Shaped Structural Element



Morphological Filtering

Opening

Morphological operation called Opening is the erosion of A by B followed by the dilation of the result by B

This operation is useful in removing background noise.

$$A \oslash B = (A \ominus B) \oplus B$$

where

A = Image

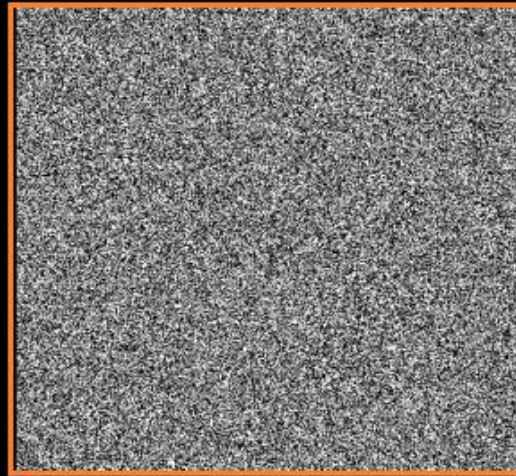
B = Structural Element

Morphological Filtering (Opening)



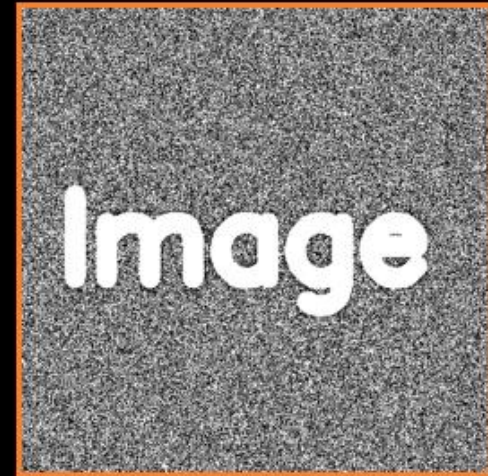
Input Image

+



White Noise

=

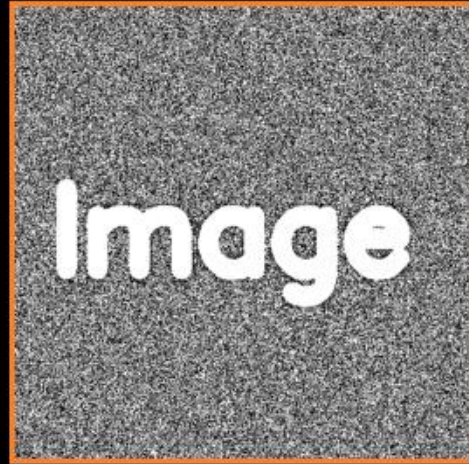


Noisy Image

Morphological Filtering (Opening)



Input Image



Noisy Image



**Filtered Image
after Opening**

Closing

Morphological operation called Closing is the dilation of A by B followed by the erosion of the result by B

This operation is useful in removing noise from foreground objects, such as black dots on top of the white text.

$$A \oslash B = (A \oplus B) \ominus B$$

where

A = Image

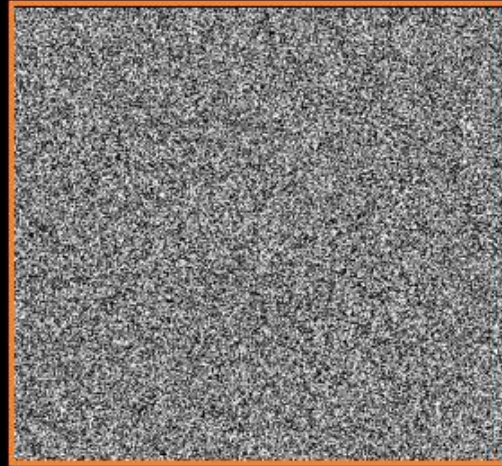
B = Structural Element

Morphological Filtering (Closing)



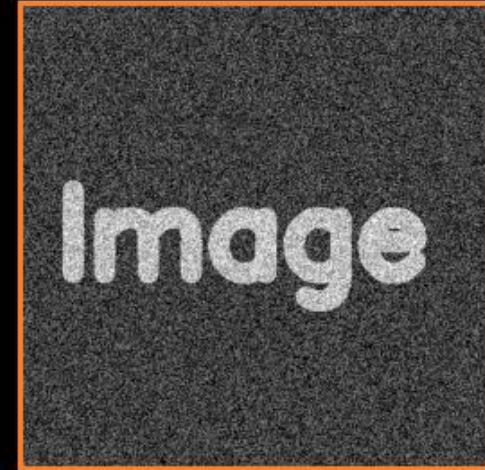
Input Image

+



Black Noise

=

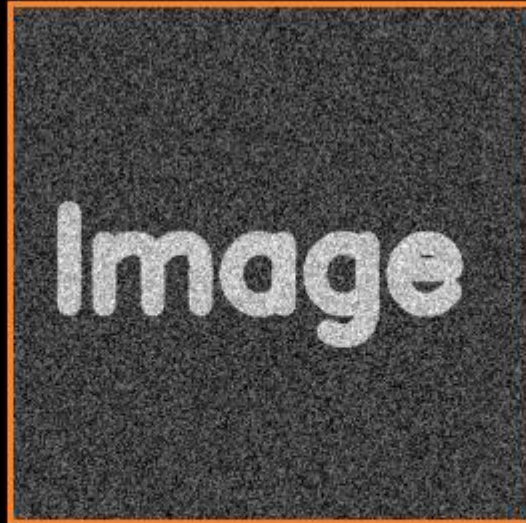


Noisy Image

Morphological Filtering (Closing)



Input Image



Noisy Image



**Filtered Image
after Closing**

Image Gradient

Image Gradient is calculated by calculating difference between dilation and erosion of an image.

This operation is used to extract boundaries OR edges of the image.

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

where

$\epsilon(A)$ = Gradient of Image A

B = Structural Element

Boundary Extraction by Image Gradient



Input Image



Image Gradient

