# LAB-10: Morphological Operations

Objective:

The objective of this lab is to apply morphological operations on both grayscale and binary images.

Theory:

Morphological image processing is quite like spatial filtering. The structuring element just like a spatial mask is moved across every pixel in the original image to produce an output pixel. The value of this new pixel depends on the operation performed. Two basic morphological operations are erosion and dilation.

Erosion shrinks the size of foreground (1-valued) objects; smooths object boundaries and removes small objects. In erosion, for each foreground pixel (also called input pixel):

❑ Superimpose the structuring element on top of the input image so that the origin of the structuring element coincides with the input pixel position.

❑ If **for every** pixel in the structuring element, the corresponding pixel in the image underneath is a foreground pixel, then the input pixel is left as it is.

❑ If any of the corresponding pixels in the image are background, however, the input pixel is also set to background value
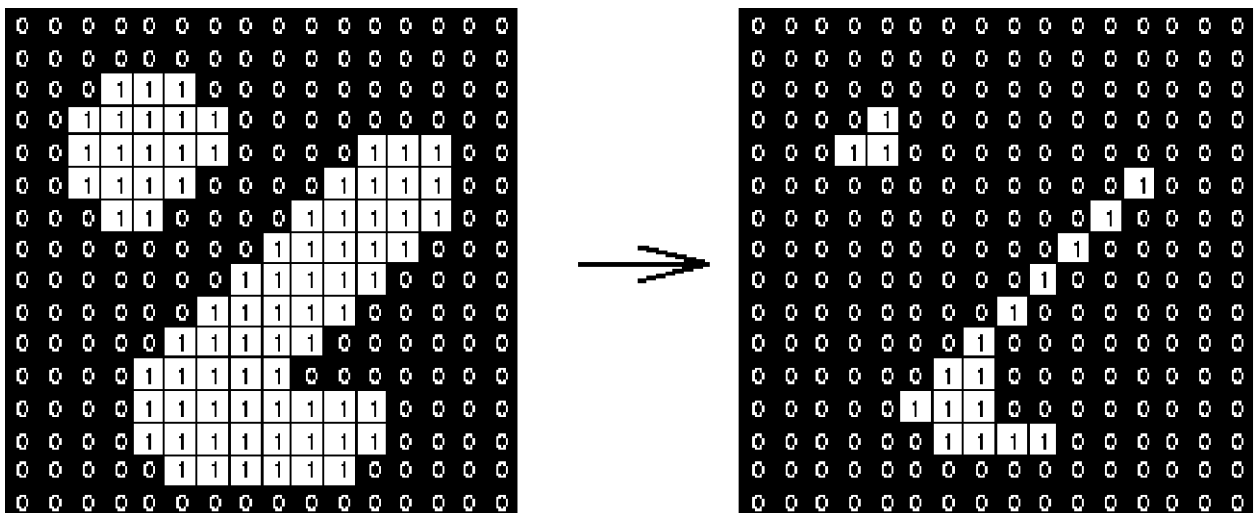
On the other hand, **dilation** expands the size of foreground (1-valued) objects; smooths object boundaries and closes holes and gaps. In dilation, for each foreground pixel (also called input pixel)

- Superimpose the structuring element on top of the input image so that the origin of the structuring element coincides with the input pixel position

- If **at least one** pixel in the structuring element coincides with a foreground pixel in the image underneath, then the input pixel is set to the foreground value

- If all the corresponding pixels in the image are background, however, the input pixel is left at the background value
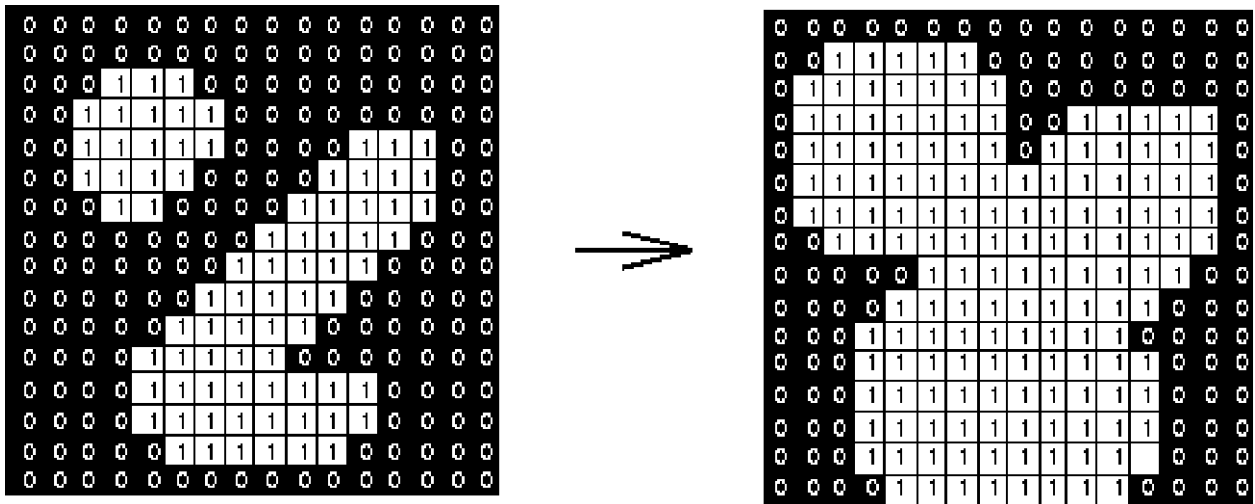
More interesting morphological operations can be performed by performing combinations of erosions and dilations. The most widely used of these compound operations are **opening** and **closing**.

In **opening, erosion** is followed by **dilation.** On the other hand, in **closing, dilation** is followed by **erosion.**

All these operations can be applied on grayscale images as well. Following image shows the application of morphological operation on a grayscale image.
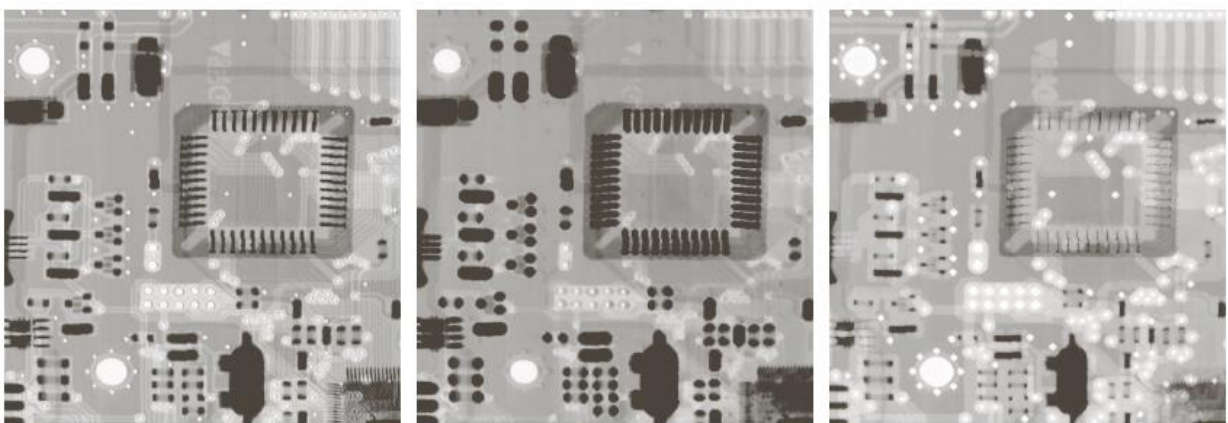
Some Useful Commands:

No new commands are needed for this lab.

Lab Tasks:

Lab Task 1:

Erode the image "fp.tif" using a suitable structural element so that all the noise is removed from the image. Apply erosion on Fig01.tif with structuring elements of different sizes.

Lab Task 2:

Dilate the image "broken_text.tif" such that the breakages in the characters/alphabets no longer exist. Apply dilation on Fig01.tif with structuring elements of different sizes.

Lab Task 3:

Morphological operations can also be performed on grayscale images. For dilation, the maximum value is used that falls under the structuring element. For erosion, the minimum value is used that falls under the structuring element. Perform dilation and erosion on Fig01.tif.

Lab Task 4:

Morphological operations can also be used to segment out objects from an image. Using opening and a suitable structuring element (disc, diamond and rectangle), segment out each object from the "Objects.png" image.

Conclusion:

This lab has given an introduction to morphological operations and has shown how an image can be preprocessed using morphological operations.