**Assignment1**

In this assignment, we will be exploring the basic operations of logical and morphological operations.

This exercise will provide you with the necessary knowledge to process binary images with morphological operations.

**Part 1: Paper deliver**

1. Perform **morphological dilation of the image A with the structuring element B.**
2. Perform morphological erosion of the image A with the structuring element B.



1. Open image A with structuring element B



**Part 2: Practical Part:**

All the test images and supporting Matlab routines (if not available in normal Matlab toolbox)

**Hand in** your **write-up with necessary and relevant descriptions** along with the Matlab code. Please submit a **softcopy** of the write-up during class on the due day, as well as a soft copy of the write-up and the codes to the course directory on

1. Using Matlab, load 2 images and apply the same logical operations mentioned in part 1, question1.

**Dilation:**

Dilation is one of the basic operators in the area of morphology. The basic effect of the operator on a binary image is to expand the region boundary of the foreground pixels gradually.

1. **(Lab),** read the ‘bwtext.tif. Use the dilation operation on this image with two different size structuring elements (square). This size of the structuring element is of your choice. Save your results as bwtext-1.tif and bwtext-2.tif. Compare and contrast your results. Explain your observations.



Figure.1. bwtext.tif

1. In this problem, read the ‘square-circle.png’. Use the dilation operation on this image with two different structuring elements (square and circle). This size of structuring element is of your choice. Save your results as square-cirlce-1.png and square-circle-2.png. Compare and contrast your results. Explain your observations.



Figure.2. Square-cirlce.png

1. There are many other uses of dilation. For example, it can be used to fill in small spurious holes (‘pepper noise’) in images. In this problem, read the ‘cameraman.png’ image. This image contains pepper noise. Use a suitable structuring element to dilate this image, hence removing the noise from the image. The image quality may not be that great. Save your image as cameraman-denoised.png.



Figure.3. Cameraman.png

**Erosion:**

The basic effect of the erosion operator on a binary image is to erode away the boundaries of regions of foreground pixels. Thus the areas of the foreground pixel shrink in size and holes within those areas become larger.

1. **(Lab)** Apply the erosion technique to ‘circuit .tiff’. Use two different structuring elements (disk with different size). Save the image as circuit-erode. tif. Compare and contrast your results. Explain your observation



Figure.4 circuit .tiff’

1. Apply the erosion technique to ‘circle-square.png’. Use two different structuring elements (circle and square). Save the image as circle-square-erode.png .Compare and contrast your results. Explain your observation.



Figure.5.Circle-square.png

1. There are many special uses of erosion. One of the most common application using the erosion is to separate the touching objects in a binary image so that can be counted using a labeling algorithm. In this section just use the erosion method to display the circles in the image distinctly. Use the Circle.png image for this purpose.



Figure.6. Circle.png

The image shows a number of dark disks against a light background. Do a thresholding of this image and then use the erosion operation to display the circles distinctly in the image. Save your image as circle-erode.png.

1. Noise reduction:

Using the same image in the problem 2 (cameraman.png) reduce the salt noise in the image using the erosion technique. Save your image as the cameramanerode.png. Describe your observation.

**Opening and Closing:**

These are operations that are derived from the fundamental operations of erosion and dilation. The basic effect of an opening is like erosion in that it tends to remove some of the foreground (bright) pixels from the edges of regions of foreground pixels. The exact operation is determined by the structural element only. Closing is similar in some ways to dilation, in that it tends to enlarge the boundaries of the foreground regions in an image.

1. **(Lab)** In this section, you will be separating out various objects from the images using the opening function. For the given image bwfinger.tif**,** use the opening technique with the appropriate structuring element.



Figure.7. bwfinger.tif

1. (bonus points) In this section, you will be separating out various objects from the images using the opening function. For the given image Circle\_and\_Lines.png**,** use the opening technique with the appropriate structuring element.



Figure.8 Circle and Line

1. Your mission is to separate the circles from the lines. Save your image as circle.png and line.png. The Circle\_and\_Lines.png image should contain only circles, and the line.png image should contain only lines. Explain the structural element you have used. If you have experimented with other structural elements, describe your results and observations. What are the drawbacks or limitations of this method? Compare and contrast with the previous methods you have implemented. Apply opening to the same image with the same structural element of different sizes. How the sizes of the structuring elements affect the results.
2. Develop an algorithm; using the appropriate morphological filters, to count how many circles and how many lines are there in Circle\_and\_lines.png (via circles.png. and lines.png), Label each item in the picture with a distinct integer. Discuss your algorithm briefly, and document your code (label\_and\_count.m) and your results in the report.