Digital Image Processing

Assignment 2

Deadline **17th March 2019 11:59PM**

Introduction:

In this assignment, we will be exploring the basic operations of morphological filtering. This exercise will provide you with the necessary knowledge to process binary images with morphological operations in Opencv.

Images Folder

https://drive.google.com/open?id=1BmP-NdXTfCwzo-kraUdax2Nff_JcTKFB

Note:

- Any mentioned -Save your image- (just show the output using matplot in your jupyter notebook)
- Any explanation just write it as a text cell in Jupyter

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 gradually expand the region boundary of the foreground Pixels.

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-circle-1.png and square-circle-2.png. Compare and contrast your results. Explain your Observations.

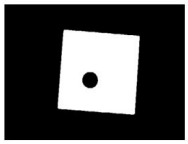


Figure.1. Square-cirlce.png

2. 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.2. Cameraman.png

3. Edge detection can be accomplished using dilation in conjunction with other operations. There are different methods. Describe how you perform edge detection using dilation. Use the lady.png for this operation. Save your result as lady-edge.png

Figure.3. Lady.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.

4. 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.

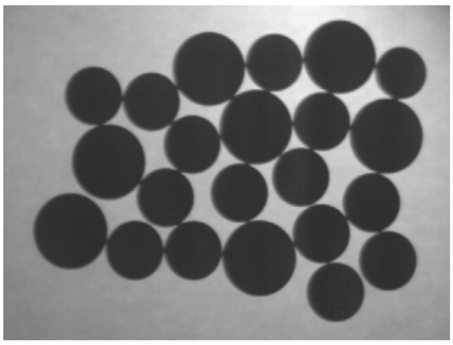


Figure.5. Circle.png

5. 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.

6. 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 cameraman erode.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

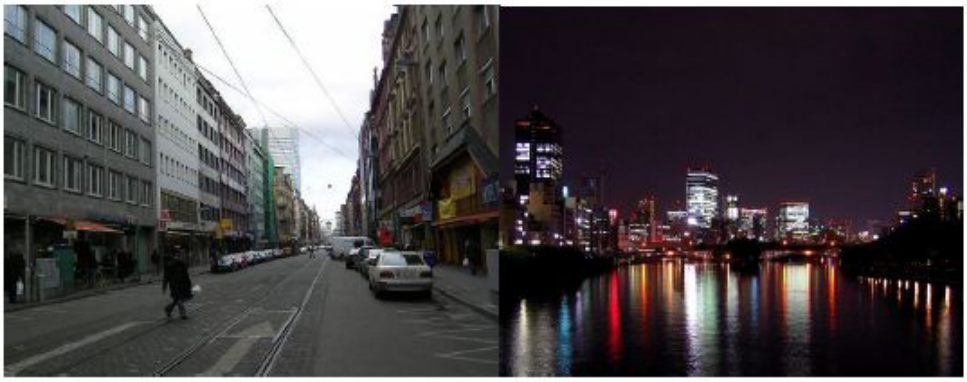
7. (2 points) In this section you will be separating out various objects from the images using the opening function. For the given image Circle_and_Lines.png, use the opening technique with the appropriate structuring element.

Figure.6.Circle and Line

(a) Your mission is to separate the circles from the lines. Save your image as circle.png and line.png. The circle_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.

(b) 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 and your results in the report.

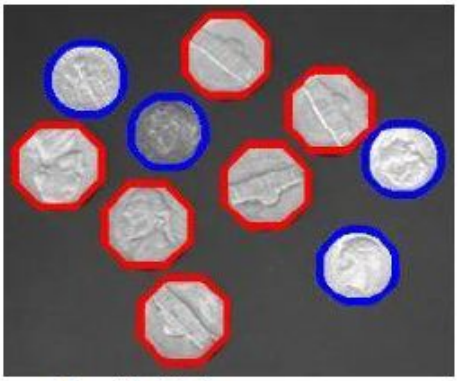
Q12. (Practical) Propose a pipeline to replace the morning background of the left image with the night background of the right image.



Expected Output:

Q13. (Practical) Design an image processing pipeline for calculating the money and highlighting the coins available in the following image.
Given that the large coin is 50, and the small one is 25.

To produce the output



How could you generalize it to work with this?

Bonus (Starting from here is bonus)

Read and Think for a solution but don't implement it

Q13. (Practical) Design and implement an image processing algorithm to automatically determine which of the 5 training images is most similar to the testing image. Clearly describe the steps of your algorithm, including intermediate results if they help to explain the process. Your algorithm should generate a numerical similarity score, or alternatively a distance score, between a pair of leaf images, e.g., similarity (training image #1, testing image) = 0.8, similarity (training image #2, testing image) = 0.6, etc. Report the similarity score or distance score between every training image and the testing image, i.e., 5 numbers. Does your algorithm assign the highest similarity score, or equivalently lowest distance score, to the correct training leaf?

Training Samples:

Testing Samples:

8. **In real world applications** closing can be used to enhance binary images of objects obtained from thresholding. In this problem you will use the concept of closing to compute the skeleton of the following images.
[Note] Don't do the following on the Falcon Image only Figure 8,9,10

Figure.7.Falcon

Figure.8. Girl

Figure.9.Dog

Figure.10. Hot Balloon

a. Describe your method of computing the skeleton of the images. What kind of structural elements will you be using? What happens when you change the size of the structuring element?
b. Compute the location and center of mass of the shapes for the four pictures. Discuss your algorithm and document your code in the write-up.
c. Compute the area of each of the shape of images.

Hit and Miss Transform

The hit and miss transform is a general binary morphological operation that can be used to look for particular patterns of foreground and background pixels in an image. As with other binary morphological operators it takes as input a binary image and structuring element and produces another binary image as output.

9. The main purpose of using the hit and miss transformation is used to locate isolated points in binary image. It is also used for detecting the end points on a binary skeleton. Use the hit and miss operations and other morphological operations to find out the isolated end points and the junction points of the given image. Describe your method and compare this method with other methods. Use the skeleton images derived from the (8) and apply hit and miss transform to the images. Save and report the images.