University of Tehran

School of Electrical and Computer Engineering

Digital Image Processing

Instructor: Hamid Soltanian-Zadeh

Assignment 7

Chapter 9 – Morphological Image Processing

Due Date: 18th of Ordibehesht 1401

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Problem 1

In this problem, you will learn how to apply basic morphological operations to a binary image. Do the following to “star.tif”.

a. Dilate the image with structuring elements of sizes 3×3 and 5×5.
b. Erode the image with structuring elements of sizes 3×3 and 5×5.
c. Open the image with structuring elements of sizes 3×3 and 5×5.
d. Close the image with structuring elements of sizes 3×3 and 5×5.

Note: You **are not allowed** to use **built-in functions** for morphological operations so you should implement each of them. You can compare your results with built-in functions to make sure that your code works correctly.

Problem 2

Do the following with the reconstruction function (imreconstruct) for the image “char.tif”.

a. Load the image and extract the characters that contain long vertical strokes.

b. Try to clear border objects.
Note: You **are not allowed** to use “imclearborder” function.

c. Try to fill the holes in the characters of the image.
Note: You **are not allowed** to use “imfill” function.

Problem 3

The image "shapes.tif" includes circles, squares, and triangles of various sizes which are in 2 types with or without holes. Provide algorithms that use morphological and logical operations to classify circles, squares, and triangles and for each of them in two groups of with or without holes (it means that we have 6 classes). Count each shape in each class.

Note: The size of circles, squares, triangles, and holes can be any value, but the size of shapes is not too small. Your method must work for any similar image. **Please note that you are not allowed to use built-in functions to find circles, squares, and triangles.**

Problem 4

Numerous morphological techniques are based on gray-scale morphological concepts. In this question, we are going to implement these techniques using morphological operations.

a. Apply shading correction on the image "rice.tif". Now, find the number of connected components in the image and compute the area of each connected component. In the end, plot the histogram of their areas.

b. Find the two dominant particle sizes in the image "wood_dowels.tif".

c. In the image "blobs.tif" you can see two textural areas. A region composed of small blobs which are surrounded by large blobs. Find a boundary between these two regions based on their textural content.

Descriptive Assignments

Please solve the following questions from the 9th chapter of the textbook: 3, 6, 18, 20, 34, 36.

Notes:

1. Put written codes for each problem in one m-file, and for each section, intercept them by %%.

2. Analytical problems can be solved on papers, and there is no need to type the answers. The only thing that matters is the quality of your pictures. Scanning your answer sheets is recommended. If you are using your smartphones, you may use apps such as CamScanner or Google Drive Application.

3. Simulation problems need report as well as source code and results. This report must be prepared as a standard scientific report.

4. Your report is particularly important in the correction process. Please mention all the notes and assumptions you made for solving problems in your report.

5. You have to prepare your final report, including the analytical problems answer sheets and your simulation report in a single pdf file.

6. Finalized report and your source codes must be uploaded to the course page as a ".zip" or ".rar" file with the file name format as:

Fullname_StudentNumber_HW#.rar

7. Plagiarisms will be strictly penalized.

8. You may ask your questions from the corresponding TA of each assignment.