

SWE315 : C++

Homework 11 (Real sequence is #7) - (Due date 07-29 : two weeks!!)

General notes:

1. Please send solution to: zbaharav@cogswell.edu
2. You know the drill by now: Simply hit reply, and no zipped directories etc.. Just ascii-files or Word documents (or equivalent)
3. Please attach as well (word document preferred) screen shots of the console output, and of the images produced.
4. This homework goes beyond the technicalities, and you are expected to plan and use some of the OOP concepts you learned so far. So **'think before you write'** !

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Assignment:

Images come in different types and flavors. In this exercise we will deal with two types of images:

B/W images: Values of pixels are {0 , Max_Value}.

Gray level images: Values of pixels are integers in the range [0 .. Max_Value].

These image types have many things in common. For example, every image is a rectangle, with a given number of rows and cols. Every image should have `getpixel()/putpixel()` member interface, as well as the ability to read and write files, put comments, etc.

However, there are also differences: `histogram()` is valid operation on a gray level image, but it doesn't make sense in a binary image class. Similarly, morphological operations, like binary erosion and dilation, do not make sense on gray level image (there ARE extensions, but we will ignore these for now).

Your job, should you choose to accept it, is:

1. Create a base class for an image, and two derived classes for binary and gray level images.
2. Implement the standard interfaces (reading from a file, constructors, destructors, etc).
3. Perform the following in your main:
 - a. Read a gray level image.
 - b. Calculate and present histogram of the gray level image.
 - c. Threshold the image (threshold given by user) to get a binary image (which will be saved in a binary class.)
 - d. Perform an 'opening' of the binary image: This means erosion followed by dilation.

Please submit the following as one word document (or equivalent):

1. The programs
2. Screen shots of the images/histogram screen
3. Your design choices (and some rational behind them). What is common at the base class, what are the interfaces, which functions are implemented internally, etc. Please keep it short: I just want to make sure you made conscious decisions about the options.

Hints and guidelines:

1. Assume both images are stored as an integer array. (namely, do not try to save space by reverting to char etc).
2. Erosion and dilation:
 - a. Assume 3x3 kernel element of all 1's.
 - b. Good resource for erosion/dilation:
 - i. <http://homepages.inf.ed.ac.uk/rbf/HIPR2/erode.htm>
 - ii. <http://homepages.inf.ed.ac.uk/rbf/HIPR2/dilate.htm>
 - c. Opening: <http://homepages.inf.ed.ac.uk/rbf/HIPR2/open.htm>
3. You wrote MANY of the components of this homework previously. Please re-use code!!

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Here are some results for your information:

Image: Casablanca_ascii.pgm

Image histogram:

Number of pixels { 0 <= pixel < 25} = 35012 (%21.14)
Number of pixels { 25 <= pixel < 50} = 25760 (%15.56)
Number of pixels { 50 <= pixel < 75} = 17890 (%10.80)
Number of pixels { 75 <= pixel < 100} = 13890 (% 8.39)
Number of pixels {100 <= pixel < 125} = 12434 (% 7.51)
Number of pixels {125 <= pixel < 150} = 18195 (%10.99)
Number of pixels {150 <= pixel < 175} = 15903 (% 9.60)
Number of pixels {175 <= pixel < 200} = 8573 (% 5.18)
Number of pixels {200 <= pixel < 225} = 6339 (% 3.83)
Number of pixels {225 <= pixel < 256} = 11604 (% 7.01)



Note how many 'white segments' there are in the hair, and how these disappear after erosion (well, the small ones), and how only that which survived grow again in the dilation.

This operation (erosion+dilation) filtered-out small white islands in the picture.

Feel free to try it on other pictures, and learn more about the usefulness of Morphological operators. You can try Dilation+erosion, a few cycles off, etc.

Image after Erosion



Image after Erosion+Dilation



=== End of Homework 11 ===