APPM4058A, COMS7238A - Digital Image Processing
Lab Test I

April 4, 2018

Student Number:

Instructions

- Specified course materials, i.e., lecture slides, students' own notes, are allowed to be used during the test. When these materials are not in print, students are allowed to view them using desktops, laptops or pads.
- Electronic devices other then those specified above, and Internet are not allowed during the test.
- You may use a calculator.
- Test duration: 11:00 a.m. – 13:00 p.m.
- Save your scripts and resulting images using the file names specified in each question.
- Put all your script files and resulting images in a folder named using your student number. Compress this folder and submit it on sakai.
- Honours students are requested to answer the questions in Part I only, and MSc students are requested to answer the questions in both Parts I and II.
- The total mark for this test is 40, and bears a weight of 20% towards your final mark.

Total Mark: [ ]/**40**

Part I [40]

1. Write a script to apply contrast stretching on image 'cubes_org.png'. Save your script as 'Q_cubes.m', and the resulting image as 'Q_cubes.png'. [4]

2. Image 'square.tif' is degraded due to low contrast and noise. As a result, some details are hidden. Apply suitable techniques to adjust the contrast and remove the noise in the image. Save your script as 'Q_square.m', and the resulting image as 'Q_square.png'. [6]

3. Apply an averaging filter of size 5×5 to the noisy image 'barbara_noisy.png'. Save your script as 'Q_barbara.m', and the resulting image as 'Q_barbara.png'. [4]

4. You are given an image 'rice.tif'.

   (a) Write a script that convert the image to a black and white image using the following thresholding transform function:

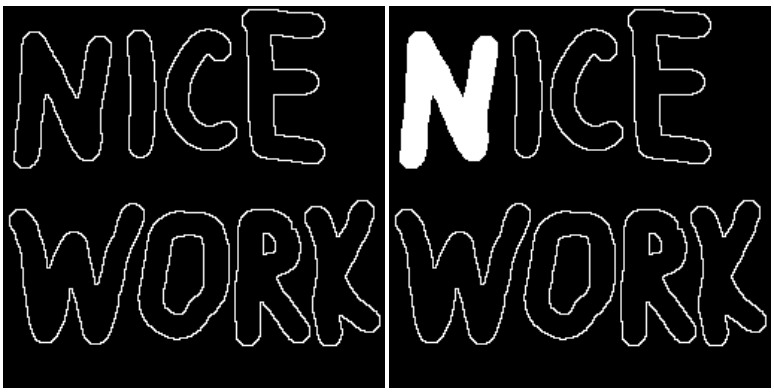
   $$g(x,y) = \begin{cases} 255 & \text{if } f(x,y) >= 128 \\ 0 & \text{if } f(x,y) < 128 \end{cases}$$

   Save your script as 'Q_rice_1.m', and save the converted image as 'Q_rice_1.png'; [4]

   (b) implement the following algorithm: firstly, apply an opening of the image using a sufficiently large 'disk' structuring element; secondly, subtract the result of previous step from the original image; and lastly, apply a suitable thresholding transform to the result of second step. Save your script as 'Q_rice_2.m', and save the resulting image as 'Q_rice_2.png'. [6]

5. Write a script that finds the external and internal boundaries of image 'rice_new.png'. Save your script as 'Q_rice_3.m', and save the resulting external boundary image as 'rice_new_exB.png', and internal boundary as 'rice_new_inB.png'. [6]

6. Write a script that convert image (a) ('nicework_b.png') in Figure 1 to image (b) in the same figure. Save your script as 'Q_nicework.m', and the resulting image as 'Q_nicework.png'. (Hint: this is a region filling problem and `imfill` function can be used, where you specify a location in the function. See help `imfill`.) [4]



(a) (b)

Figure 1: Images

7. Apply a DFT filtering (i.e., filtering in the frequency domain) to image 'window.png' using a 'Sobel' horizontal edge detector. Save your script as 'Q_window.m', and the resulting image as 'Q_window.png'. [6]

Part II [8]

1. Write a script that displays the spectrum of Fourier transform of image 'cage.png'. Save your script as 'Q_cage.m', and the resulting image as 'Q_cage.png'. [3]

2. Apply an image enhancement to image 'moon.tif' using a suitable Laplacian filter. [5]