

EEE-6512 Image Processing and Computer Vision
Fall 2018 Homework #3
September 21, 2018

Due: September 29, 2018, 11:59 PM

This assignment should be completed individually by the student. Late submissions will not be accepted. Proper citation should be provided for any references used.

Part I Textbook Questions [50 points]

Answer the following questions from the textbook:

3.6, 3.34, 3.36, 3.48, and 3.55

Part II MATLAB Programming [50 points]

Please read the directions carefully. Solutions that do not follow the provided specifications will not receive credit.

Implement the following smoothing techniques as a function called *myfilt* that takes the size of the filter, the filter type, and the input image as arguments. The function should return the filtered image as the output argument and apply them to the input image Noisy.pgm. (You might also want to try it on other images as well, but you are only required to turn in results for this one.) Explain the results of each method and mask/kernel size. You are free to use whichever padding method you like (zero, replication, or mirrored)

- Uniform averaging kernels ("box filters") of size 3x3, 5x5, 7x7, and 9x9
- Median filtering with size 3x3, 5x5, 7x7

You must code the spatial filtering (convolution or correlation) and median filtering routines yourself.

For the programming assignment, prepare a brief write-up describing your function and its results. Make sure to include copies of the output images and any intermediate images in your write-up.

Part III Extra Credit [10 points]

To remove noise, an image is convolved with a 3 x 3 Gaussian kernel composed from two 1D kernels, namely a horizontal Gaussian kernel with a σ value of .5 and a vertical Gaussian kernel with a σ value of .5. Then, to differentiate, the resulting smoothed image is convolved with the

horizontal $\frac{1}{2} [1, 0, -1]$ and vertical $\frac{1}{2} [1, 0, -1]$ kernels. Write the equivalent 2D kernels that if the original image were convolved with them, would yield the same result. What do you notice about this kernel that is undesirable? What are the implications regarding smoothing before differentiating?

To receive full credit for this assignment, you should submit four files. 1.) A document containing answers to the textbook questions (.DOC, .DOCX, or PDF file) and extra credit question 2.) An M-file containing commented MATLAB code for the function *myfilt* 3.) A brief write-up which discusses the results of *myfilt*. Students should ensure that their M-files execute without warnings/errors to avoid receiving point deductions.