BME 7112 PROCESSING OF MEDICAL IMAGES SPRING 2019

Homework Project # 4B (10 points) **Due Date for Slides: 02-20-2019, 11:00AM**
Report Due/Class Presentations: 02-21-2019

In this project, you will implement a filtering operation in the spatial domain. You are to write a MATLAB program that applies a k x k-sized kernel to a given grayscale image of dimensions m x n. Your program should be able to handle any image size and any kernel size ($k \leq m$, $k \leq n$). The image files, "**Data_File_4A.tif", "Data_File_4B.tif" and "Data_File_4C.tif"**, and the PowerPoint template file, "**BME7112_HW4B.pptx"** are available on Pilot. Each data file contains an image that is corrupted by a different type of noise, and your task is to use the filter that has been assigned to you to improve one of the three images. You'll need to determine which image is most improved with your assigned filter(s).

The following filters will be implemented by you and your peers: Gaussian, Median, Iterated Median, Conditional Median, Directional (Vertical/Horizontal) Median, Truncated Median, Hybrid Median, Mode, Olympic, Top Hat, Bilateral, Nonlocal Means, Grayscale Erosion/Dilation, and Kuwahara.

We will view the results of the filter operations in class. The PowerPoint file contains two slides. Each slide contains spaces for your original and resultant images. The first slide shows the entire image. On the second slide, we will look at the image at the pixel level. For this slide, create a new image that contains the portion of the first phalanx, i.e. Acropped = A(152:218,161:194). Edit the slide titles appropriately (your name, filter type, and kernel size), and then replace the left images on both slides with the original (noisy) images and the right images on both slides with your resultant images.

Questions/Discussion
In general, what is the purpose of this filter? What are the drawbacks to using this type of filter? How did you select the image for showing the results (either Data File 4A, 4B or 4C)? How did your filter perform on the other images? How did you select the final kernel size? How did you tune any other parameters associated with your filter type (as appropriate)? How did you handle operations at the image borders? Did you run into any unexpected algorithmic challenges with your particular filter(s)?

Describe the test image before and after application of your filter. Consider both the entire image and the image ROI (region of interest). If your filter would perform better on an image with different type of noise corruption, please discuss.

Finally, estimate the performance of each filter type on each of the images. Include a table (Table 1) in your report wherein you assign an anticipated performance score to each filter/image combination, based on your understanding of these filters. Use a scale of 1 to 3, where 1 = expect this filter to effectively remove the noise; 2 = expect this filter to remove some, but not all of, the noise; 3 = expect this filter to be ineffective in removing the noise.

Submit to Pilot 1) a copy of your MATLAB code; 2) your PowerPoint slides; and 3) a short report that describes your approaches and addresses the questions above for each implemented filter. If you've been assigned two filters and implement them via separate .m files, include the filter type in the .m filename. Submit one PowerPoint file that includes all of your slides/results.

Submit your files to Pilot using these filenames:

Code:	*BME7112_HW4_YLN_FilterType_yourFilename.m*
Report:	*BME7112_HW4_YLN.docx (or .pdf)*
PowerPoint file:	*BME7112_HW4_YLN.pptx*

Table 1. Template of table of expected performance to include in HW 4 report.

Filter Type	Image A	Image B	Image C
Gaussian			
Median			
Iterated Median			
Conditional Median			
Horizontal Median			
Vertical Median			
Truncated Median			
Hybrid Median			
Mode			
Olympic			
Top Hat			
Bilateral (Conditional Gaussian)			
Nonlocal Means			
Grayscale Erosion/Dilation			
Kuwahara			

Note: Copying images displayed in MATLAB to the slides: Once you've shown the image of interest in a figure window, from the MATLAB toolbar, choose Edit > Copy Figure. Open the .ppt file, right click, and choose Paste. Within PowerPoint, first crop the image if needed and then scale it to the (exact) same size as the samples on the slides.

Filter Assignments:

	Gaussian	Median	Iterated Median	Conditional Median	Directional Median	Truncated Median	Hybrid Median	Mode	Olympic	Top Hat	Bilateral (Conditional Gaussian)	Nonlocal Means	Grayscale Erosion/Dilation	Kuwahara
Dave, Hemal							X							
Davies, Chris												X		
McNeil, Ryan									X	X				
Patel, Milan		X	X	X	X	X								
Petrack, Alec													X	X
Shar, Jason	X							X			X			