DIP Assignment 2

SSE@TJU, Fall 2020

November 18, 2020

Due: Dec 1, 23:59:59

1 Problem 1: Gaussian Noise

File 'p1' contains the image for problem 1. The line length is 600 bytes.

(1) Read and display the image. Filter the image using matlab function 'filter2' or 'conv2' with masks of all ones of different sizes. Display and submit. What's the difference between 'filter2' and 'conv2'? How dose the size of mask affect the blurring and noise reduction? Which mask do you think provides the best tradeoff between blurring and noise reduction in this image?

(2)
- Write a function **gauss(sigma, n)** that returns an 1-D Gaussian filter of size n for a given sigma. Don't forget to normalize the filter.
- Create a function **gauss2d(sigma, n)** that returns a 2D Gaussian filter. Remember that a 2D Gaussian can be formed by convolution of an 1D Gaussian with its transpose.
- Write a function **gaussConv(image, sigma, n)** which applies Gaussian convolution to a 2D image for the given value of sigma. You should use the gauss2d(sigma, n) to generate a gaussian filter and can do the convolution with function 'conv2'.
- Apply gaussian filter to the image 'p1' using **gaussConv(image,sigma)** and make a comparison with the matlab function 'imfilter'. Display and submit.

Hints: for efficiency and compactness, it is best to avoid "for" loops in Matlab.

2 Problem 2: Pepper and salt noise

File 'p2d1', 'p2d2' and 'p2d3' contains the image for problem 2. The line length is 600 bytes.

(1) Read and display 'p2d1'. Write a function **minFilter(img, n)** which apply min filter to 'img' with window of size $n \times n$. Apply min filter to the 'p2d1' with n in [1, 3, 5, 7]. How does the window size affect the result?

(2) Read and display the image in 'p2d2'. Write a function **maxFilter(img, n)** which apply max filter to 'img' with window of size $n \times n$. Apply max filter to 'p2d2' with n in [1, 3, 5, 7]. How does the window size affect the result?

(3) Read and display the image in 'p2d3'. Apply median filter to 'p2d3' with the matlab function 'ordfilt2' with window size in [1, 3, 5, 7]. How does the window size affect the result?

(4) Can we apply the max filter to 'p2d1' or apply the min filter to 'p2d2'? Can you describe the scope of application of these three different filters?

3 Problem 3: Sharpen

File 'p3' contains the image for problem 3. The line length is 600 bytes.

(1) Sharpen the best result in Problem 1 using the Laplacian mask:

$$\begin{matrix} 0 & -1 & 0 \\ -1 & 5 & -1 \\ 0 & -1 & 0 \end{matrix}$$

Display and submit. Does this operation affect the blurring and the noise reduction?

(2) Filter the image 'p3' using Laplacian mask:

$$\begin{matrix} -1 & -1 & -1 \\ -1 & 8 & -1 \\ -1 & -1 & -1 \end{matrix}$$

And apply log of gaussian operator to 'p3' using matlab function 'fspecial' and 'imfilter' with window size of 3. Adjust the parameter **sigma** to show the correlation between the two operators.

Note: All programs should be implemented in MATLAB. Use latex to prepare your report and the report should be submitted in pdf format. Don't forget to include the result of each problem and your MATLAB code in your submission. The report should be no more than 10 pages.