Homework 2: Edge-Aware Filtering and Image Denoising

Due date: 2pm April 26, 2017
Submission files:
1) Source code: the code should work well with no modification. Provide 'readme.txt' and an interface for easily setting input images and parameters used in the code.
2) Technical report including all results and analysis
Programming tools: C (C++) or MATLAB depending on your preference

Input images: 'Peppers.bmp', 'Cameraman.tif', 'Lena.tif', 'PeppersRGB.bmp', 'LenaRGB.bmp'
http://www.eecs.qmul.ac.uk/~phao/CIP/Images/

1. Bilateral filtering

1-1. Implement the bilateral filtering in a straight-forward manner. Show 1) how the runtime varies as the window size increases, and 2) how the results vary as you adjust the smoothing parameters (sigma_s and sigma_r).

Note) You should show the results for both grayscale images and color images. Namely, the results for color images should be obtained by using a color distance that considers RGB data simultaneously.

2. O(1) time Bilateral Filtering

Implement O(1) time bilateral filtering method (called bilateral grid) explained at p11-15 of 'P2_Efficient_EAF.pptx'. (Part 2 from https://sites.google.com/site/filteringtutorial/)

For more details, refer to the following paper [a]:
[a] S. Paris and F. Durand, "A fast approximation of the bilateral filter using a signal processing approach," in European Conference on Computer Vision (ECCV), 2006

This work consists of three steps: 1) Downsampling, 2) Gaussian linear filtering, 3) Slicing and division

2-1. For grayscale image, perform O(1) bilateral filtering. Show how filtering results and runtime change with varying quantization levels of step 1) mentioned above. To compare an objective quality, you may measure the PSNR between two filtering results of the original bilateral filtering and O(1) time bilateral filtering. Please explain the case of providing the best trade-off in terms of the filtering accuracy and speed. Compare the runtime with the original bilateral filtering.

Note) PSNR (Peak signal-to-noise ratio): https://en.wikipedia.org/wiki/Peak_signal-to-noise_ratio

2-2. For RGB image, perform O(1) bilateral filtering for R, G, and B separately. Namely, apply the smoothing on 3D space for each channel independently. Repeat all the tasks mentioned in 2-1.

* Note

In technical report, you should include the following three things.
1) Description of your algorithm
2) The reason of the parameter setting you chose in your source code.
3) Show the results of your algorithm using various images which you want to use.