

E9 241 Digital Image Processing

Assignment 04

Due Date: November 14, 2024 - 11:59 pm

Total Marks: 55

Instructions:

For all the questions, write your own functions. Use library functions for comparison only.

- Your function should take the specified parameters as inputs and output the specified results.
- Also provide the wrapper/demo code to run your functions. Your code should be self-contained, i.e., one should be able to run your code as is without any modifications.
- For python, if you use any libraries other than **numpy**, **scipy**, **scikit-image**, **OpenCV**, **pillow**, **matplotlib**, **pandas** and default modules, please specify the library that needs to be installed to run your code.
- Along with your code, also submit a PDF with all the results and inferences. Include answers to subjective questions, if any.
- Put all your files into a single zip file and submit the zip file. Name the zip file with your name.
- **Vectorize your code. Non-optimized code may be penalized.**

1. Image Denoising:

- (a) Use the bilateral filter to denoise the image **building_noisy.png** corrupted by the Gaussian noise and compare the results with the Gaussian smoothing. Use a window size of 7×7 and tune the other parameters to get a good result. Check Figure 1 for reference. It shows the optimal results on a patch of the image.

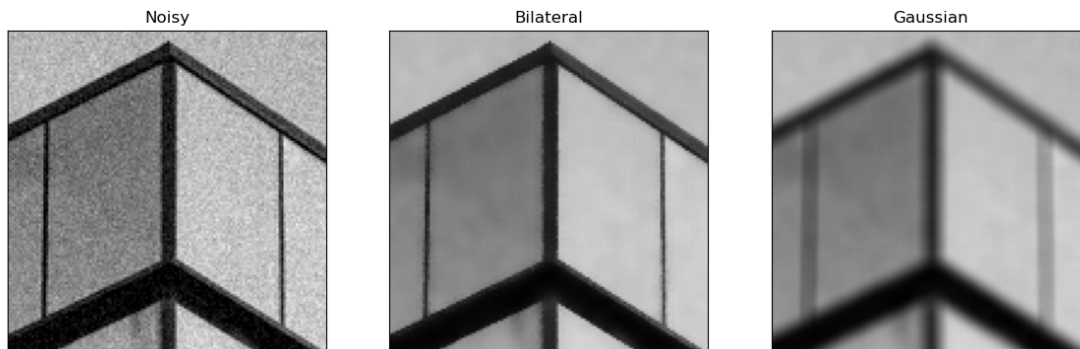


Figure 1: Expected results on a patch

- (b) Apply Laplace filter on the input image, bilateral filtered image and the Gaussian smoothed image. What do you observe from the results?

(20+5=25 Marks)

2. Hough Transform:

- (a) Implement Hough Transform for detecting circles in an image. You can utilize the edge gradient information if you want. Assume that you know the radius of the circle. Analyze for different scenarios like (i) Presence of noise, (ii) Where the actual radius is slightly different from the value you have chosen, (iii) increasing the number of circles present (have a few partially occluded circles also). You can do the assignment with synthetically generated images, but try to find a real example also (like coins/cells, etc).

- (b) The first step of Hough transform is edge detection. For the images used in this assignment, try with two different gradient based edge detectors. Analyze the effect of different parameters like threshold and also noise, occlusion etc on the output of the edge detection algorithms and resulting Hough transform outputs.

(20+10=**30 Marks**)