

Assignment 4 : Image Denoising

6 points

Due Date: 09.11.2020

1 Background

One of the fundamental challenges in the field of image processing and computer vision is image denoising, where the underlying goal is to estimate the original image by suppressing noise from a noise-contaminated version of the image. Image noise may be caused by different intrinsic (i.e., sensor) and extrinsic (i.e., environment) conditions which are often not possible to avoid in practical situations. Therefore, image denoising plays an important role in a wide range of applications such as image restoration, visual tracking, image registration, image segmentation, and image classification, where obtaining the original image content is crucial for strong performance. While many algorithms have been proposed for the purpose of image denoising, the problem of image noise suppression remains an open challenge, especially in situations where the images are acquired under poor conditions where the noise level is very high. We will be exploring non-local means algorithm for image denoising in this assignment.

2 Problem Statement

Perform image denoising using *non-local means* algorithm and compare the results with the Gaussian filtering method. The reference paper is uploaded on Google Classroom along with the data.

3 Procedure

- You have been provided with 10 images (of different resolution) for this assignment. Convert images to grayscale (if they already are not) to perform all the subsequent operations.
- You are required to introduce noise to these images. You will use standard noise models like Gaussian Noise and Salt & Pepper Noise. The images provided to you will act as ground truth denoised version of the noisy counterparts.

- Perform *non-Local means* and Gaussian filtering on these noisy images to obtain their denoised versions.
- Report the Mean Square Error (MSE) and PSNR between the denoised images and the corresponding ground truth.

4 Deliverables

- You are required to submit a report as per the following requirements.
 1. Tabulate the metrics (MSE and PSNR) obtained for both the denoising methods for all the images.
 2. Show visual results over a few images. You may report the ones with best visual quality.
 3. Report the comments on your observations about which method proves better for different noise types.
 4. Mention all the assumptions or considerations that you have made while attempting the assignment.
- Submit a well-commented code along with a README file. You are free to use either Matlab or Python for this assignment.
- Avoid any sort of malpractice and adhere to the institute's code of conduct.