

# Assignment 1 : Image Denoising

10 points

Due Date: 29.08.2021

## 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

- Open the [colab file](#), and follow along the lines. The dataset downloading util and some other utils have already been completed for you. You can start with running them.
- Before starting, go through the colab to understand the assignment in a better way.
- You have been provided with 10 images (of different resolution) for this assignment.

- 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 in the report.
- For any doubts, add your questions to the [FAQ document](#).

## 4 Deliverables

1. You are required to submit a report (2 marks) (PDF) which contains:
  - Methodology of your non-Local means algorithm in detail. (0.5 mark)
  - Metrics (MSE and PSNR) obtained for both the denoising methods for all the 10 images tabulated properly. (0.5 mark)
  - Your understanding of the sigma\_h, small\_window and big\_window parameters. (0.5 mark)
  - Comments on your observations about which method proves better for different noise types. (0.5 mark)
  - All assumptions or considerations that you have made while attempting the assignment if any.
2. You need to finally submit one **colab file** (8 marks). For this you need to make a copy of the template colab file and save it as **RollNo\_Assignment1.ipynb**
3. Avoid any sort of malpractice and adhere to the institute's code of conduct.