Design and Analysis of Algorithms

Project Proposal

Patch Based Near Optimal Image Denoising

- The project aims at implementing the patch-based locally optimal Weiner (PLOW) filter for image denoising and analyzing the complexity of the same. Also, we intend to improve this algorithm if possible.
- We have decided to implement the PLOW filter which uses the already existing Wiener filter and implement Wiener filter with image clustering and photometrically similar patches to create a high performance practical image denoising algorithm.

Introduction

Images play a large role in our day to day life, they have a wide range of applications from capturing events and trips to more serious applications including surveillance, security and medical fields. However, images that are captured using modern cameras or images from satellites are heavily corrupted with noise which makes it hard to use them for surveillance and security as the information cannot be easily interpreted and sometimes can also be wrongfully interpreted. While advances in optics and hardware technologies try to reduce these noises from captured images they usually have more cost to them therefore, software based denoising approaches are more popular as they are device independent and widely applicable. Image denoising is a process by which the resolution of an image is increased so as to create a more sharp and visually appealing image without the loss of finer details.

Wiener Filter

One of the recent most efficient algorithms for image denoising uses the wiener filter for image denoising. Wiener filter is used to produce an estimate of desired signal by linear time-invariant (LTI) filtering of an observed noisy process. This means that the Wiener filter takes a noisy image as an input with known noise spectra and additive noise information

and makes an estimate to what a filtered image should be. On making this estimate the Wiener filter ensures to minimize the mean square error between the estimated process and the desired process.

PLOW Filter

PLOW filter short for patch-based locally optimal wiener filter. In this filter, instead of directly using the wiener filter we first take the noisy image input and create geometrically and photometrically similar patches and the parameters of the wiener filter are then learned from these geometrically and photometrically similar patches to make a better estimate of the desired image. Hence, this filter builds over the quality of image produced by wiener filter and creates a more sharp and visually appealing image.

Goals

- To analyse the PLOW filter for image denoising
- To implement the image denoising algorithm on various images
- To improve the existing algorithm for better time and space complexity (if possible)

References

1. P. Chatterjee and P. Milanfar, "Patch-Based Near-Optimal Image Denoising," in IEEE Transactions on Image Processing, vol. 21, no. 4, pp. 1635-1649, April 2012.
2. “Wiener Filter” in Wikipedia n.d.

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