DMET 1002 – Advanced Media Lab

Lab 2 Preparation

Unsharp Mask

1. Objective

This experiment aims at implementing unsharp masks to sharpen colored images.

2. Pre-requisites

- Image smoothing basics

- Edge detection basics

- MATLAB programming knowledge

3. References

- Computer Vision lectures of Winter 2018

4. Theoretical Background

In this experiment, you will be implementing unsharp masks that can be used to sharpen images. There are two methods with which such sharpening can be achieved in the spatial-domain. Both methods will be outlined in the next sub-sections.

4.1 Sharpening by Mean Subtraction

- The goal is to obtain a sharpened version of any image as shown below

Original Image

Sharpened Image

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- The first method is based on average filtering. The main idea is that when sharpening, one would like to enhance pixels that are significantly different from their neighborhood. Therefore, this can be obtained by obtaining the difference between each pixel and its neighborhood, and then boost those pixels with large difference from the neighborhood.

- Algorithm steps:

    1. Convolve the image with an average filter with size $s \times s$ to obtain the smoothed image F

    2. Subtract the smoothed version F from the original image I to get a matrix G

        $$G = I - F$$

    3. Add G to the original image I using the following equation

        $$S = I + w \times G$$

        where S is the sharpened image and w is a weight factor.

- The weight factor w can be used to adjust the amount of sharpening in addition to the size of the averaging filter s.

4.2 Sharpening by Edge Detection

- Another approach for sharpening is based on edge detection. In this method, edge pixels are first determined and then enhanced.

- Algorithm steps:

    1. Apply an edge detection operator to the image to obtain the edge magnitude matrix M

    2. Add the edge magnitude matrix M to the original image using the following equation

        $$S = I + w \times M$$

        where S is the sharpened image and w is a weight factor.

    3. If needed, the output sharpened image S should be re-scaled.