Report for Q1

September 28, 2020

1 Introduction

The unsharp filter is a simple sharpening operator which derives its name from the fact that it enhances edges (and other high frequency components in an image) via a procedure which subtracts an unsharp, or smoothed, version of an image from the original image.
Unsharp masking produces an edge image *g(x,y)* from an input image *f(x,y)* via

$$g(x, y) = f(x, y) - f_{smooth}(x, y)$$

where $f_{smooth}(x, y)$ is a smoothed version of *f(x,y)*. $f_{smooth}(x, y)$ is obtained by applying Gaussian lowpass filter of Standard Deviation σ on Original Signal *f(x,y)*.
After subtracting away the lowpass component of original signal, we get highpass or 'edge' representation of signal, i.e. *g(x,y)*.
This edge image can be used for sharpening if we add it back into the original signal so the final equation becomes:

$$f_{sharp}(x, y) = f(x, y) + k * g(x, y)$$

where k is scaling factor. While sharpening images using Unsharp Filter we've to tune two parameters namely Standard Deviation(σ) and Scaling Factor(k).

2 Observation

For Figure 1, the image is sharpest when the parameters are:

$$\sigma_1 = 8, k_1 = 0.7$$

When σ is increased beyond this, the high intensities in the image seeps into lower ones around their area and hence sharpness of the image is decreased.

For Figure 2, the image is sharpest when the parameters are:

$$\sigma_2 = 6, k_2 = 0.9$$

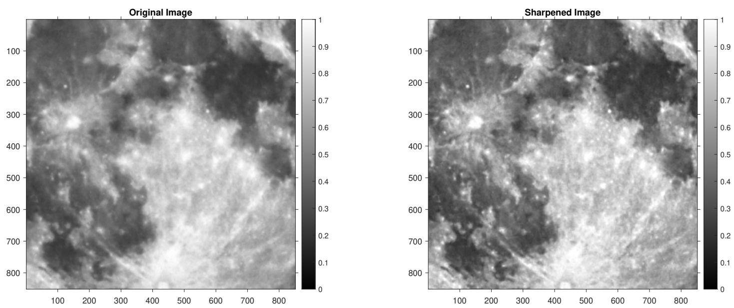

Figure 1: Super Moon

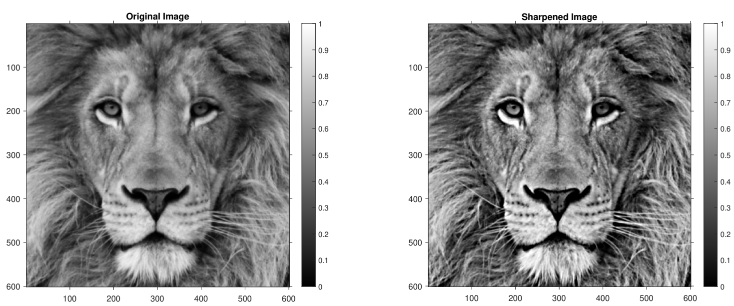

Figure 2: Lion