# Project 1 Write Up

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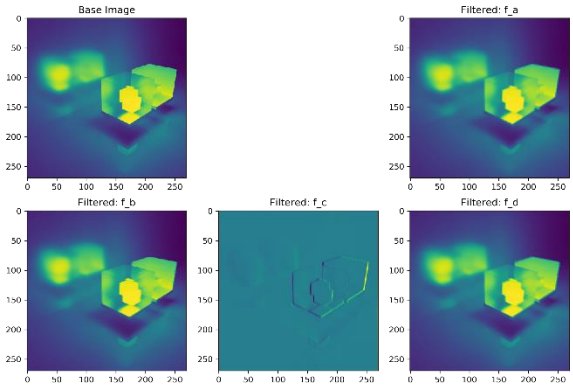
## I. P1.1.1 Simple Filters

For this section four filters were applied to a base Image.

$$f_a = \frac{1}{9}\begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix} \quad f_b = \frac{1}{3}\begin{bmatrix} 0 & 0 & 0 \\ 1 & 1 & 1 \\ 0 & 0 & 0 \end{bmatrix}$$

$$f_c = \frac{1}{6}\begin{bmatrix} -1 & 0 & 1 \\ -1 & 0 & 1 \\ -1 & 0 & 1 \end{bmatrix} \quad f_d = \frac{1}{3}\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$




fa: Filter “a” is the box filter. It applies a smoothing/blurring effect on the image by taking the pixels around each pixel and averaging it. This filter was discussed in class and is separable.

$$f_a = \frac{1}{6}[1 \quad 1 \quad 1] \cdot \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$$

fb: Filter “b” is like the box filter. It applies a smoothing/blurring effect on the image by taking the line of pixels next to each pixel and averaging it. This is a separable filter.

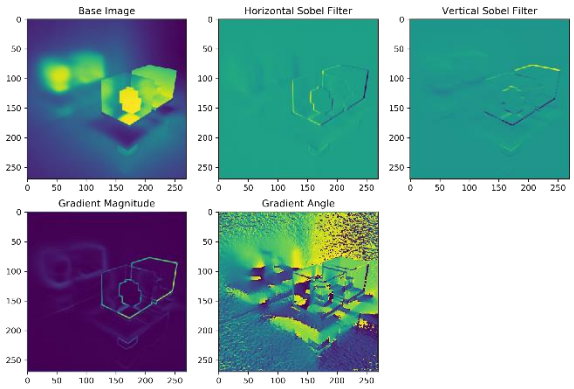
$$f_b = \frac{1}{3}[1 \quad 1 \quad 1] \cdot \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix}$$

fc: Filter “c” is the Prewitt filter. This filter helps with edge detection as it makes the lines show clearer. This is a separable filter.

$$f_c = [-1 \quad 0 \quad 1] \cdot \frac{1}{6}\begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$$

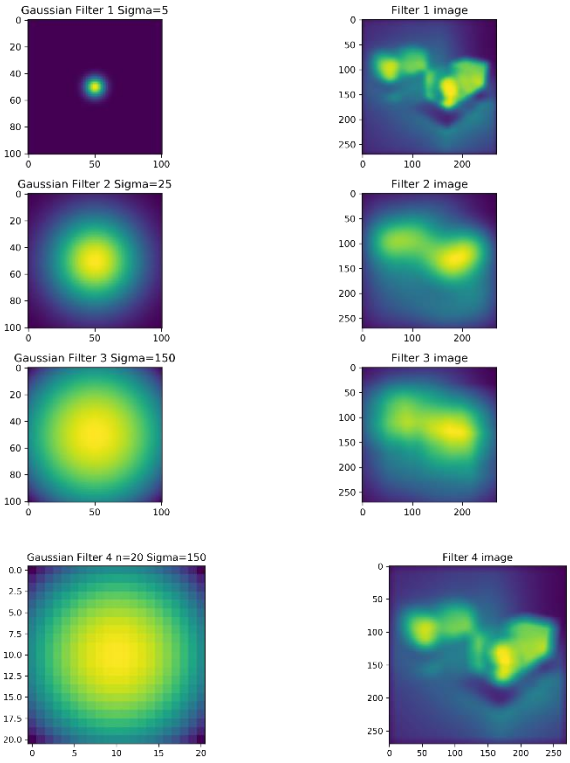
fd: Filter “d” is another blurring/smoothing filter. This filter averages the values of the diagonal pixels to make the image appear smoother. This not a separable filter.

## II. P1.1.2 Image Derivatives




Laplacian filter measures the rate of change of an image’s first derivative by computing its second derivative. This allows us to realize changes in adjacent pixels helping us to identify edges.

## III. Gaussian Filtering




If the filter width were too small compared to sigma the image will not be affected as much by the large sigma value.

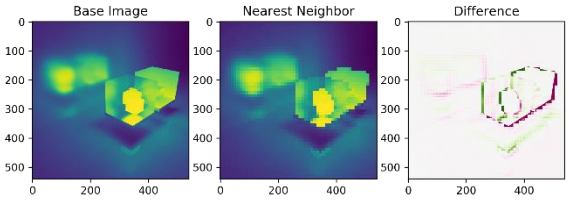
The sigma of the given filter is 25.

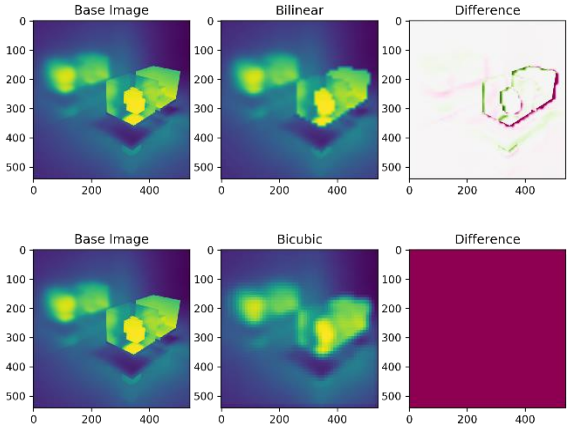
$$g = \frac{1}{16}\begin{bmatrix} 1 & 2 & 1 \\ 2 & 4 & 2 \\ 1 & 2 & 1 \end{bmatrix}$$

## IV. Derivative of Convolution

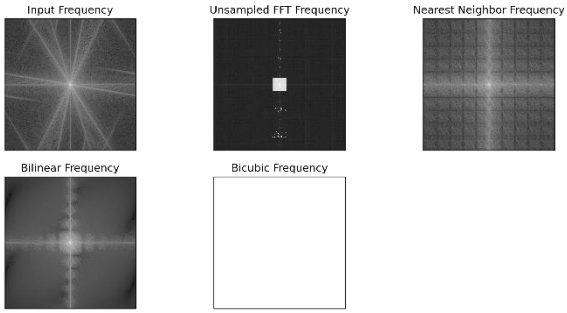
The answer you seek could not be found at this time. Please try again later.

## V. Image Upsampling




## VI. Upsampling with Fourier Transforms




The last 3 Images are not working in my code due to the way that the previous section was implemented, but it worked on my parthners.

Wagon wheel effect – When something is moving faster than the shutter speed so it appears like its going in the opposite direction.

## VII. P1.3

Not completed.