ENSC 474

Assignment 7 - Random and Periodic Noise Removal

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For this lab, the given image was being distorted with two independent forms of noise. At first glance, the obvious noise was the salt and pepper noise, which was the random portion of the noise on the image. The second noise, which was black horizontal lines in the spatial domain, turns out to be sinusoidal noise.

The general equation of a sinusoid noise is:

$$n(x,y) = cos(2\pi\left(u_0\frac{x}{M} + v_0\frac{y}{N}\right))$$

and the sinusoidal noise present in our image only travels in the y direction, only existing on fixed x values. For this to be true, the value of u_0 must be zero, to cause the noise to only travel in the y direction (since the x value cancels out). The equation looks like:

$$n(x,y) = \cos(2\pi v_0\frac{y}{N})$$

This means it is very easy to see when the Fourier transform of the image is taken. In the Fourier domain, all the noise would exist on the left edge of the image, since the u value is 0.

The process used for this code is to save the DC value, set the left column to zero, and add the DC value back in. There was no need to use "fftshift()" for the matrix since all the noise was held in the leftmost column. I tested by only removing certain points on the leftmost column, but the superior output came when all the values except the DC value were removed.

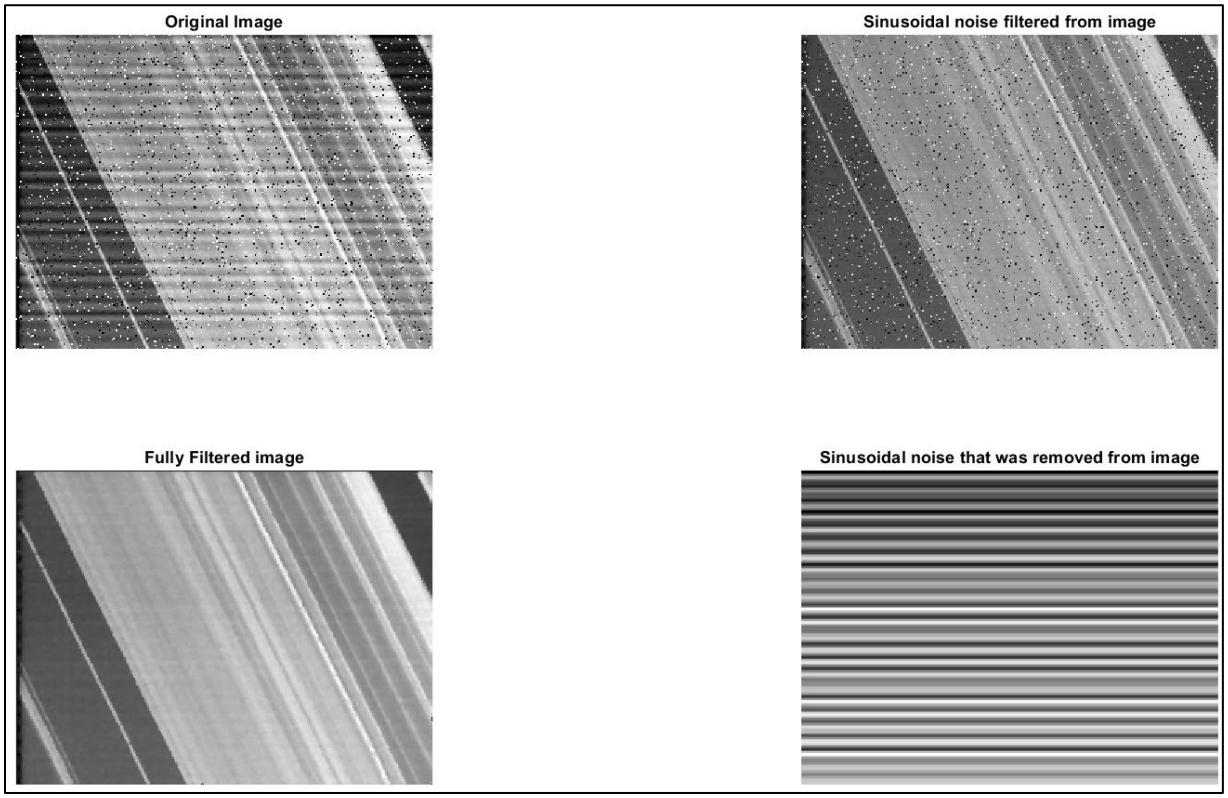

Figure x: Original image, along with products of filtering

Initially, the sinusoidal noise was removed, because if SnP were removed, that would cause smudging in the image, and potentially cause portions of the image to be removed when the sinusoidal filter was applied. Once the sinusoidal noise was removed, the median filter was applied to remove the SnP noise. This resulted in the image seen in the bottom left above, which is the fully filtered, mostly noise free image.

On the bottom right above, one can see the sinusoidal noise that was filtered out of the image.

This is my image processing pipeline, and hopefully NASA will hire me.