CS663 ~~As~~ Homework 3 Q7

! Given: we have the high pass filter shown in Figure 1.
The first ~~path~~ part shows the frequency domain of the ideal, Butterworth & Gaussian filters & the second part shows the spatial representations.

The equations are:

Ideal

$$H(u,v) = \begin{cases} 1 & \text{if } D(u,v) \le D_0 \\ 0 & \text{if } D(u,v) > D_0 \end{cases}$$

Butterworth

$$H(u,v) = \frac{1}{1 + [D_0 / D(u,v)]^{2n}}$$

Gaussian

$$H(u,v) = 1 - e^{-D^2(u,v)/2D_0^2}$$

on frequency domain $\Rightarrow$ HPF has no amplitude gain. we write it as

$$H(u,v) = 1 - \underbrace{L(u,v)}_{\text{low pass filter}}$$

Taking inverse Fourier Transform to the spatial domain,

$$F^{-1}(H(u,v)) = F^{-1}(1) - F^{-1}(L(u,v))$$

$$F^{-1}(H(u,v)) = \delta(x,y) - F^{-1}(L(u,v))$$

$$h(x,y) = \delta(x,y) - l(x,y)$$

This Dirac delta function causes the spikes we are observing & is responsible for the anomaly.