Lab 8: Frequency Domain Processing

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**OBJECTIVE:** The objective of this lab was to learn the basis of digital image filtering using techniques implemented in the frequency domain, and be able to write custom MATLAB scripts utilizing these techniques.

**METHODS:** In part 1 to 3, I simply copy-pasted the codes from the lab sheet, which I used the step function of MATLAB to go through step by step to understand what each line of the code is doing.

In part 4, I started off by loading the image and converting it into frequency domain using fft2(), which I then displayed after applying fftshift() to make it easier to understand. From the displayed frequency domain image, I saw that there are no significant bands of noise that are corrupting the image. Thus, I decided to simply apply a lowpass filter on it using a gaussian filter with 5.0% bandwidth to complete part A. Then, for part B, I immediately noticed that I must use highpass filter just from looking at the example image. I first created a highpass filter with 5.0% bandwidth and applied it. However, it was taking too much of the high frequency that it was introducing too much noise. Therefore, I changed the number a few times and settled with 2.0% bandwidth. Then, since the example image had a little bit of blurring, I decided to apply a lowpass filter as well. I started with 5.0% bandwidth and settled with 10.0% bandwidth after changing the values a few times. Once all the filtering is done, the images were transformed back into spatial domain and the padding were removed to display the image.

**RESULTS:** For part 4, before deciding to apply the low and high pass filters, I decided to apply band-pass filter on the vertical and horizontal bright band of frequencies. However, the resultant image was nowhere close to the original image and was only displaying random lines around the entire image. Thus, I concluded that only low and high pass filters would apply for this image.

Change in the bandwidth percentage of the high and low pass filters drastically changed how the resultant image looked, especially the highpass filter. Extreme values of bandwidth for highpass filters caused the image to seem extremely noisy to the point that the bone was indifferentiable from the background.

**CONCLUSION:** This lab exercise introduced me to filtering in the frequency domain and some useful filtering techniques using frequency domain. Additionally, seeing a few images in the frequency domain with alterations allowed me to understand the original image from the characteristics of the frequency domain image.

**APPENDIX:**