Lab 5 Frequency Domain Filtering

- Implement the Sobel filter to the input images Q5_1.tif in both spatial domain and frequency domain. Compare the results. Refer to slides 78 to 81 of Lecture 4.

- Implement the ideal lowpass filter with $D_0 = 10, 30, 60, 160 \text{ and } 460$ to filter the input image Q5_2.tif, respectively.

- Implement the Gaussian low pass and high pass with $D_0 = 30, 60, \text{and } 160$, to the input image Q5_2.tif, respectively.

- Implement the Butterworth notch filters to the input images Q5_3.tif. Refer to slides 110 to 114 of Lecture 4.

- Making clear the following:

  In general, compare your results, describe what you observed, explain reasons behind, and comments if any.

  In particular,

  1. Explain why perform a shift in Step 4 on slide 81 of Lecture 4 in the first Exercise.
  2. Explain what cause the ring effect in the ideal filtering. Design an experiment to verify your reasoning.
  3. In the above implementation 4, how the parameters in the notch filters are selected, and why.
  4. Explain why $H(\mu, \nu)$ has to be real and symmetric in the Step 5 on slide 71 of Lecture 4, which is also the case for all the filter used in this laboratory.