

ENGR 391: Computer Vision

Homework Assignment # 3

Spring 2024

Problem 1: Edge detection in the space domain

For this problem and the next one we use the image in figure 1. You can use built in functions or the convolution code you wrote last time. Show your work and discuss your results.

1. Apply the horizontal Sobel mask to the image.
2. Apply the vertical Sobel mask to the image.
3. Discuss the difference between the horizontal and vertical masks (in terms of the result)
4. Use the magnitude to combine the horizontal and vertical edges.
5. Apply the horizontal Prewitt mask to the image.
6. Apply the vertical Prewitt mask to the image.
7. Use the magnitude to combine the horizontal and vertical edges.
8. Compare between the two filters.

Note: The magnitude is given by:

$$|\nabla f(x, y)| = \sqrt{\left(\frac{\partial f}{\partial x}\right)^2 + \left(\frac{\partial f}{\partial y}\right)^2} \quad (1)$$

and can be approximated by

$$|\nabla f(x, y)| \simeq \left| \frac{\partial f}{\partial x} \right| + \left| \frac{\partial f}{\partial y} \right| \quad (2)$$

$$|\nabla f(x, y)| \simeq \max \left\{ \left| \frac{\partial f}{\partial x} \right|, \left| \frac{\partial f}{\partial y} \right| \right\} \quad (3)$$

Problem 2: Edge detection in the frequency domain

1. Obtain the FFT of the horizontal and vertical Sobel masks. You need to perform zero padding.
2. Perform filtering in the frequency domain using the horizontal Sobel mask.
3. Perform filtering in the frequency domain using the vertical Sobel mask.

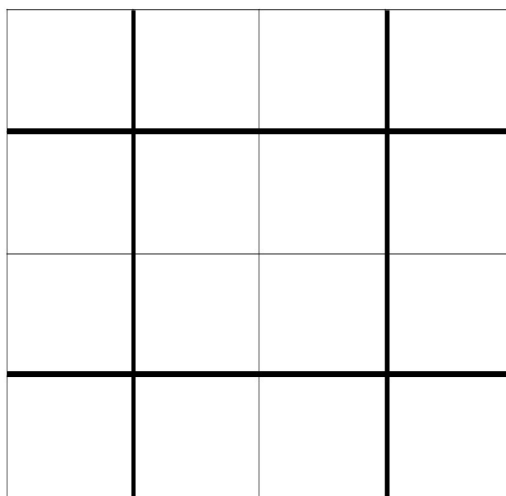


Figure 1: Image for homework