

Assignment 3:

Submission Instructions: Please submit a .zip file named <your name>.zip containing 1) A report named report.pdf including your answers to all required questions with images and/or plots showing your results, and 2) the python notebook or files used, with the cells run in the submitted book for python notebooks, and the relevant source code. If you include other source code files for a given exercise, please indicate it in the report.

Problem 1. Separable Convolution (20%)

Separable Convolution refers to breaking down the convolution kernel into lower dimension kernels.

1. Show that convolution with a 2D Gaussian kernel is a spatially separable convolution. (i.e. there exists two 1D kernels that if applied to the image row-wise and column-wise in sequence, will be equivalent to convolving that image with the 2D Gaussian kernel)
2. Is Sobel kernel spatially separable?
3. Why are separable convolutions preferable?

Problem 2. Edge Detection (50%)

1. Implement Canny Edge Detection algorithm as described in the class. Apply your program to detect edges in image 1. Your program will take as an input a grayscale image, the sigma of the Gaussian filter and the two low and high thresholds. The output of your program is a binary image.
2. Implement gaussian convolution as a separable sequence of horizontal and vertical convolutions.

Problem 3. Corner Detection (30%)

Implement Harris Corner Detection algorithm described in the class. Apply your program to detect corners in image 1.