Readings

- Forsyth & Ponce Chpt 8 — Edge Detection (uploaded online to LumiNUS)
- Szeliski 4.2.1 — Edge Detection
- Klette 2.3.3, 2.4.1 — Basic Edge Detectors, LoG and DoG

Summary

Motivation

- Image edges convey information: e.g. object boundaries, textures & appearance, change in surface orientation & shape, etc. which is useful for recognition and 3D understanding

Image Gradients

- Image edges are sharp discontinuities in intensity; they can be formalized as gradients i.e. a vector that points in the direction of most rapid change in intensity
- Gradient vector has two components: magnitude & orientation
- Image gradients can be extracted with Sobel filters gradients

DoG Operator

- Purely extracting differences with derivatives amplifies noise; need to first do smoothing(e.g. via a Gaussian filter)
- Smoothing + derivative can be merged into one, hence the derivative of the Gaussian
- Trade-off in extent of smoothing vs. edge localization, controlled via Gaussian's σ parameter

Canny Edge Detector

- Converts a gradient magnitude image into a single-pixel width edge image
- Procedure:
    - Filter with derivative of Gaussian & find gradient magnitude & orientation
    - Edge thinning via non-maximum suppression (either with or without interpolation)
    - Hysteresis thresholding to link together strong and weak edges