**Lecture 7: Edge and Corner Detection**

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* Edge detection

Edges are just intensity discontinuities. There are ramp edge and step edge. Difference filter respond strongly to noise. Generally, the larger the noise the stronger the response. To find e edges, look for peaks in d/dx(f\*g) = f\*d/dx(g). (g is gaussian smoothing. d/dx(g) is derivative of gaussian filter) But there are trade-off between smoothing and localization. Because smoothed derivative removes noise, but blurs edges. It makes hard to find precise region of edges. And also, sobel operators approximate the derivative of Gaussian filter in a simple form. There are many ways like Laplacian, Laplacian of Gaussian.

The most popular method for edge detection is Canny Edge Detector. There are three criteria for edge detection. They are low error rate of detection, localization of edges and single response. In Canny Edge Detector, there are 3 steps. Image Gradient using low-pass & High-pass filters, Non-maximum suppression and double thresholding.

* Corner Detector

Corner are interest points that can used for image alignment, motion tracking and object recognition and etc. Corner Detection’s basic idea is that Shifting a window in any direction should give a large change in intensity.

Corner Response function can be expressed using determinant and trace of the second matrix moment matrix. If response function R is R>0, it will be corner. But it is smaller than 0, it will be edge. In the eigen vector’s view, if two eigen vector of M is both bigger than threshold, it will be corner.

In summary, Compute M matrix for each window to get their cornerness scores. And then find points whose surrounding window gave large corner response (R> threshold). Finally, take the points of local maxima.