HW6 Report

Computer Vision
Section 02
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- **HW 6**
  - **Sobel Operator**

Sobel operator is computing the gradient magnitude of the input image using 3x3 filters. gradient magnitude is a number giving the absolute value of the rate of change in light intensity in the direction that maximizes this number for each a pixel.

Sobel

$$M(x,y) = mag(\nabla f) = \sqrt{g_x^2 + g_y^2} \approx |g_x| + |g_y|$$

  - **Canny Edge Detector**

Canny edge detection goes a bit further by removing noise with a low pass filter first (Gaussian filter), and then applying a sobel filter, doing non-maximum suppression to pick out the best pixel for edges

Algorithm
  1. Noise Reduction

The noise in the image makes difficult to find edge. Therefore, smooth the image using Gaussian filter

  2. Compute the Gradient magnitude and angle images

The gradient in each direction is obtained by applying the image horizontally and vertically using a Sobel mask. horizontally gradient is Gx, vertically gradient is Gy.

  3. Apply nonmaxima suppression to the gradient magnitude image

Find the direction d_k that is closest to a(x,y) (a: gradient direction)
If the value M(x,y) is less than at least one of its two neighbors along d_k, suppress it(set to zero)

  4. Use double thresholding and connectivity analysis to detect and link edges

- $M(x,y) \geq T_H$ ← edge
- $M(x,y) < T_L$ ← non-edge
- Otherwise ← undetermined, use connectivity analysis