

# Sobel Edge Detection

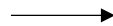
이진영



# Sobel Filter

- A pair of 3×3 convolution filter for calculation of gradient magnitude
- Separate calculation of gradient component in horizontal and vertical directions

-1	0	1
-2	0	2
-1	0	1



1
2
1

-1	0	1
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-1	-2	-1
0	0	0
1	2	1



1	2	1
---	---	---

-1
0
1

Sobel Filter

Weight

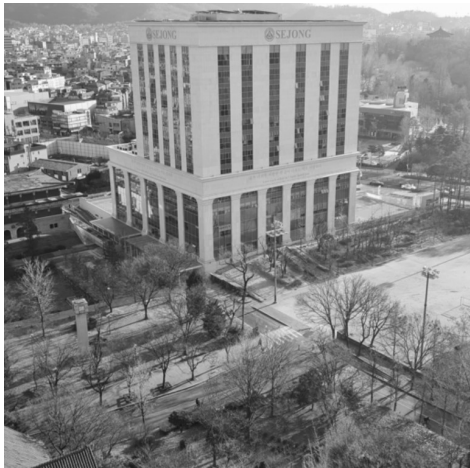
Derivative



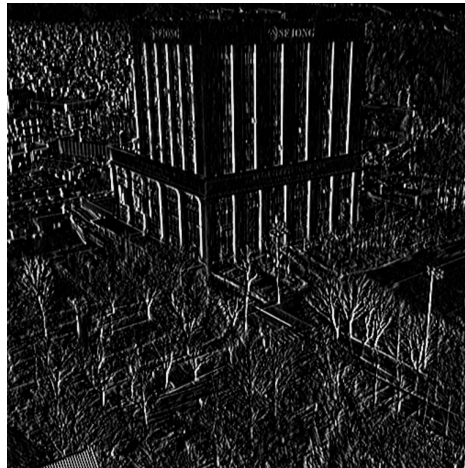
# Experiment

- Edge detection based on Sobel filter
- Edge image using  $G_x$  and  $G_y$

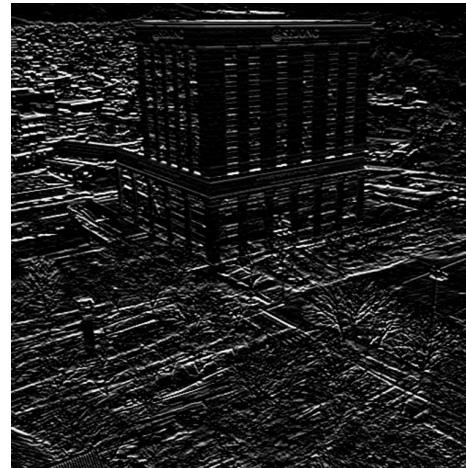
$$\|\nabla f\| = \sqrt{G_x^2 + G_y^2} = \sqrt{\left(\frac{\partial f}{\partial x}\right)^2 + \left(\frac{\partial f}{\partial y}\right)^2}$$



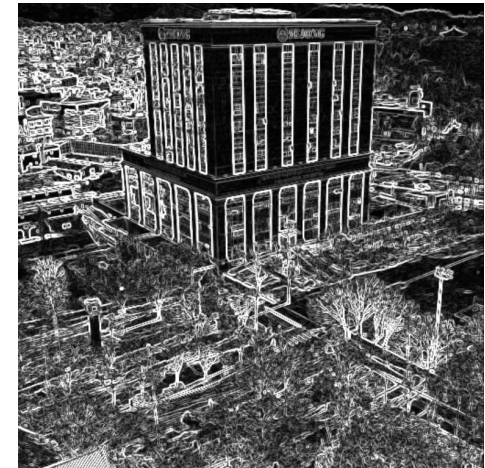
AICenterY.bmp



$G_x$  Image



$G_y$  Image



Edge Image



```
double G = sqrt(Gx * Gx + Gy * Gy);  
Y3[j * width + i] = (unsigned char)(G > 255 ? 255 : (G < 0 ? 0 : G));
```

# Prewitt Filter

- Similar to Sobel edge detector, except for filter coefficients
- No emphasis on neighboring pixels that are closer to a center pixel (Equal weight)

-1	0	1
-1	0	1
-1	0	1

-1	-1	-1
0	0	0
1	1	1

Prewitt Filter



# Roberts Filter

- Simplest edge detection filter (Lower complexity than Sobel and Prewitt filtering)
- Emphasis on intensity change in a diagonal direction
- Inaccurate edge detection in noisy images

-1	0
0	1

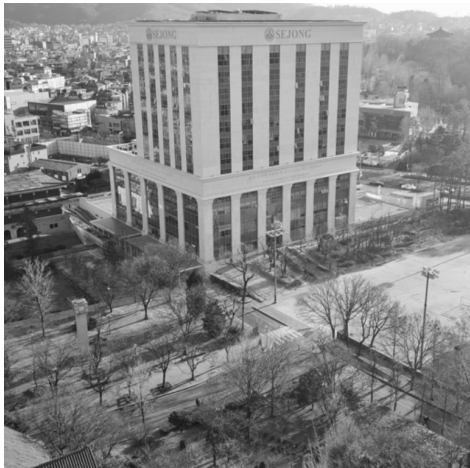
0	-1
1	0

Roberts Filter

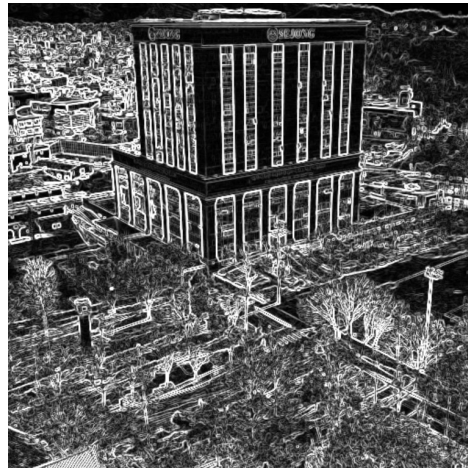


# Experiment

- Comparison of edge images achieved from Sobel, Prewitt, and Roberts filters
- Edge images representing gradient magnitude calculated by each filtering



AlCenterY.bmp



Sobel



Prewitt



Roberts



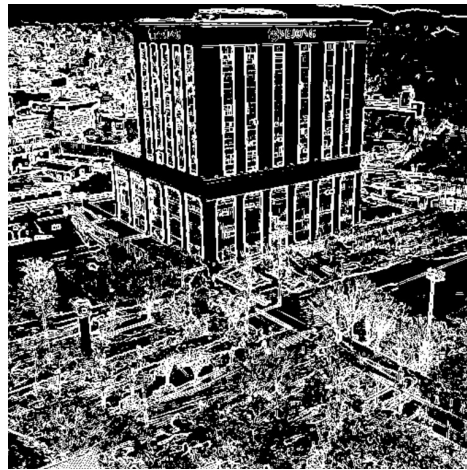


# Thresholding

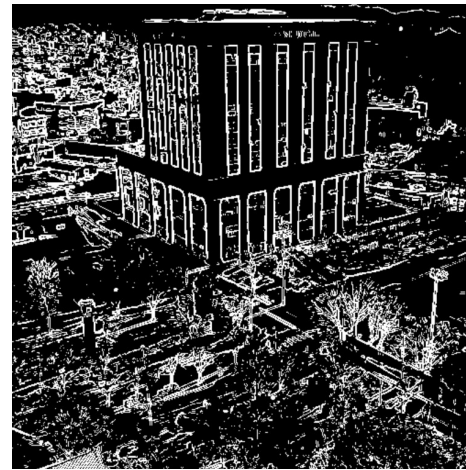
- Comparing gradient magnitude with a predefined threshold to determine edges
- More edges with low thresholds, but less edges with high thresholds



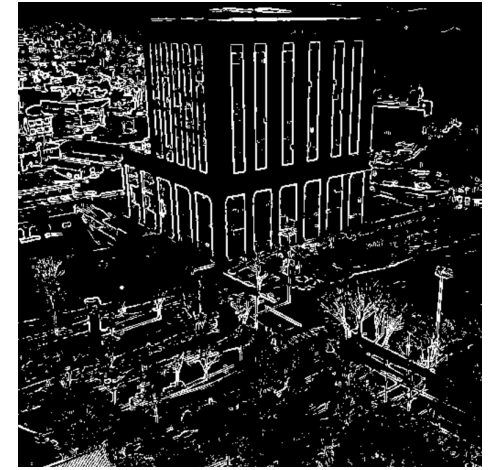
Gradient Magnitude



Threshold=100



Threshold=150



Threshold=200

Sobel



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