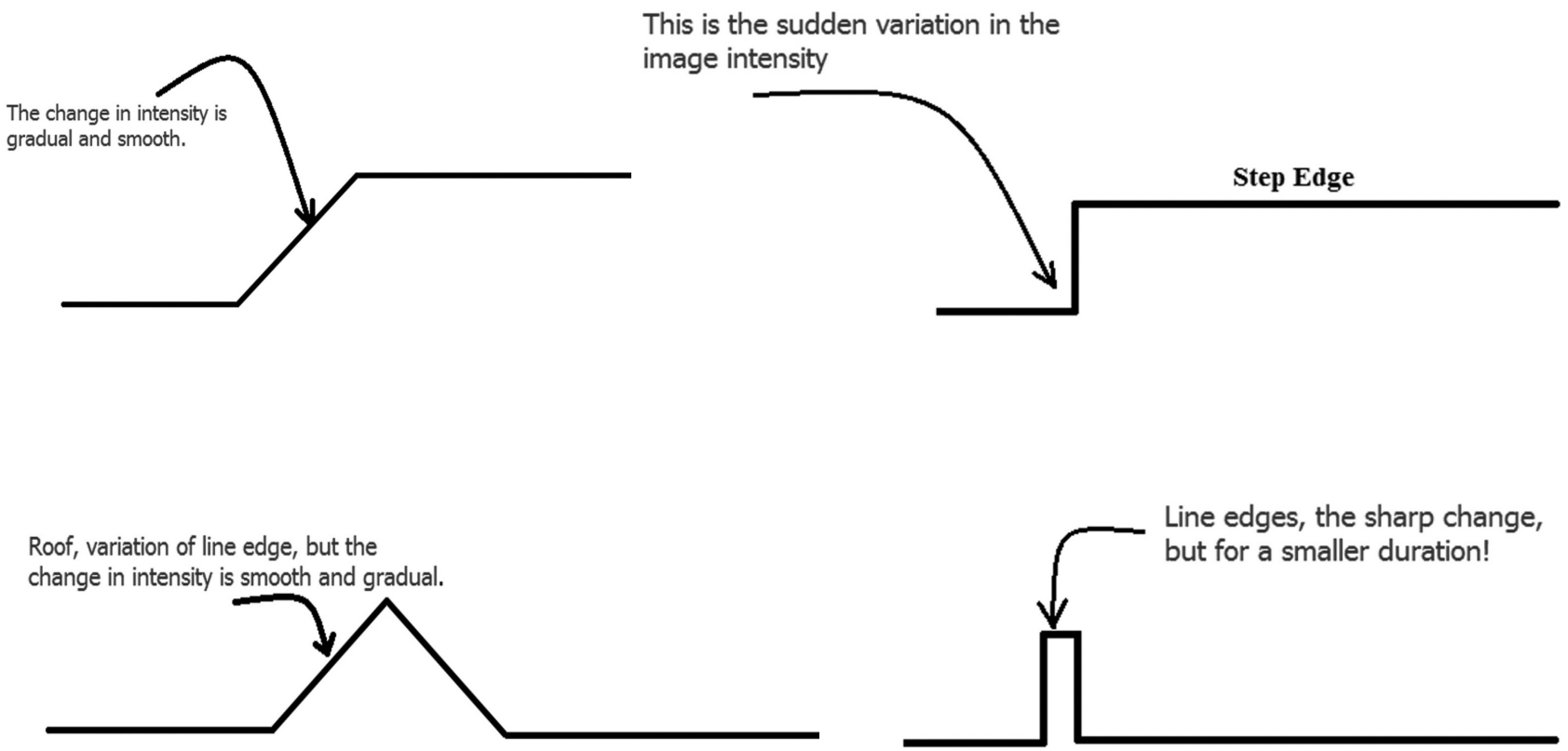
Lecture 7
Edge Detection

ECE 1390/2390

Types of edges



Sobel filter

Low-pass filter

High-pass filter

$$\begin{bmatrix} 1 \\ 2 \\ 1 \end{bmatrix} * \begin{bmatrix} 1 & 0 & -1 \end{bmatrix} = \begin{bmatrix} 1 & 0 & -1 \\ 2 & 0 & -2 \\ 1 & 0 & -1 \end{bmatrix}$$

1D Gaussian Filter

x - Derivative

Sobel - X

$$\begin{bmatrix} 1 \\ 0 \\ -1 \end{bmatrix} * \begin{bmatrix} 1 & 2 & 1 \end{bmatrix} = \begin{bmatrix} -1 & -2 & -1 \\ 0 & 0 & 0 \\ 1 & 2 & 1 \end{bmatrix}$$

y - Derivative

1D Gaussian Filter

Sobel - Y

$$G = \sqrt{G_X{}^2 + G_Y{}^2}$$

Prewitt filter

Mean
smooth filter

$$\begin{bmatrix}1\\1\\1\end{bmatrix} \otimes [1 \quad 0 \quad -1]$$

High-pass
filter

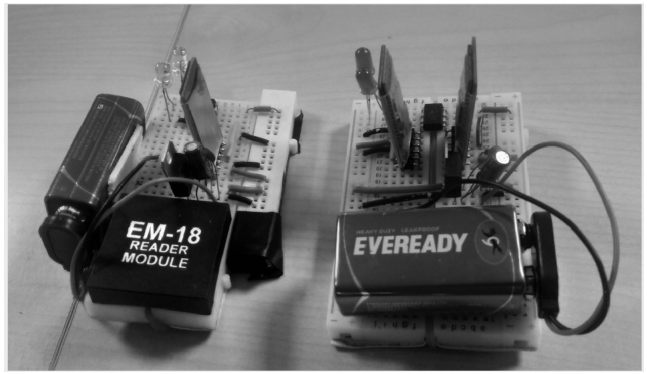
$$\begin{vmatrix}1 & 0 & -1\\1 & 0 & -1\\1 & 0 & -1\end{vmatrix}$$

Prewitt – X

$$\begin{bmatrix}-1\\0\\1\end{bmatrix} \otimes [1 \quad 1 \quad 1]$$

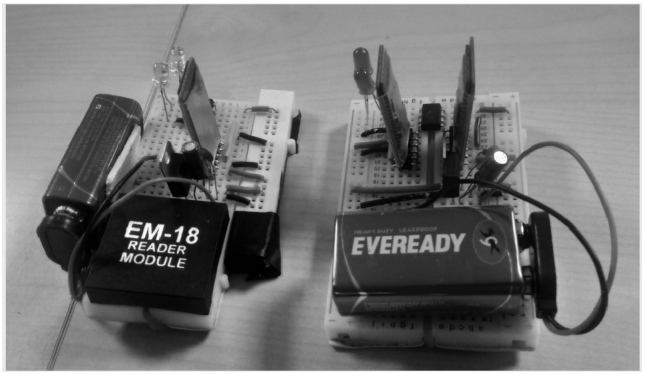
$$\begin{vmatrix}-1 & -1 & -1\\0 & 0 & 0\\1 & 1 & 1\end{vmatrix}$$

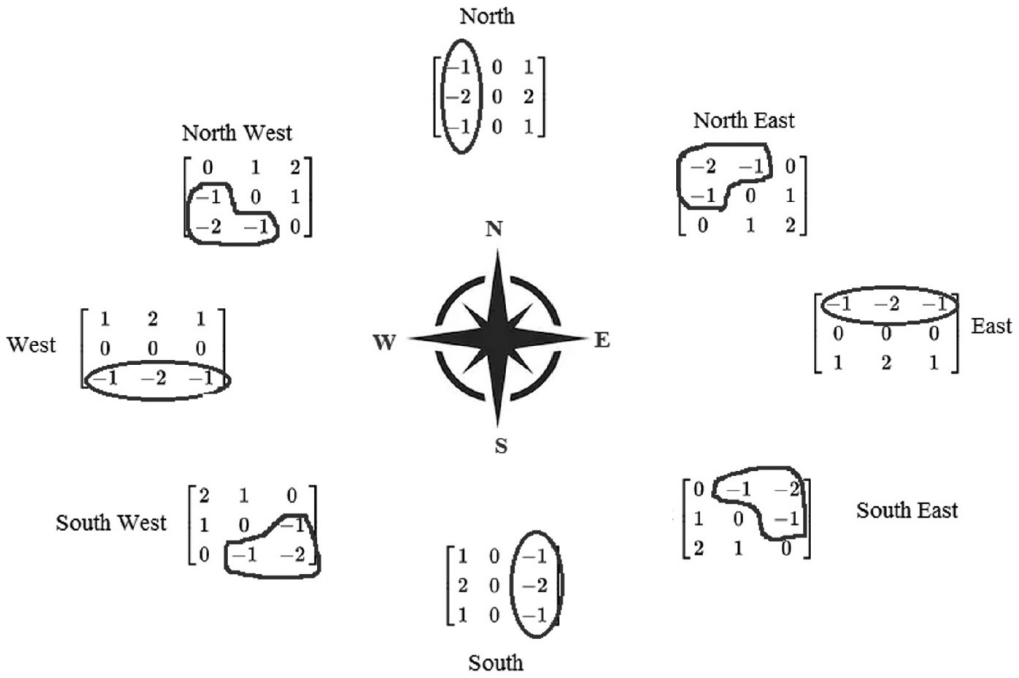
Prewitt – Y



$$G = \sqrt{G_X{}^2 + G_Y{}^2}$$

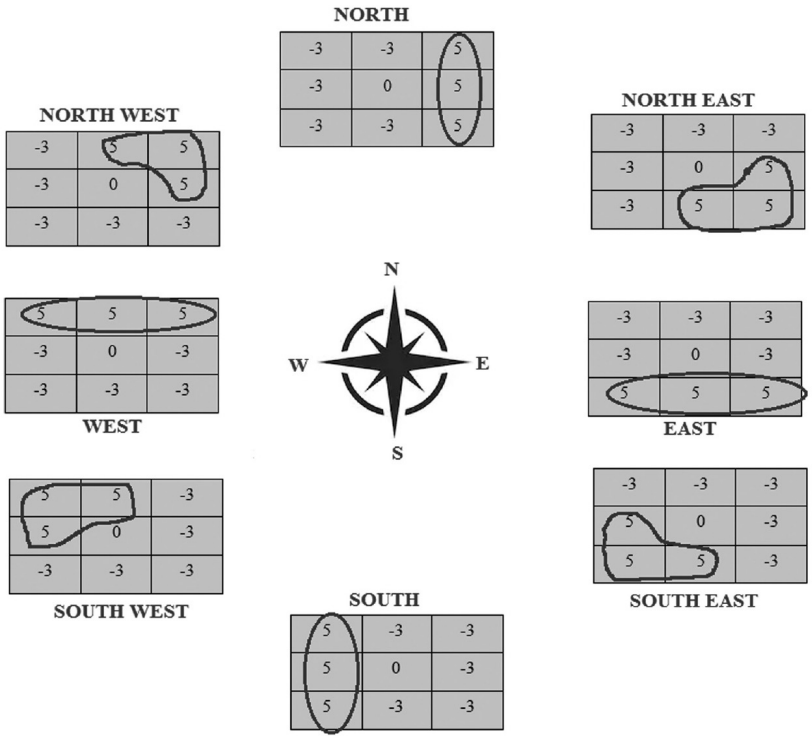
Robinson filter

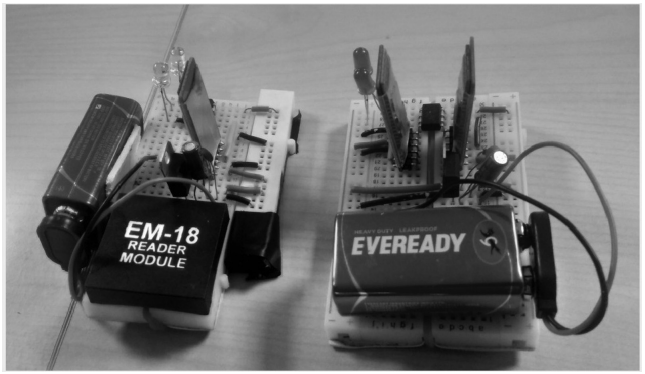


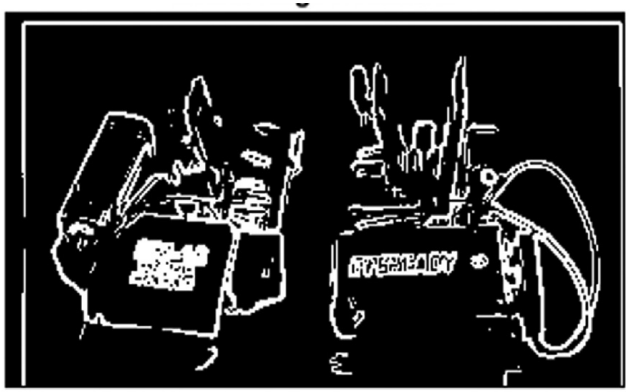


$$G = \sqrt{\sum_{i=1}^{8} G_i^2}$$

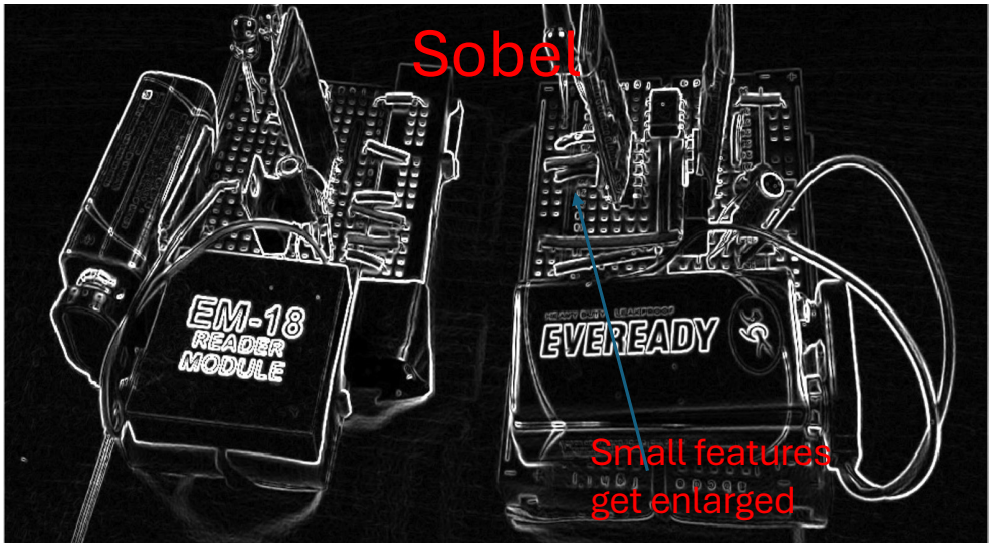
Kirsch Edge Filter





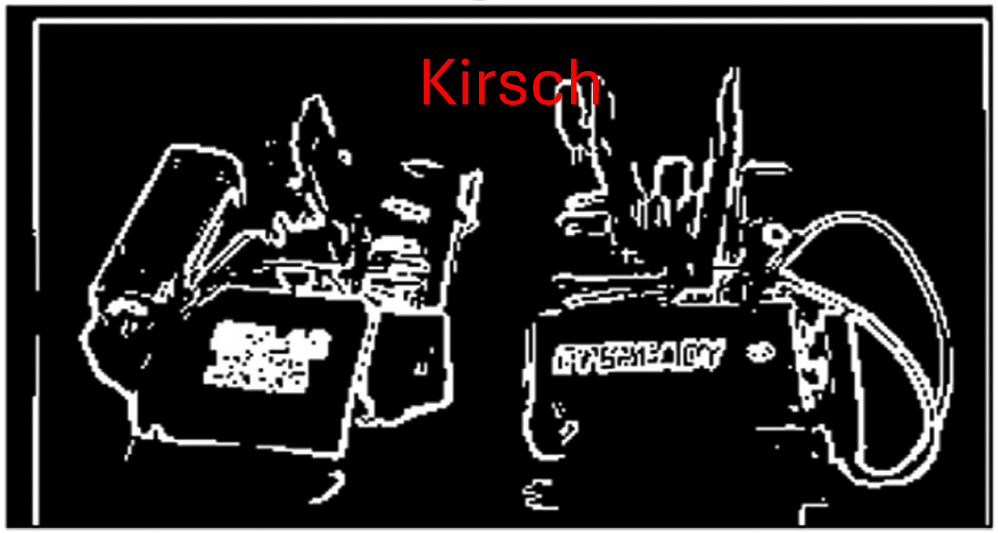


$$G = \sqrt{\sum_{i=1}^{8} G_i^2}$$


Sobel
EM-18
READER
MODULE
EVEREADY
Small features
get enlarged


Prewitt
EM-18
READER
MODULE
EVEREADY


Robinson

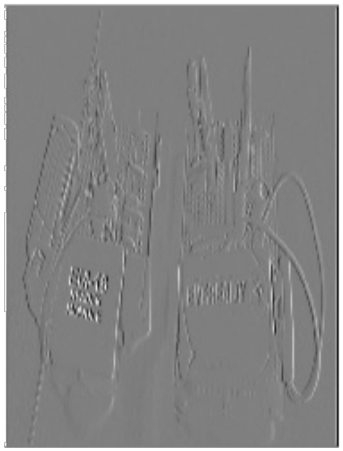

Kirsch

Cany filter

Greyscale image

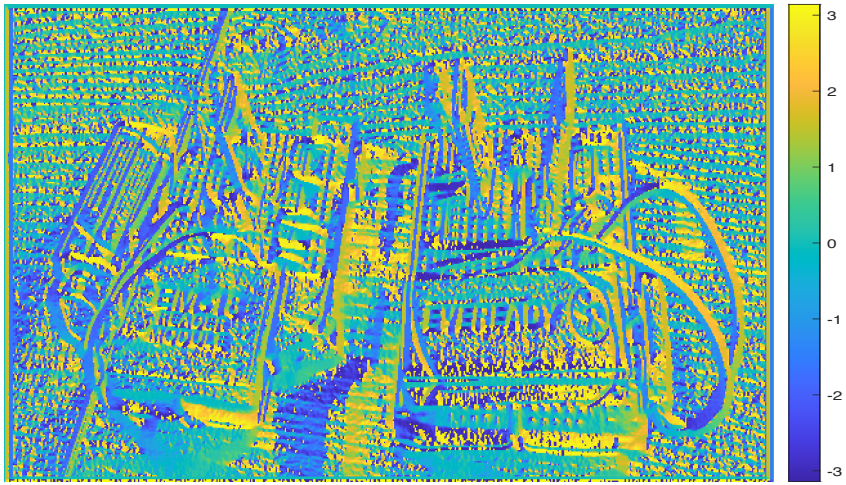
Gaussian Blur

Sobel filter



$$\sqrt{edgeX^2 + edgeY^2}$$

$$\theta = \tan^{-1}\left(\frac{edgeX}{edgeY}\right)$$



Laplace (2nd derivative)