Convolution Kernels with Output Images

Identity Kernel

$$\begin{bmatrix} 0 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 0 \end{bmatrix}$$

Figure 1: Filtered Image with Identity Kernel

Sharpen

$$\begin{bmatrix} 0 & -1 & 0 \\ -1 & 5 & -1 \\ 0 & -1 & 0 \end{bmatrix}$$

Figure 2: Filtered Image with Sharpen Kernel

Box Blur

$$\frac{1}{9}\begin{bmatrix}1 & 1 & 1\\ 1 & 1 & 1\\ 1 & 1 & 1\end{bmatrix}$$

Figure 3: Filtered Image with Box Blur

Gaussian Blur

$$\frac{1}{16}\begin{bmatrix}1 & 2 & 1\\ 2 & 4 & 2\\ 1 & 2 & 1\end{bmatrix}$$

Figure 4: Filtered Image with Gaussian Blur

Edge Detection (Horizontal)

$$\begin{bmatrix} -1 & -1 & -1 \\ 2 & 2 & 2 \\ -1 & -1 & -1 \end{bmatrix}$$

Figure 5: Filtered Image with Horizontal Edge Detection

Edge Detection (Vertical)

$$\begin{bmatrix} -1 & 2 & -1 \\ -1 & 2 & -1 \\ -1 & 2 & -1 \end{bmatrix}$$

Figure 6: Filtered Image with Vertical Edge Detection

Sobel (Horizontal)

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

Figure 7: Filtered Image with Sobel (Horizontal) Kernel

Sobel (Vertical)

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

Figure 8: Filtered Image with Sobel (Vertical) Kernel

Prewitt (Horizontal)

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

Figure 9: Filtered Image with Prewitt (Horizontal) Kernel

Prewitt (Vertical)

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

Figure 10: Filtered Image with Prewitt (Vertical) Kernel

Scharr (Horizontal)

$$\begin{bmatrix} -3 & 0 & 3 \\ -10 & 0 & 10 \\ -3 & 0 & 3 \end{bmatrix}$$

Figure 11: Filtered Image with Scharr (Horizontal) Kernel

Scharr (Vertical)

$$\begin{bmatrix} -3 & -10 & -3 \\ 0 & 0 & 0 \\ 3 & 10 & 3 \end{bmatrix}$$

Figure 12: Filtered Image with Scharr (Vertical) Kernel

Kirsch Kernel (North)

$$\begin{bmatrix} 5 & 5 & 5 \\ -3 & 0 & -3 \\ -3 & -3 & -3 \end{bmatrix}$$

Figure 13: Filtered Image with Kirsch North Kernel

Kirsch Kernel (East)

$$\begin{bmatrix} -3 & -3 & 5 \\ -3 & 0 & 5 \\ -3 & -3 & 5 \end{bmatrix}$$

Figure 14: Filtered Image with Kirsch East Kernel

Kirsch Maximum Response (All Directions)

$$\max\left\{\begin{bmatrix}5&5&5\\-3&0&-3\\-3&-3&-3\end{bmatrix},\begin{bmatrix}-3&5&5\\-3&0&5\\-3&-3&-3\end{bmatrix}\begin{bmatrix}-3&-3&5\\-3&0&5\\-3&-3&5\end{bmatrix},\begin{bmatrix}-3&-3&-3\\-3&0&5\\-3&5&5\end{bmatrix},\right.$$
$$\left.\begin{bmatrix}-3&-3&-3\\-3&0&-3\\5&5&5\end{bmatrix},\begin{bmatrix}-3&-3&-3\\5&0&-3\\5&5&-3\end{bmatrix},\begin{bmatrix}5&-3&-3\\5&0&-3\\5&-3&-3\end{bmatrix},\begin{bmatrix}5&5&-3\\5&0&-3\\-3&-3&-3\end{bmatrix}\right\}$$

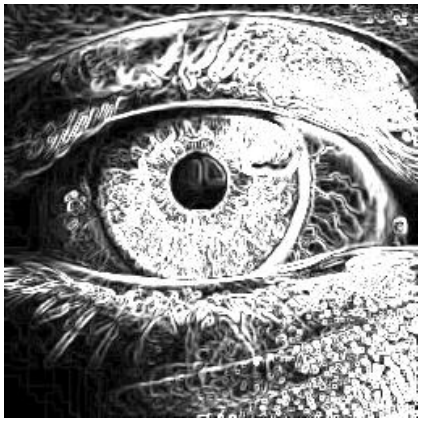

Figure 15: Filtered Image with Kirsch Maximum Response

Laplacian Kernel

$$\begin{bmatrix}0&-1&0\\-1&4&-1\\0&-1&0\end{bmatrix}$$

Figure 16: Filtered Image with Laplacian Kernel

Figure 17: Filtered Image with Difference of Gaussians

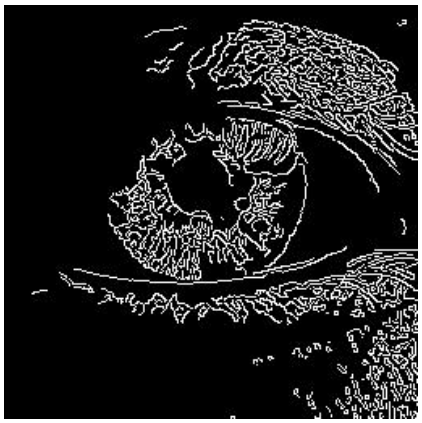

Figure 18: Filtered Image with Canny Edge Detection

Custom

$$\begin{bmatrix} 5 & -3 & 5 \\ -3 & -7 & -3 \\ 5 & -3 & 5 \end{bmatrix}$$

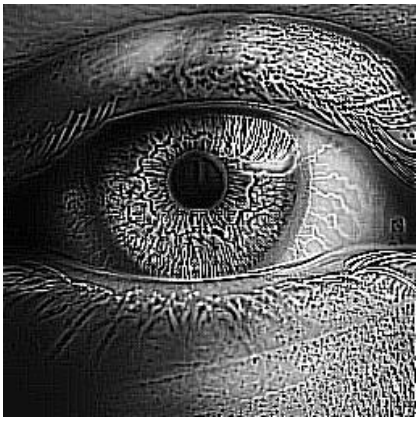

Figure 19: Filtered Image with Custom Kernel