Assignment 3

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CS 4442B

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Problem 1. Separable Convolution (20%)

1.

- deals with spatial dimensions of an image/kernel (width and height)
- divides in two, smaller kernels ($3\times3 \rightarrow [1\times3]\begin{bmatrix}1\\x\\3\end{bmatrix}$)

$$\begin{bmatrix}9 & 45 & 90\\8 & 40 & 80\\7 & 35 & 70\end{bmatrix} = \begin{bmatrix}9\\8\\7\end{bmatrix} \times \begin{bmatrix}1 & 5 & 10\end{bmatrix}$$

Simple vs Spatial Seperable

- Simple

  img → convolution w/ 3x3 matrix → output img

- S.S.

  img $\xrightarrow{\text{convolution by } 1\times3}$ int img $\xrightarrow{\text{convolution by } 3\times1}$ final img

- The sobel kernel is spatially separable

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

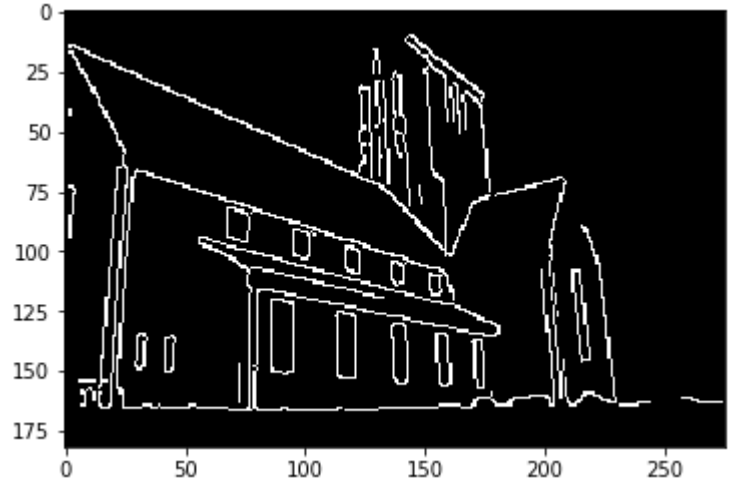
Seperable convolutions are preferred because:

- have fewer parameters than "regular" convolutional layers, and in turn less prone to overfitting
- require less operations to compute due to their lower parameters. Therefor, cheaper and faster.

Problem 2. Edge Detection (50%)

Greyscale:

Output:



Problem 3. Corner Detection (30%)

Output: