Convolutional Neural Networks I

COSC 410: Applied Machine Learning
Fall 2025
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Warm-up

1. It's spooky season. Discuss with your neighbor a fun idea for a Halloween costume.
2. What do the pixel values 0 and 255 mean in a black and white image (you probably have to google this, that's totally fine)?

Logistics

- Codelet 4 on Feed-Forward Neural Networks, due Friday Oct 31
- Codelet 5 will be released tomorrow Friday Oct 31 (due Nov 7)

Learning Objectives

- Understand and apply the core components of a CNN
  - Convolution
  - Detector
  - Pooling
- Describe the basic architecture of a CNN

Summary: We lay out the basic components of a convolutional neural network, grounding it in a tiny example. We conclude by looking at the basic components of a CNN architecture for classification.

Practice

Practice Problems

1. What is the result of convolving the image with the kernel below:

$$\text{Image} = \begin{bmatrix} 1 & 3 & 4 & 6 \\ 2 & 0 & 1 & 5 \\ 3 & 1 & 2 & 4 \end{bmatrix}$$

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

2. Apply a 2D Max pooling kernel with shape 2×2 and a stride of 2 to the following image:

$$\text{Image} = \begin{bmatrix} 2 & 100 & 40 & 20 \\ 30 & 50 & 60 & 90 \\ 11 & 233 & 34 & 12 \\ 32 & 60 & 76 & 12 \end{bmatrix}$$

Before Next Class

- Reading and pre-class quiz
- Finish Codelet 4
- Review/Work on Codelet 5