Week 6

Synthesis Questions

Convolution

- What is the name for the smaller grid that convolves over a larger image?
  - Kernel
- What are some examples of what you can do to images if you convolve them with special matrices?
  - Blur, edge detection and image sharpening
- How does Gaussian blur "work"?
  - Having a kernel with values sample from a Gaussian distribution where the center pixel has the highest weight and the edge pixels have the lowest weight. This way the pixel with be blurred.
- What is the name for the actual operation that occurs when the smaller grid is overlaid on the larger one?
  - Convolution
- Give an example of a 3x3 matrix that would not do anything to the image it convolves over. Why does it not impact the image?
  - A matrix with 1 in the center and eight 0s surrounding it. With that kernel, the pixel will be preserved and surrounding pixels will have no effect on the result since their weight is 0.

CNN

- The architecture of a CNN is loosely based on what part of the brain?
  - Connectivity pattern of neurons in the human brain and inspired by the organization of the visual cortex.
- What is stride length?
  - The step size of kernels iterating over the image. Default is 1.
- What is padding?
  - Additional 0 pixels added to surround the image.
- Why is padding useful?
  - Useful to control the dimensionality of the convolved feature.
- What is the objective of the convolutional layer in a CNN?
  - To extract features like edges, color, and gradient orientation from images.
- What is the purpose of the pooling layer in a CNN?
  - Decrease the computational power required to process data through dimensionality reduction.
- What are the two ways to pool shown to you in the article?
  - Max pooling and average pooling.
- What is flattening and when is it done in a CNN?
  - Taking a multidimensional matrix and converting it into a column vector. Usually done in the end to feed the output into regular neural networks.

- What is the purpose of the feedforward layer in a CNN?
  - To allow for back propagation and learning based on softmax classification.
- How do the convolutional layers before the feedforward layer in a CNN allow for higher accuracy?
  - Unlike traditional layers, convolutional layers are able to capture the spatial and temporal dependencies in an image, which can be fed into a neural network to train on.