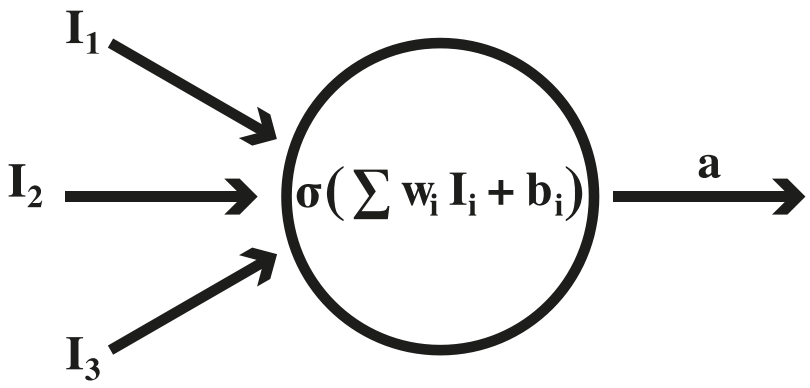
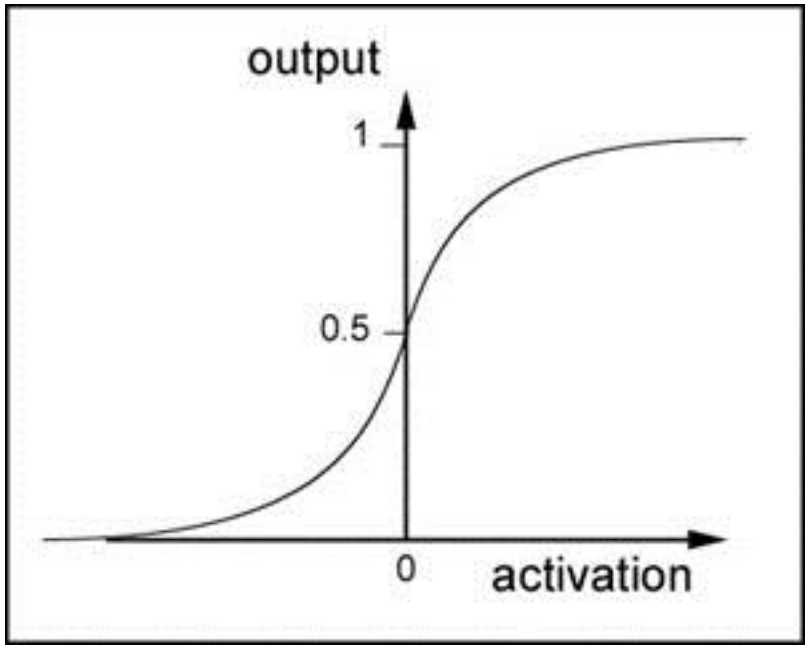
Deep Neural Networks

A very brief introduction that really only conveys some important concepts and keywords you can look up later, if you wish

What is a Neuron?

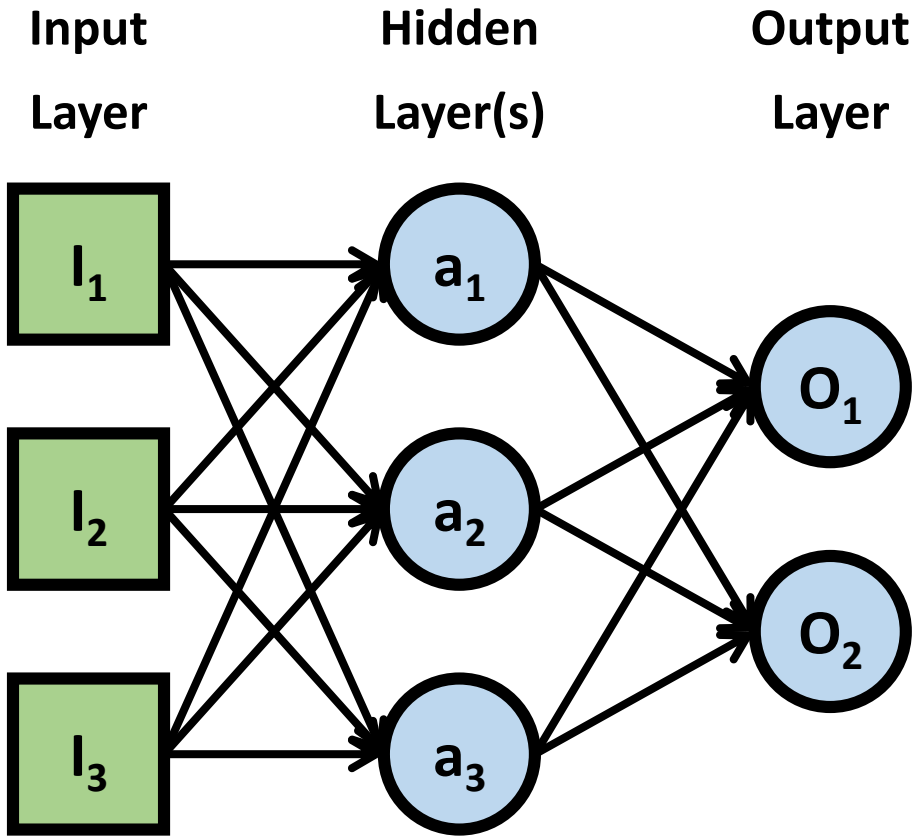


- Linear combination of inputs followed by a nonlinear "activation function"



$$\sigma(x) = \frac{1}{1+e^{x}}$$

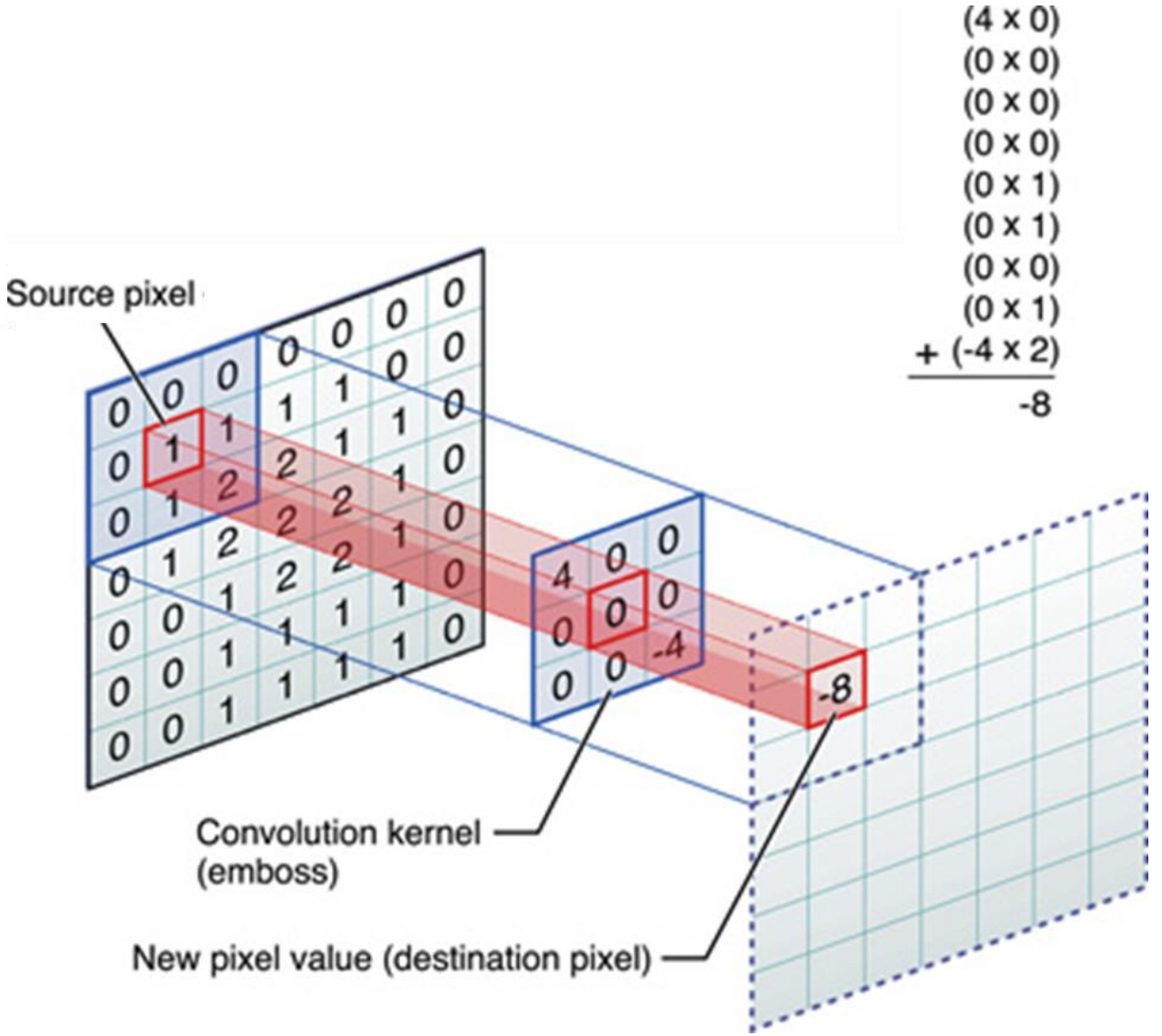
Fully Connected Neural Networks (FC)



- Consist of multiple “layers” of neurons
- Each input node connected to every subsequent layer’s node
- Arbitrary number of hidden layers and layer size

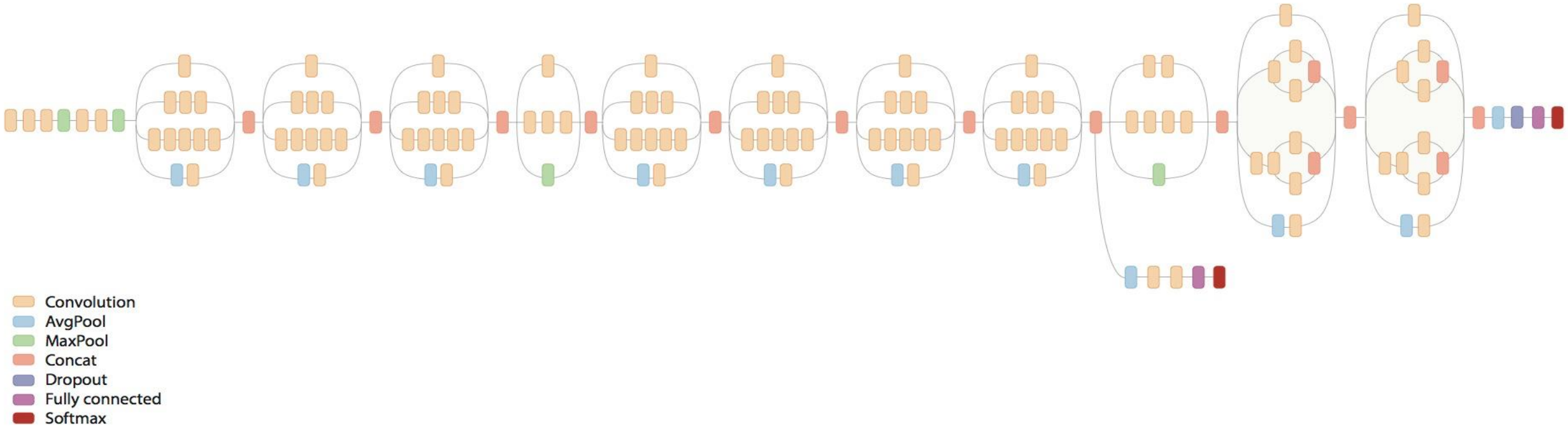
Convolutional Neural Networks (CNN)

- Each layer consists of kernels (i.e. image filters) that are applied to every input pixel and its neighbours
  - Activation function is applied to every output pixel afterwards
- Drastically reduces the number of parameters and operations in a NN
  - 2450 (FC) vs. 9 (CNN)

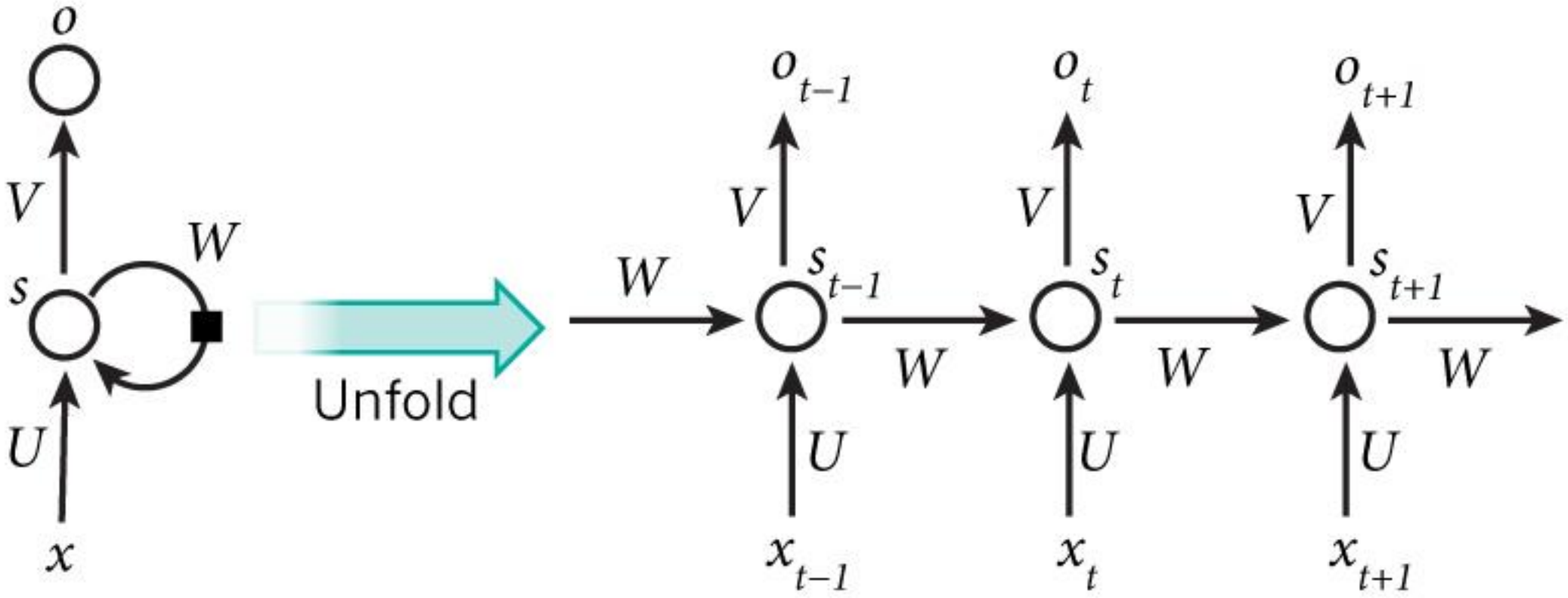


“State of the Art” Image Classification Architectures

- E.g. Google “Inception” (approx. 5 million parameters)



Recurrent Neural Networks (RNN)



- Allow connections to all nodes, not just subsequent layers
  - Permits “memory” of past events
- E.g. Natural language processing, sequential data

Training Neural Networks

- Initialize parameters of NN (usually random)
- Compare actual output with expected output of training data
  - **Backpropagation** to determine weights for expected output
  - **Stochastic Gradient Descent** to determine how weights must change