

Multilayer Perceptrons

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Chapter 1

The Basics of Multilayer Perceptrons

A **multilayer perceptron** (otherwise known as a *neural network*) is a set of nodes called **neurons**, each containing an activation – a number – which designates how active that specific neuron is.

This is loosely analogous to how our brains work, where each of our neurons can fire to send an electrical signal which, somewhere down the chain, might move our arm or let us perceive the smell of some food.

The usual image that people associate with neural networks is the following:

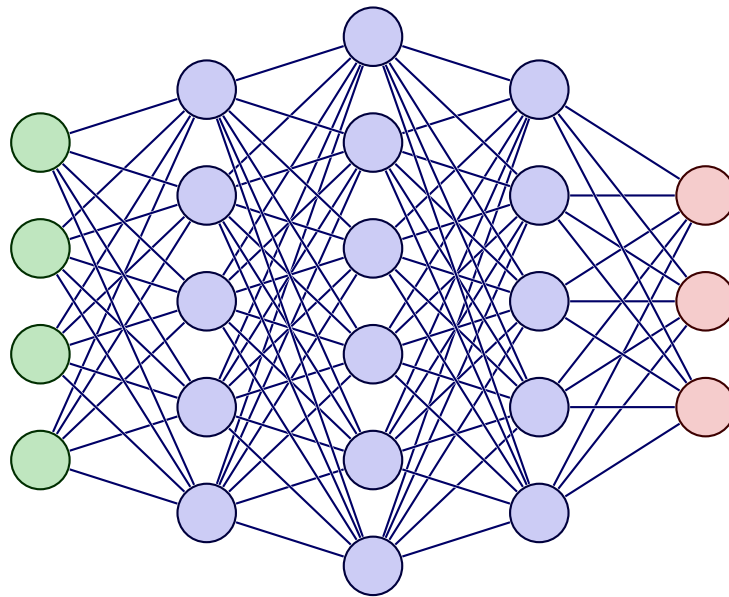


Figure 1.1: A simple neural network.

Figure 1.1 shows the structure of a neural network. At its core, a neural network has an **input layer** (colored in green), analogous to some sensory input such as our eyes capturing the light around us, an **output layer** (colored in red), analogous to the output of our vision, which is a colored image of our environment, and then some “hidden layers,” which are basically the meat of the network and encode everything about how the inputs and corresponding outputs are related to one another.

The actual math behind these networks is surprisingly simple. Let's focus in on a single connection for now:

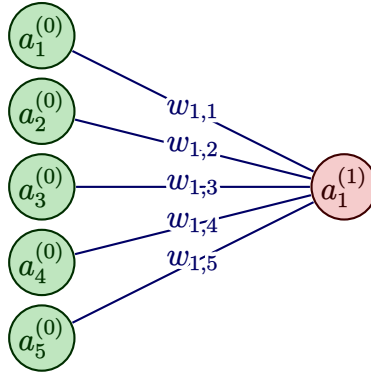


Figure 1.2: The activation of two neurons and the weight between them.

Let's decypher these symbols one-by-one:

- $a_n^{(0)}$: The activations of the nodes within the first layer.
- $w_{1,n}$: The **weights** between each of the connection. Essentially, this encodes how strongly connected the neurons are.
- $a_1^{(1)}$: The output activation.