Computer Science Write up

What is a neural network?

A neural network is a graph with weighted connections, each edge having a set value that will impact the output that can be either positive or negative. It is composed of a network of neurons or nodes, each having an activation; which we can visualise as how bright the neuron is, this activation is between 0 and 1, and a bias that determines how likely the neuron will swing to each side. Its purpose is to spot patterns in data and use this information to make predictions about similar data.

We start a neural network by setting the activation of the input layer to the inputs chosen, this might be the RGB values of an image or just raw data. The neurons in the next layer then calculate their own activation using these new inputs and so on until the last layer where the outputs of those neurons are the answer the neural network gives. This is the feed forward algorithm. The idea that all the previous neurons impacts the next one, means that just as in brains neurons could strengthen connections with some and reduce connections with others by simply changing the value of the weight that connects them.

The idea with the neural network is to change the weights and biases to certain values that accurately represents the best connections they could have to provide a good answer to inputs given. This is accomplished by training a neural network on a large dataset, for example greyscale images, with corresponding labels or correct answers and calculating how wrong the neural network is (the cost function) at each datapoint and using this information to change the weights and biases to better and more accurate numbers. This is called the back-propagation algorithm.

The feed forward algorithm

The feed forward algorithm is how the neural network comes up with a answer in the first place. It is a very simple algorithm. It consists of each node in subsequent layers calculating their activation like so:

Notation

The superscript refers to the layer it is in and the subscript refers to the node in the layer.

e.g.

We just repeat this equation for each node in the subsequent layer until we end up with a activation for the output nodes.