Hebbian Learning – “Neurons that fire together, wire together”

Simplest Neural Network

*Anatomy*

Two layers (Input and Output) form a complete bipartite graph with weighted edges

Each neuron in the input layer connects to every neuron in the output layer (vice-versa)

No neuron in the input layer connects to another neuron in the input layer

The activity of the output layer is completely determined by the activity of the input layer

Text

Description automatically generated*Computations*

Output neuron’s activation = sum of the product of each input neuron’s activation and run through the activation function. Here the bias is treated as an input neuron and the output neuron is active if the weighted sum of the activations of input neurons can overcome the bias beta.

*Inputs*

* The biological equivalent would be activations of sensory neurons
  + Sight – Photosensitive Rods and cones that make up the retina
  + Sound – Two types of hair cells in the cochlea
    - Afferent inner ear cells – carry sound information to the brain
    - Efferent outer ear cells – capable of producing sound contracting basilar membrane to improve how much sound we hear
  + Taste – gustatory neurons on tongue responsive to presence of chemicals
* Voxels – the activity of volume elements in fMRI

*Matrix multiplication*

* Start: We can represent input by a 1 x M array (matrix)
* End: We want our output array to be a 1 x N array (matrix)
* To transform our inputs to outputs, we use a weight matrix, M x N array

In matrix multiplication, A x B the xij entry corresponds to:

Multiplying the ith row of A

By the jth column of B