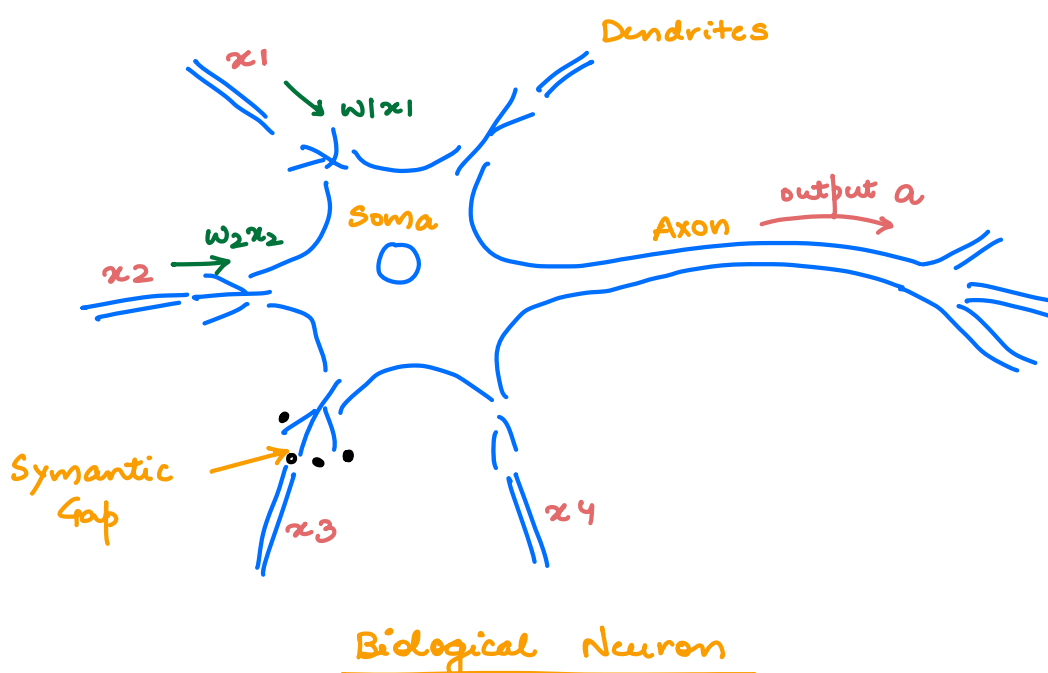


In this lecture we will understand how the idea of neural networks is inspired from working of human brain. We will also talk about similarities b/w a biological neuron and an artificial neuron.

Neuron is the basic unit of a neural network. We will be building a network which will do various tasks like predicting language, language modelling, classifying images. Google Allo, Alexa all use deep learning which is based on neural network.

Firstly let's understand how a neural network is related to a biological neuron.



- In brain you have collection of neurons and each neuron looks like this and you have **dendrites** which brings

input from other neurons to current neuron. Let's say each dendrite is bringing input x_1, x_2, x_3 and x_4 .

- This input goes to the processing unit called as **Soma**, here neuron does some processing of the information.
- In b/w there is **Synaptic gap** which basically modifies the signals. Signals are basically in the form of electrical and chemical impulses. Let's say the original input was x_1 but the input which goes to Soma will be $w_1 x_1$ (i.e. weighted input). Soma will calculate sum of all inputs $z = \sum w_i x_i$
- Some neurons will fire and some won't. Firing of neurons depends on activation function. When $z = \sum w_i x_i >$ threshold value then we can say neuron will fire.

output is denoted by a

$$z = w_i x_i$$

$$a = g(z)$$

g is a threshold $f(x)$ which is also called as activation $f(x)$.

If z is greater than some threshold then neuron is going to fire otherwise neuron will not fire. In practice g can be a sigmoid $f(x)$ but nowadays we use very interesting $f(x)$ called as ReLU (Rectified Linear Unit)

$$g(z) = \begin{cases} z & z \geq 0 \\ 0 & z < 0 \end{cases}$$

Neuron fires
Neuron Doesn't fire

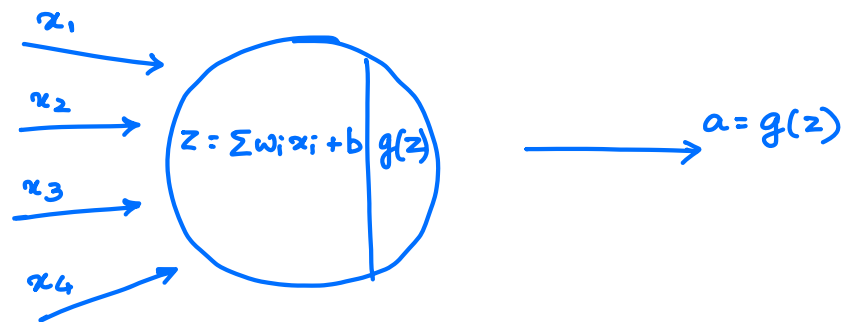
We should add a bias term to z . $z = w_i x_i + b$

If we want that a neuron should fire when the value is -10 , we will keep bias as $+10$.

$$z = \underbrace{w_i x_i}_{-10} + \underbrace{b}_{+10}$$

0

Even if $w_i x_i$ is -10 , still neuron will fire.



Artificial Neuron

w_i is the weight that we will learn using algo like Gradient Descent. This is very similar to Logistic Regression if your activation $f(x)$ is a sigmoid $f(x)$.

Resemblance b/w Biological and Artificial Neuron:

Biological	Artificial
Dendrites	Inputs

Synaptic Gap

Axon

Soma

weights

output

Activation