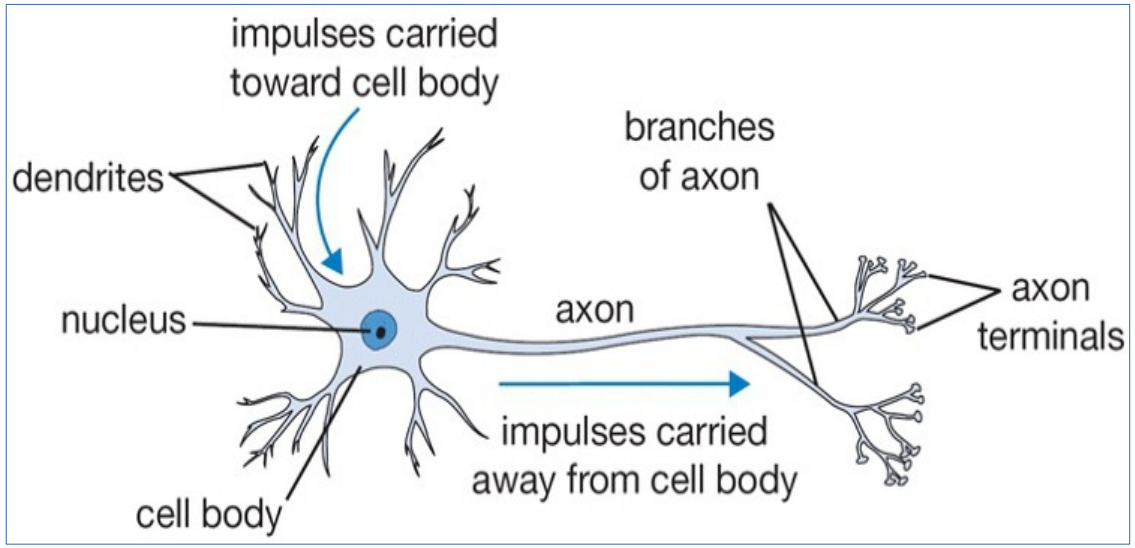
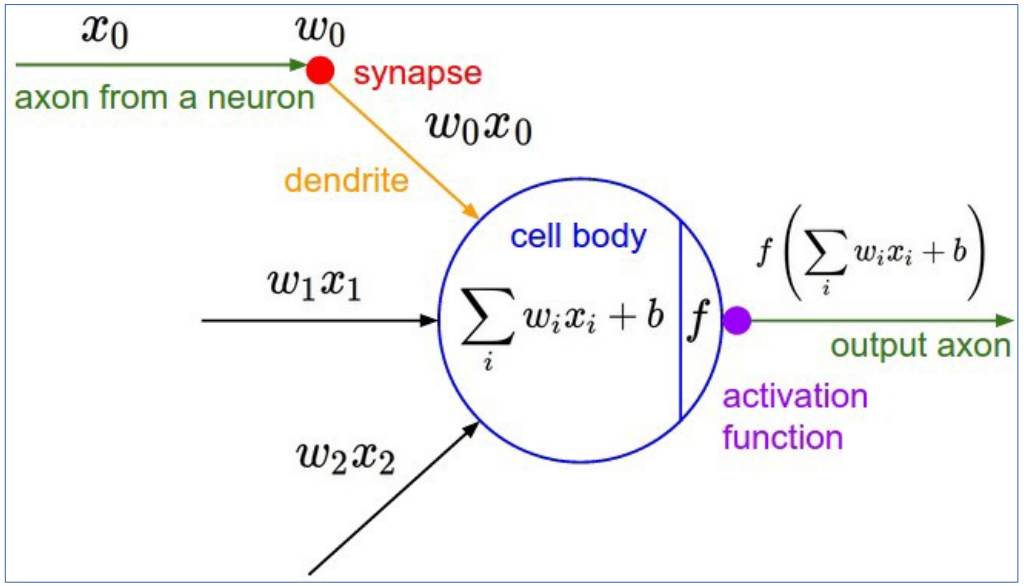
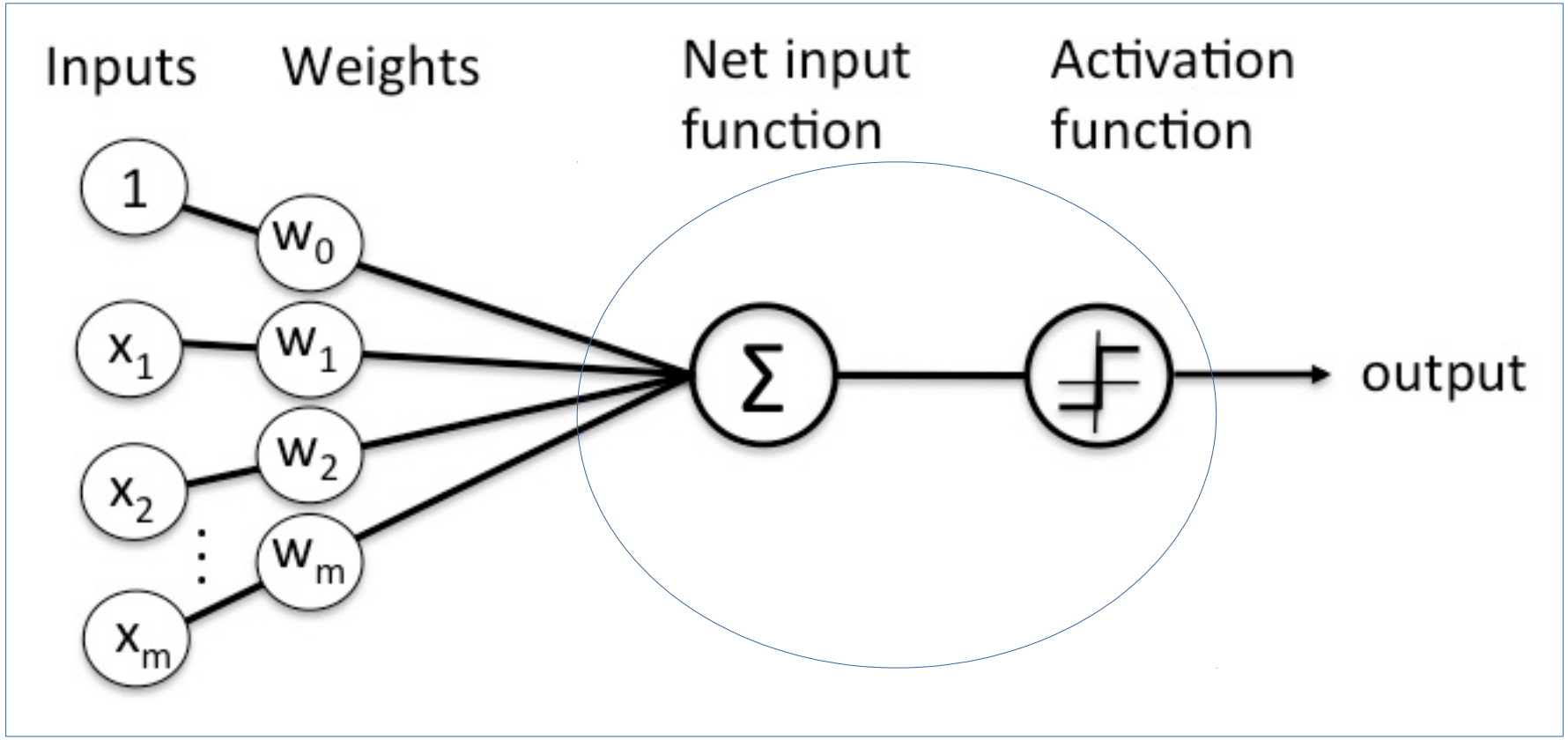
Deep Learning with Python

From Natural to Artificial

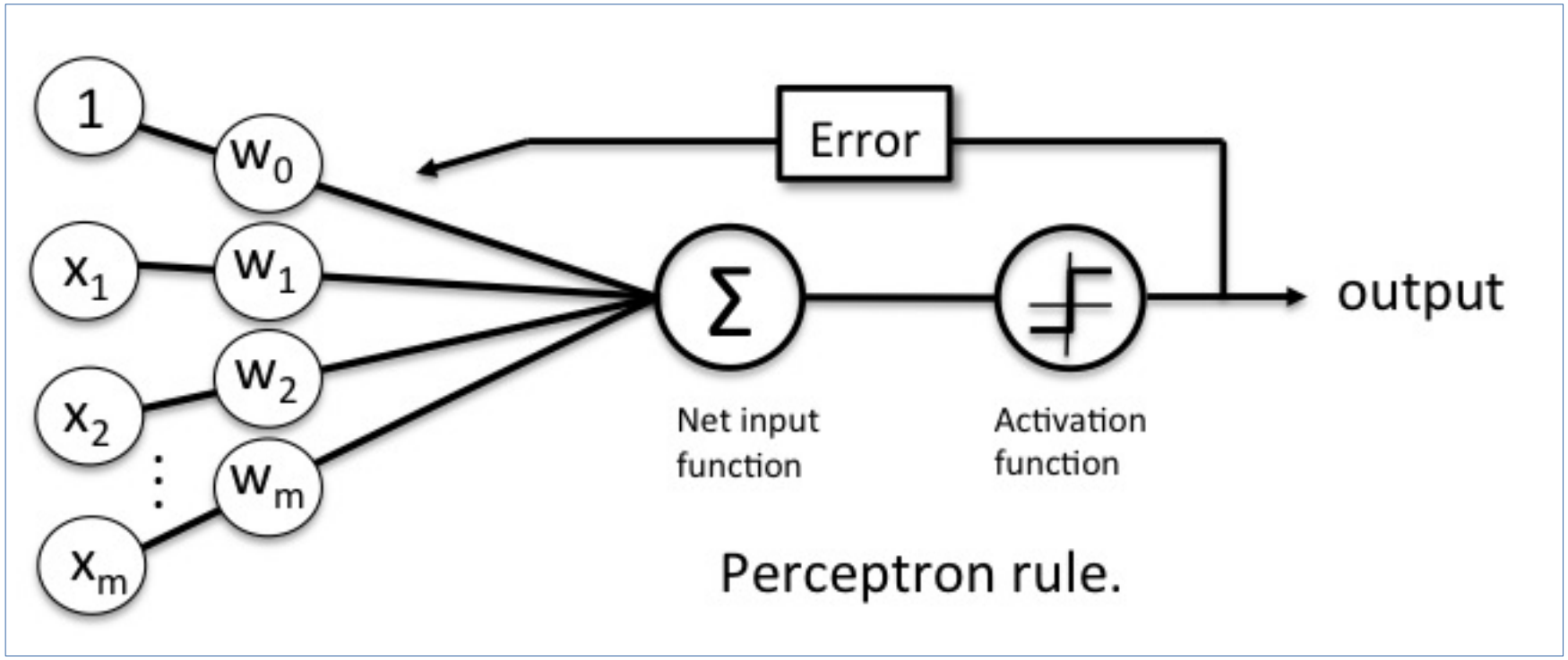




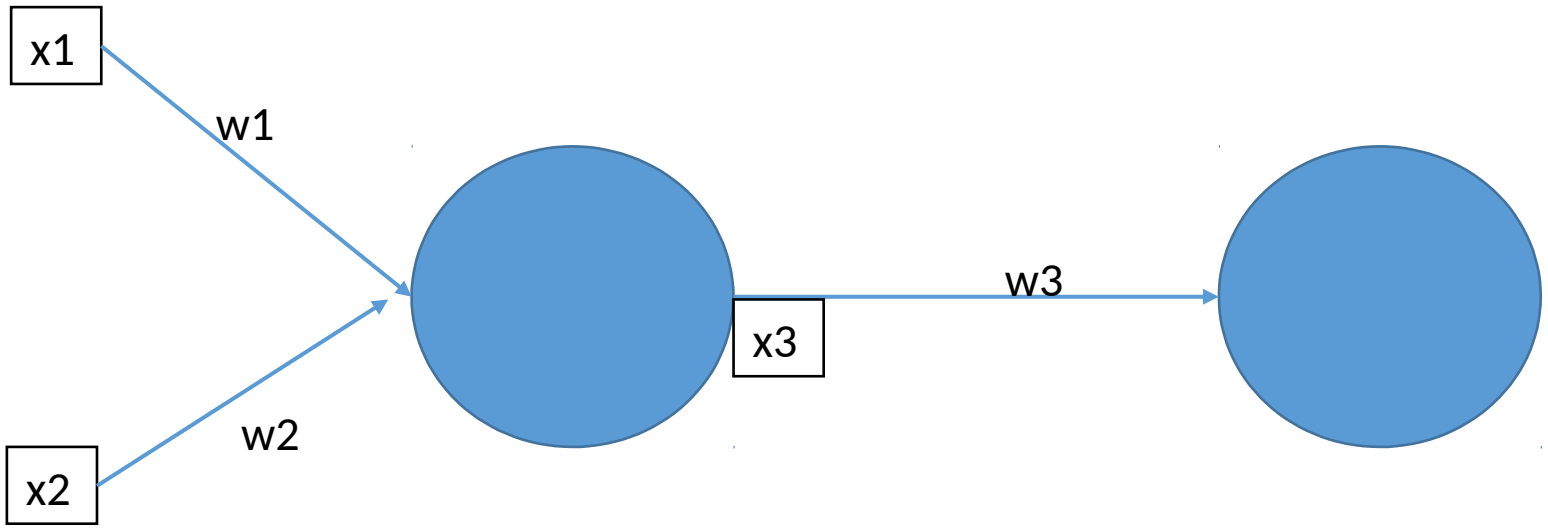
Perceptron : An Artificial Neuron



Perceptron : Learning Rule

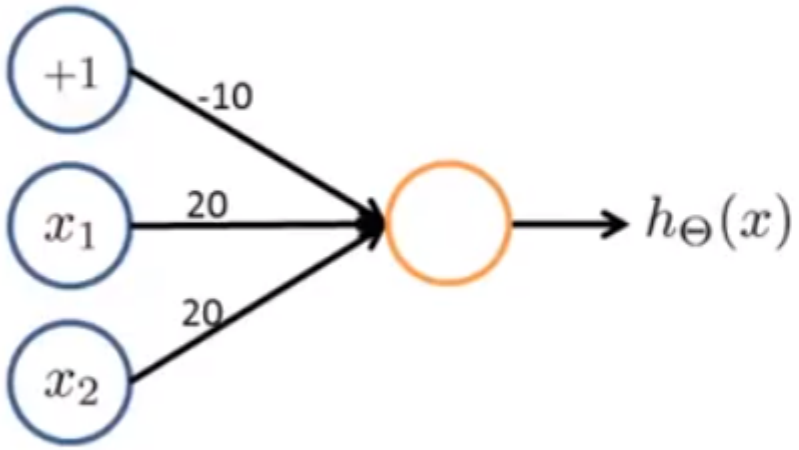


Perceptron : Learning Rule



Perceptron : Learning Rule

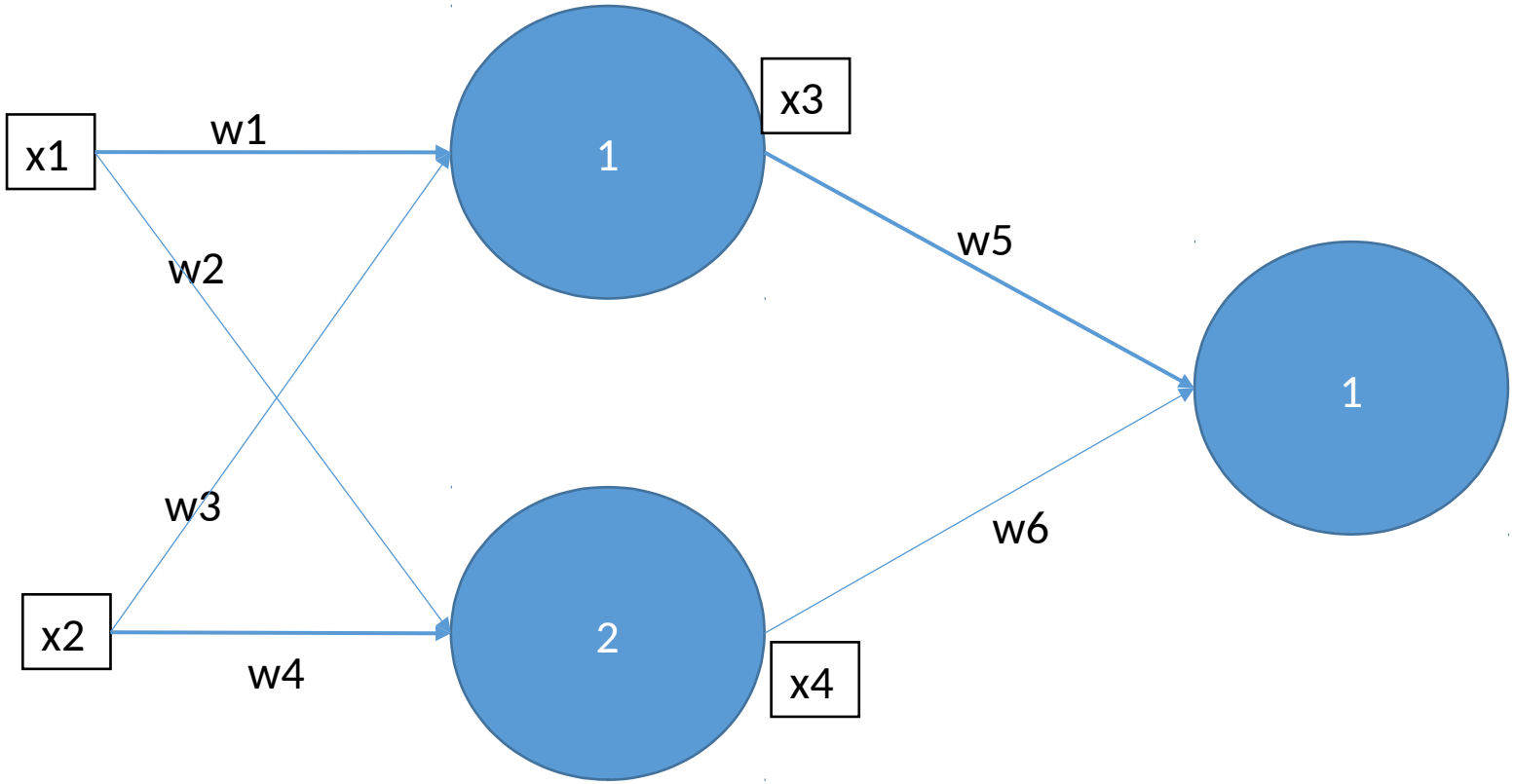
Example: OR function



$g(-10 + 20x_1 + 20x_2)$

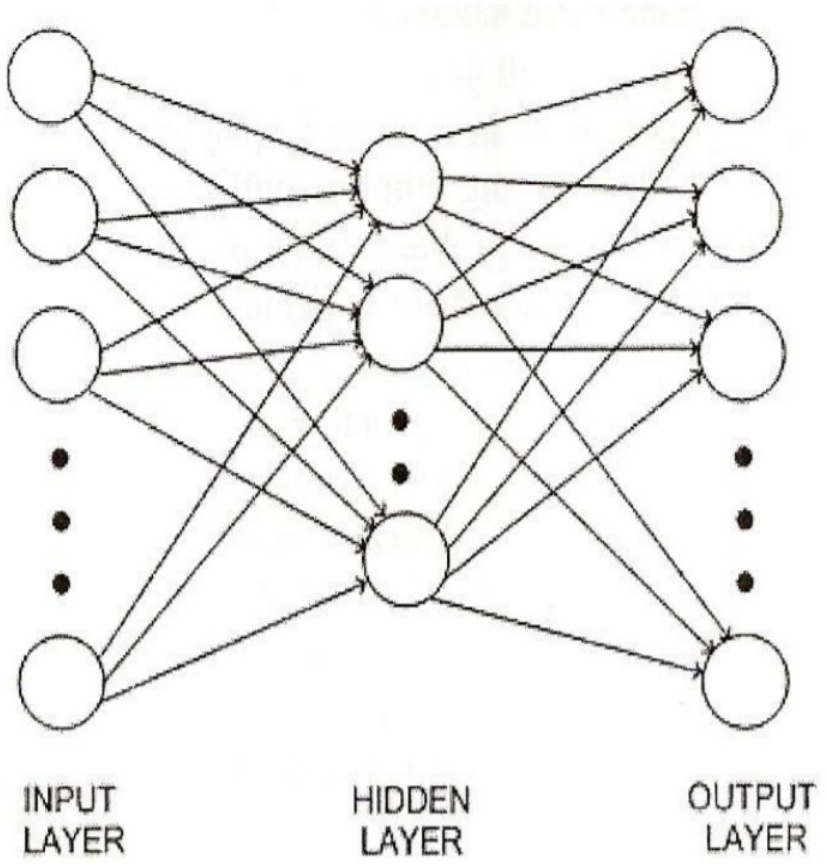
x_1	x_2	$h_\Theta(x)$
0	0	$g(-10) \approx 0$
0	1	$g(10) \approx 1$
1	0	≈ 1
1	1	≈ 1

Perceptron : Learning Rule

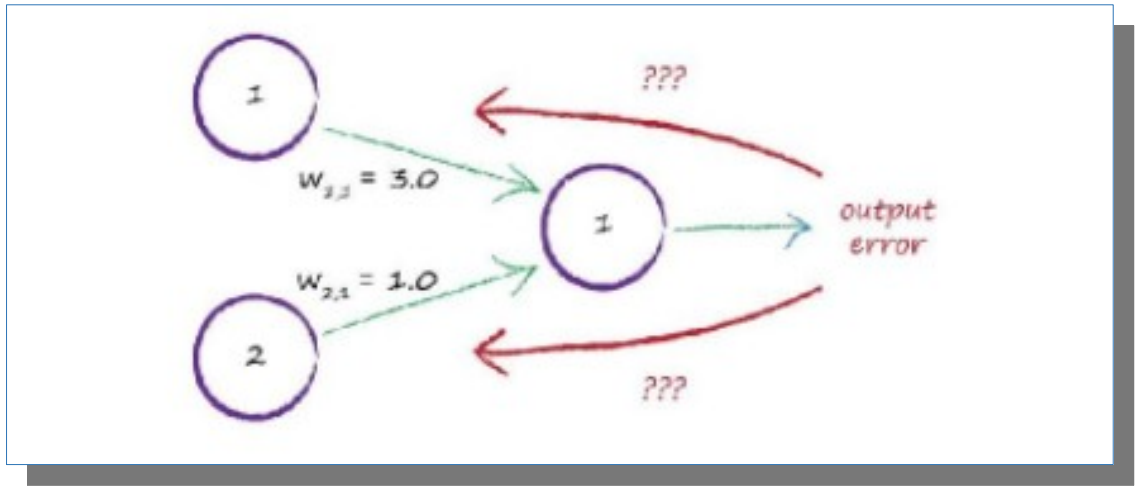


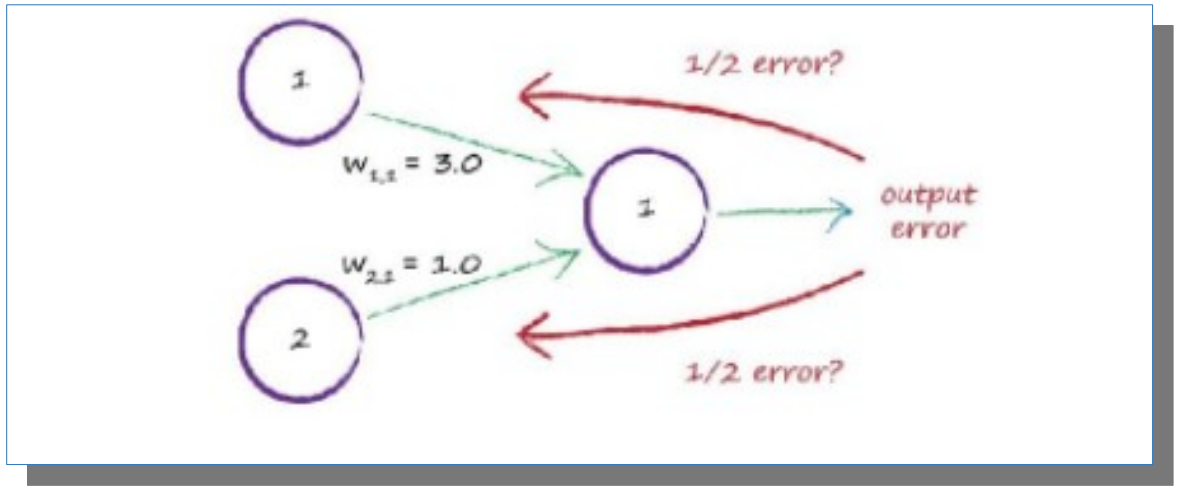
Artificial Neural Networks

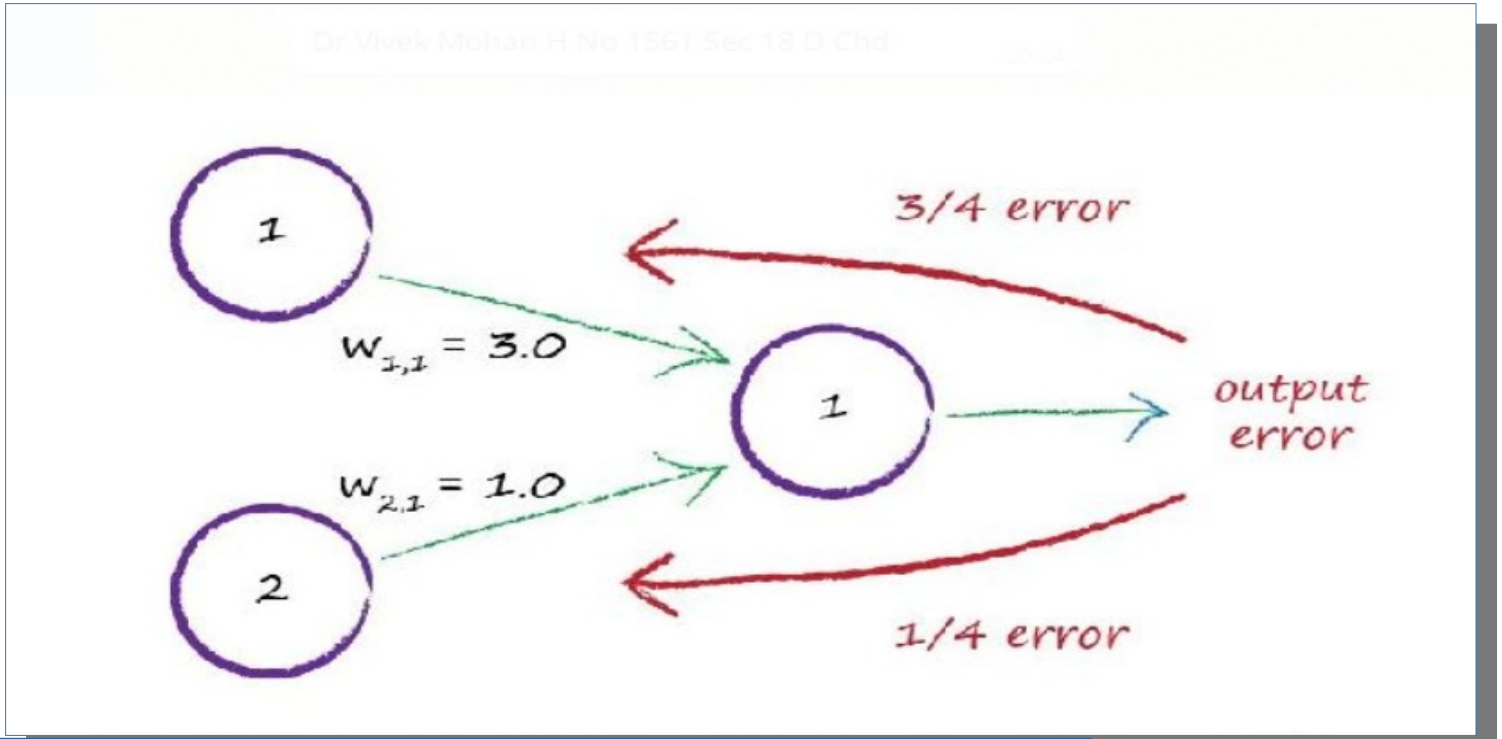
- Neural Network is a learning structure designed to mimic the function of a web of biological neurons.
- A biological neuron takes an electric input and pops out another electrical signal. However, there is a threshold that must be reached before an output is produced.
- The basic idea of the neuron model in ANNs is that the inputs to a neuron are combined (as a weighted sum) into a single value, Then, an activation function, is applied to determine whether or not the neuron fires.
- Deep Learning can be understood as an algorithm which is composed of hidden layers of multiple neural networks
- A function that takes an input signal and generates an output signal but takes into account some kind of threshold is called an **Activation function.**
- The computational systems we write are procedural; a program starts at the first line of code, executes it, and goes on to the next, following instructions in a linear fashion. A true neural network does not follow a linear path. Rather, information is processed collectively, in parallel throughout a network of nodes (the nodes, in this case, being neurons)



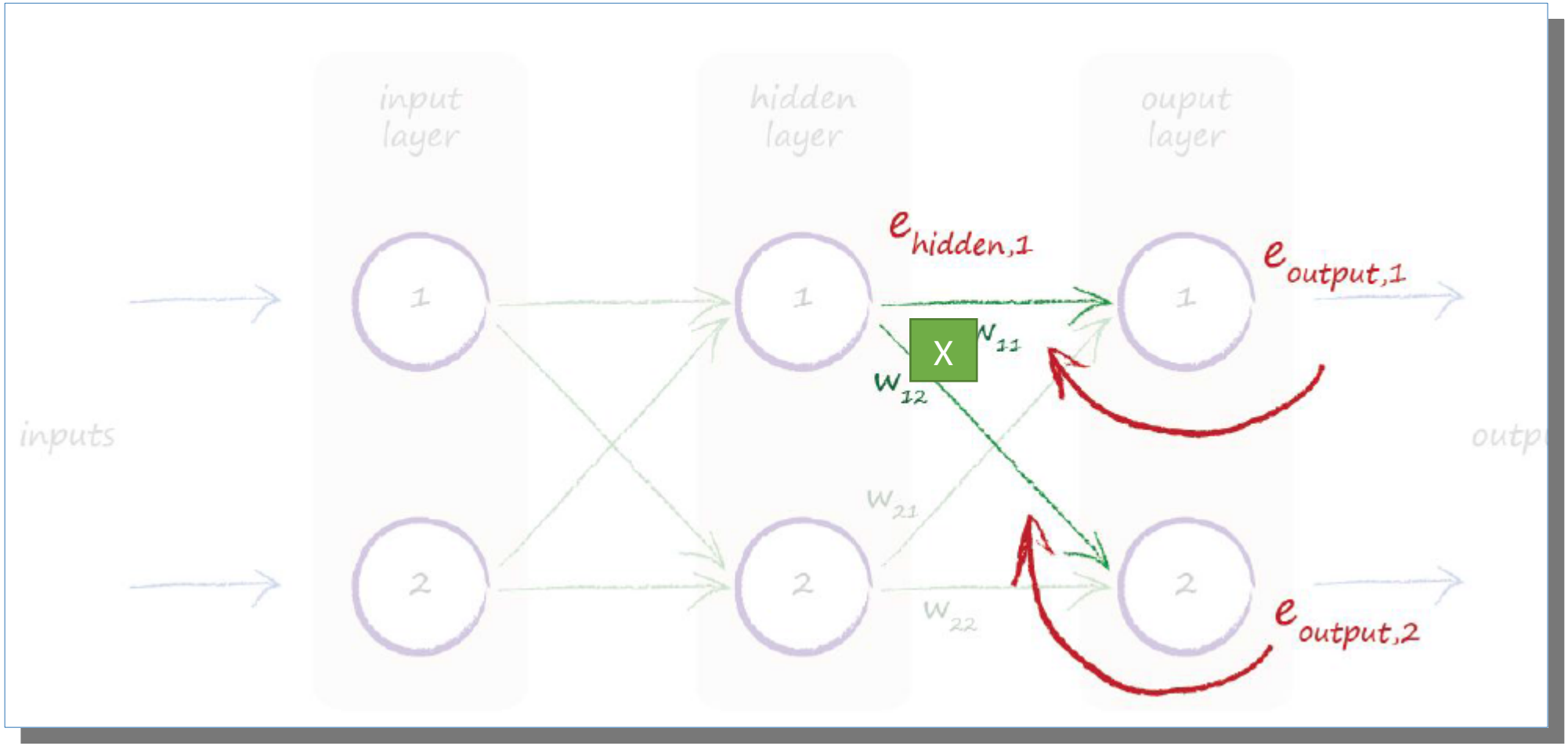
ANN – Error Proportion





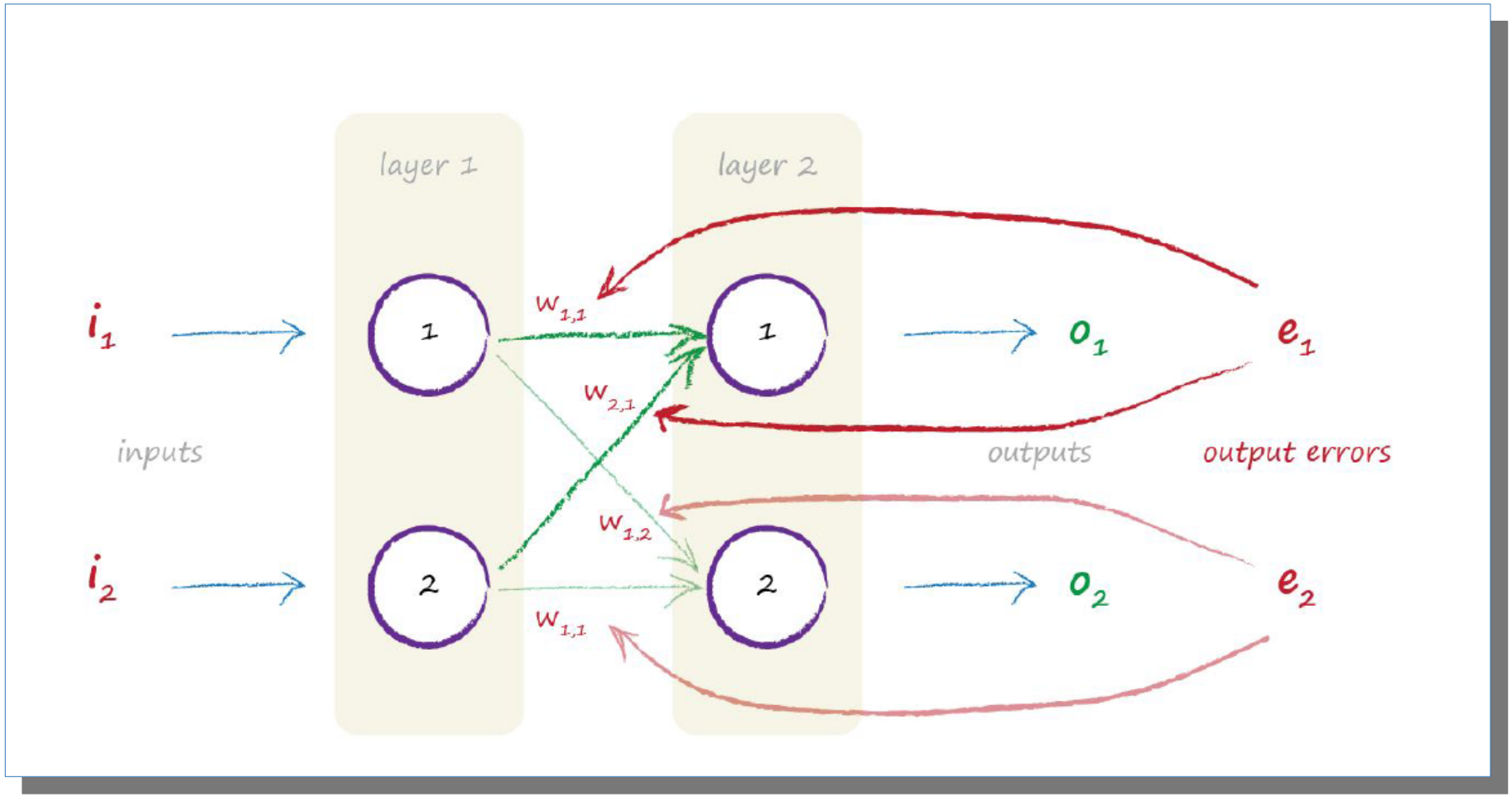


ANN – Error Propagation



$e_{hidden,1}$ = sum of split errors on links w_{11} and w_{12}

ANN – An Example



$$\frac{w_{11}}{w_{11} + w_{21}}$$

$$\frac{w_{21}}{w_{11} + w_{21}}$$

$$\frac{\partial E_{total}}{\partial w_1} = \frac{\partial E_{total}}{\partial out_{h1}} * \frac{\partial out_{h1}}{\partial net_{h1}} * \frac{\partial net_{h1}}{\partial w_1}$$

$$\downarrow$$

$$\frac{\partial E_{total}}{\partial out_{h1}} = \frac{\partial E_{o1}}{\partial out_{h1}} + \frac{\partial E_{o2}}{\partial out_{h1}}$$