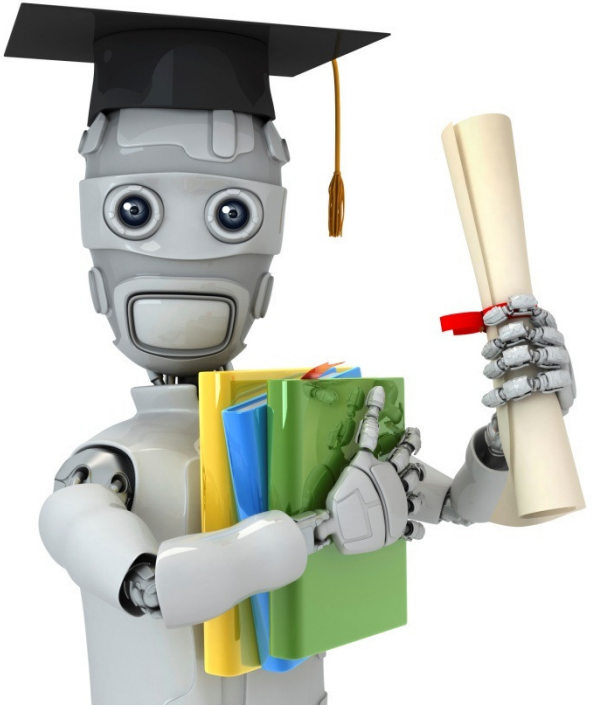


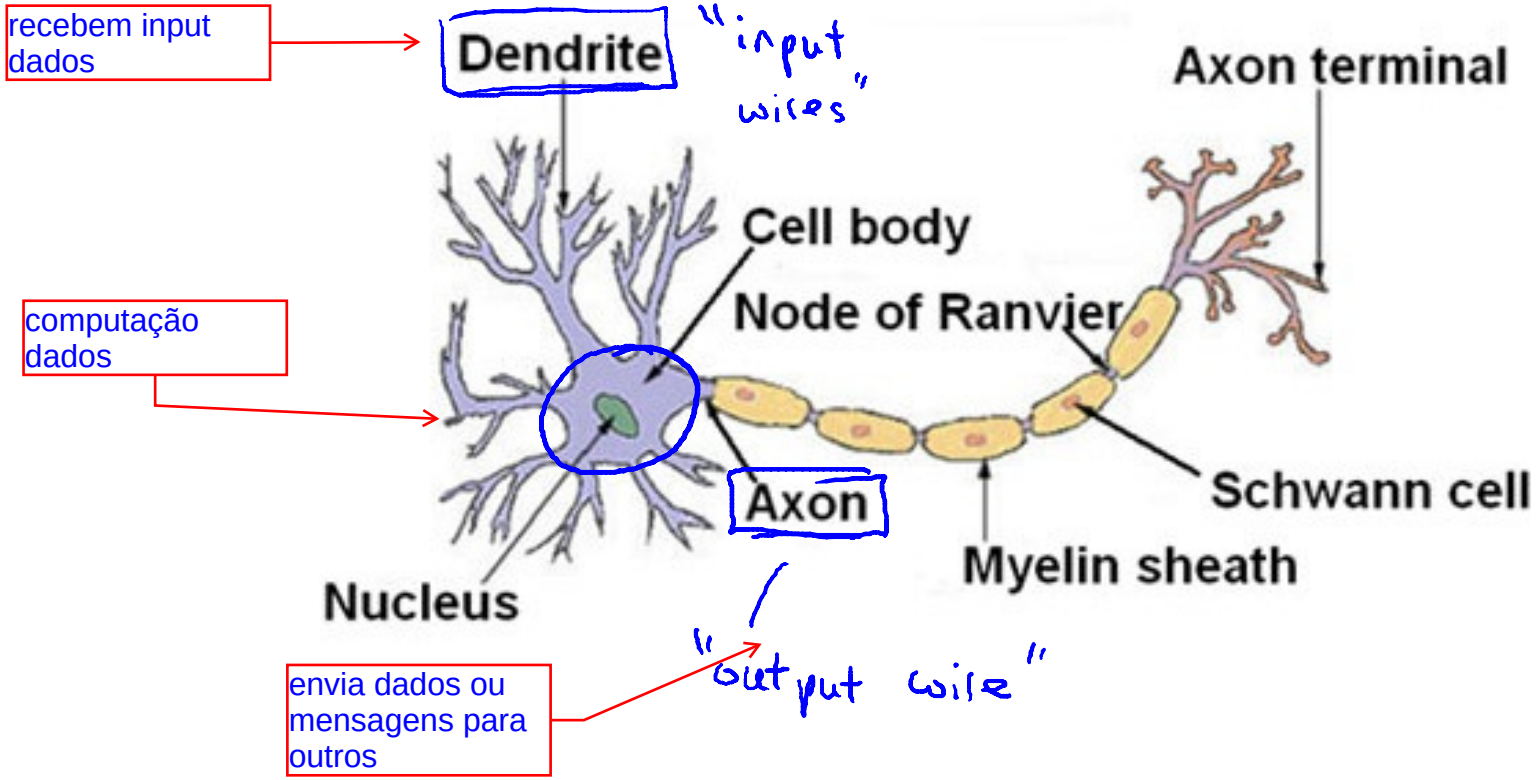
Machine Learning

Neural Networks: Representation

Model representation I

Neuron in the brain

redes neuronais simulam cerebro

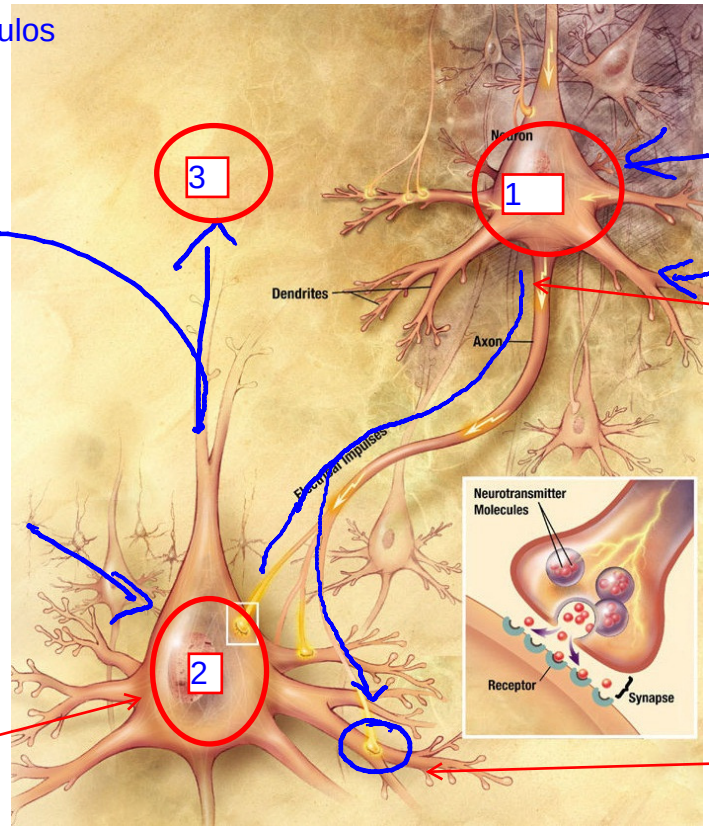


grupo neuronios

Neurons in the brain

1- os neuronios comunicam com outros atravez de impulsos electricidade (spikes)

PROCESSO dos nossos sensores e musculos



Muscle

1 neuronio

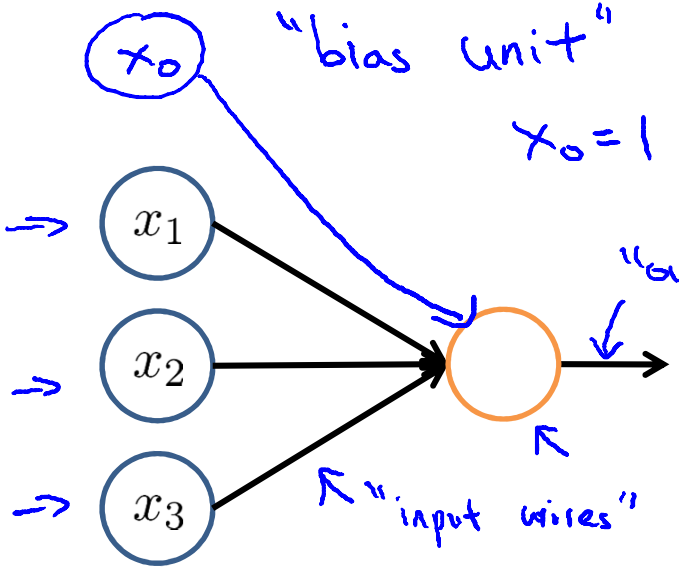
2- envio de pulso electricidade pelo axon

3- conexao com dentrite e recepçao mensagem

4- computação dados e envio de outra msg

[Credit: US National Institutes of Health, National Institute on Aging]

Neuron model: Logistic unit



$$x = \begin{bmatrix} x_0 \\ x_1 \\ x_2 \\ x_3 \end{bmatrix} \qquad \theta = \begin{bmatrix} \theta_0 \\ \theta_1 \\ \theta_2 \\ \theta_3 \end{bmatrix}$$

"weights" ← (parameters)

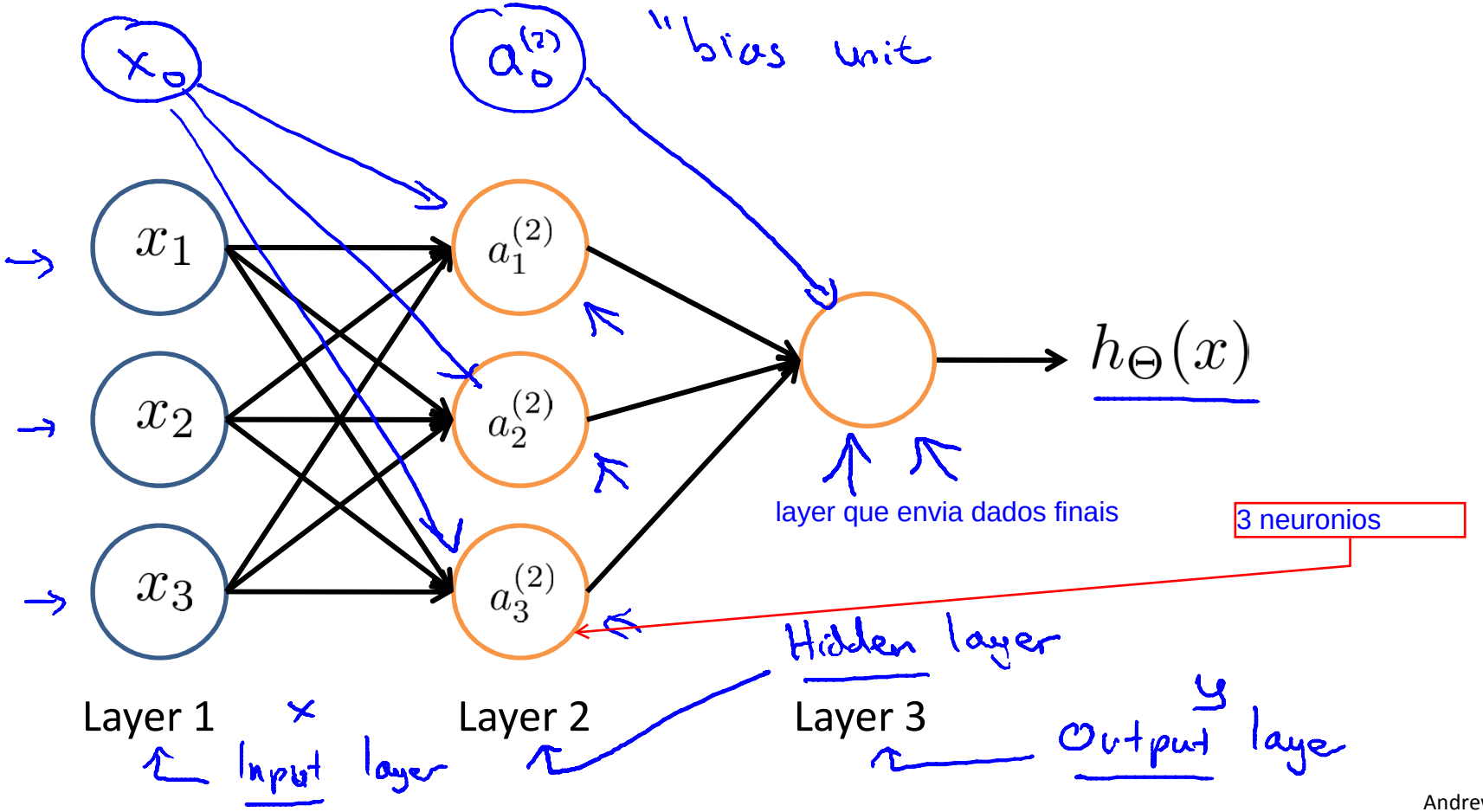
$$h_\theta(x) = \frac{1}{1 + e^{-\theta^T x}}$$

theta= peso

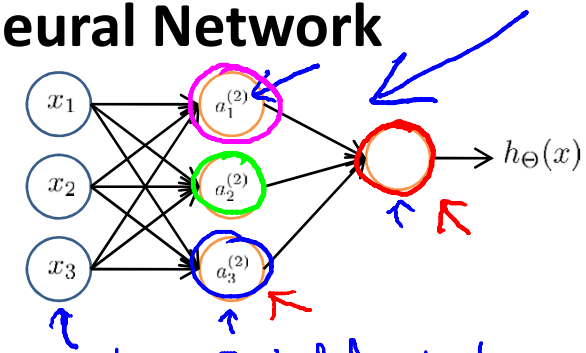
Sigmoid (logistic) activation function. nao linear

$$g(z) = \frac{1}{1 + e^{-z}}$$

Neural Network



Neural Network



valor que é calculado e enviado

→ $a_i^{(j)} =$ "activation" of unit i in layer j

→ $\Theta^{(j)} =$ matrix of weights controlling function mapping from layer j to layer $j+1$

$\Theta^{(1)} \in \mathbb{R}^{3\times 4}$

$h_\Theta(x)$

→ $a_1^{(2)} = g(\Theta_{10}^{(1)} x_0 + \Theta_{11}^{(1)} x_1 + \Theta_{12}^{(1)} x_2 + \Theta_{13}^{(1)} x_3)$

→ $a_2^{(2)} = g(\Theta_{20}^{(1)} x_0 + \Theta_{21}^{(1)} x_1 + \Theta_{22}^{(1)} x_2 + \Theta_{23}^{(1)} x_3)$

→ $a_3^{(2)} = g(\Theta_{30}^{(1)} x_0 + \Theta_{31}^{(1)} x_1 + \Theta_{32}^{(1)} x_2 + \Theta_{33}^{(1)} x_3)$

$h^{(2)}_\Theta$

→ $h_\Theta(x) = a_1^{(3)} = g(\Theta_{10}^{(2)} a_0^{(2)} + \Theta_{11}^{(2)} a_1^{(2)} + \Theta_{12}^{(2)} a_2^{(2)} + \Theta_{13}^{(2)} a_3^{(2)})$

→ If network has s_j units in layer j, s_{j+1} units in layer $j+1$, then $\Theta^{(j)}$ will be of dimension $s_{j+1} \times (s_j + 1)$.

$s_{j+1} \times (s_j + 1)$