

Deep Learning



<https://www.streamingnology.com>

[@streamingnology](https://twitter.com/streamingnology)

<https://github.com/streamingnology>

What is Deep Learning?

ARTIFICIAL INTELLIGENCE

Any technique that enables computers to mimic human behavior



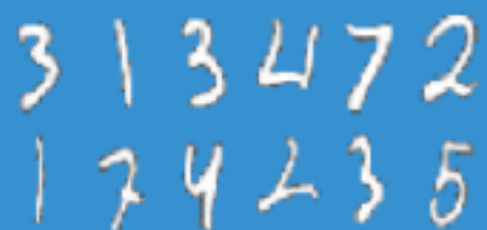
MACHINE LEARNING

Ability to learn without explicitly being programmed



DEEP LEARNING

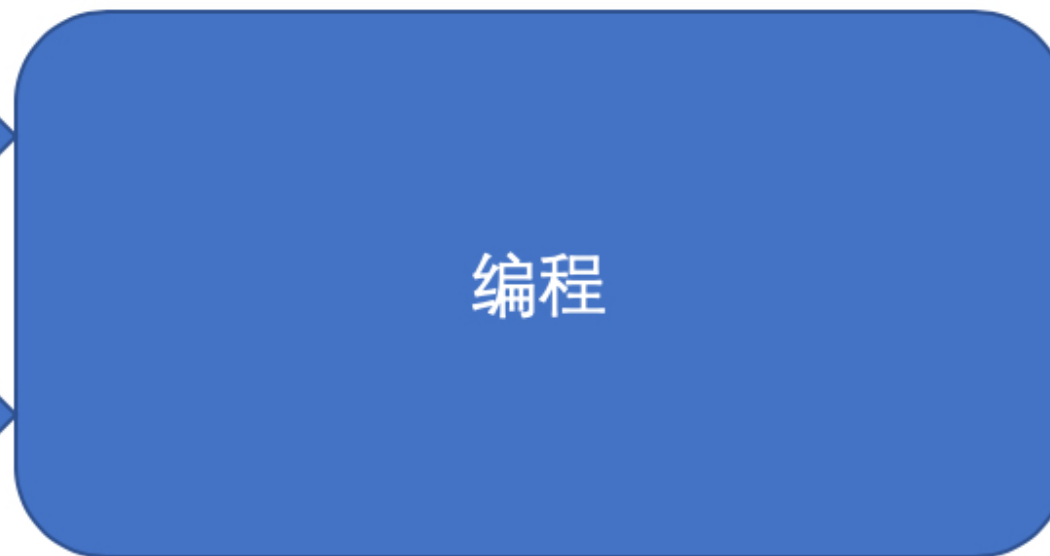
Extract patterns from data using neural networks



[0 1 2 3 4 5 6 7]



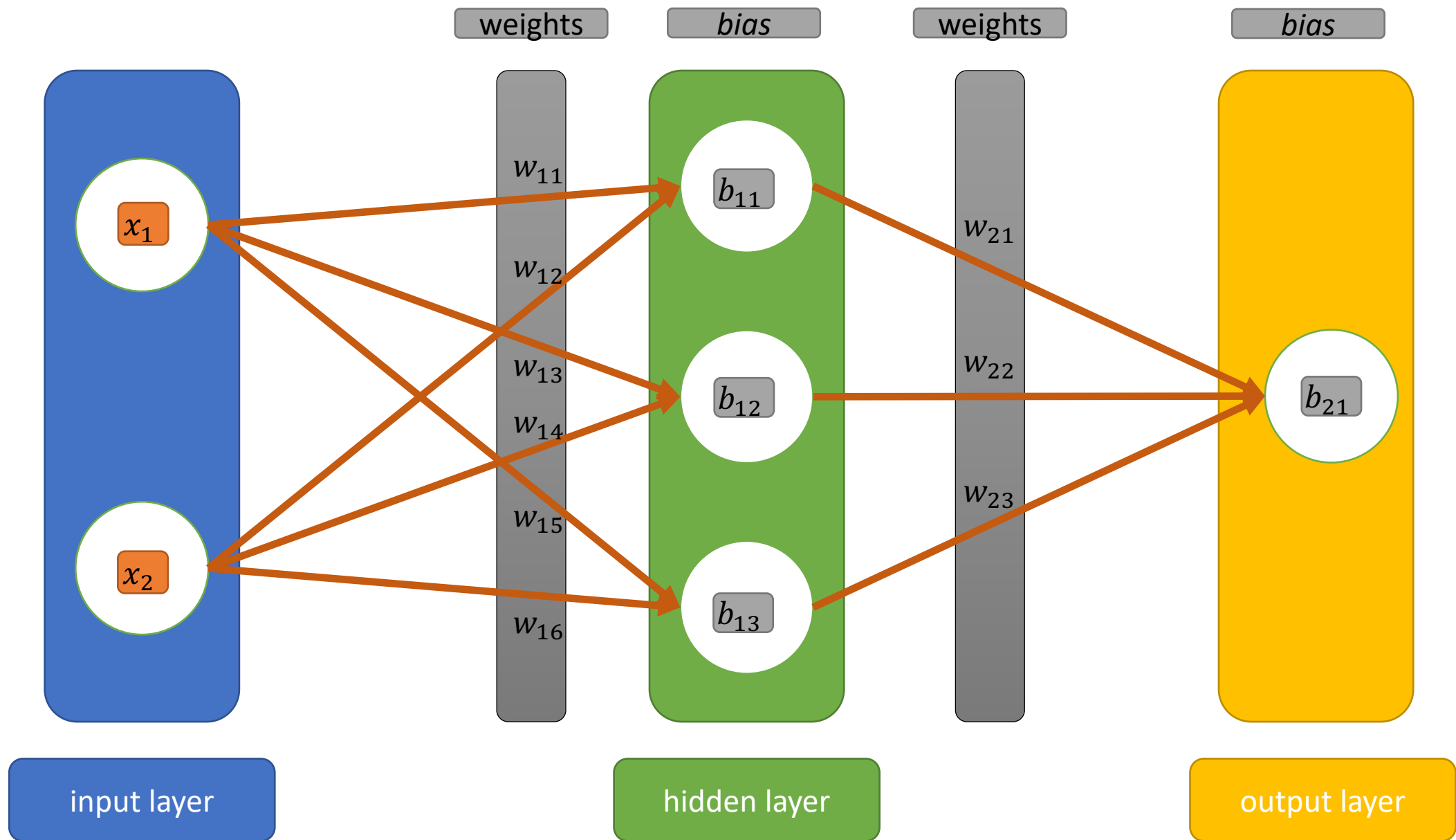
$$f(x) = 2x + 1$$

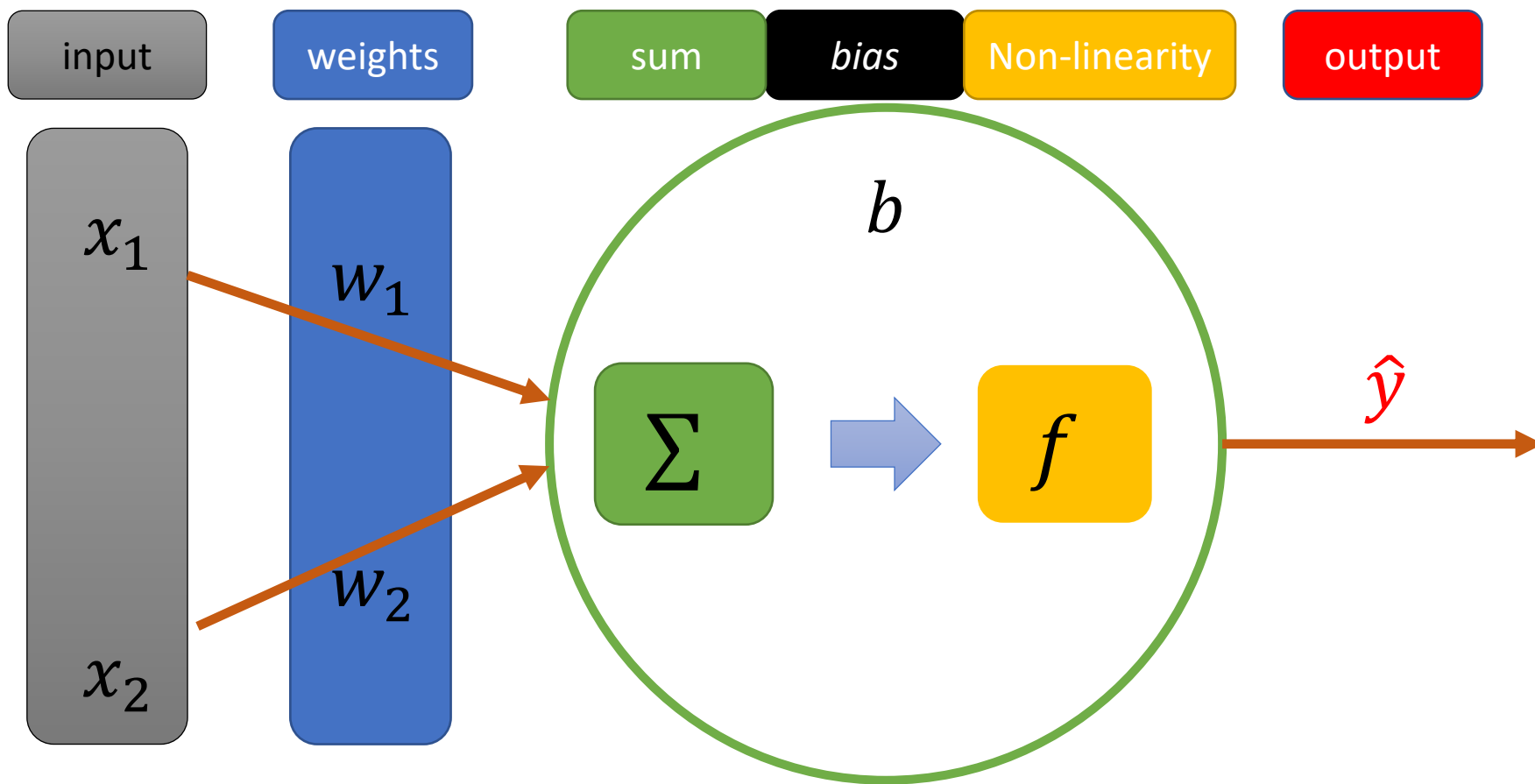


[1 3 5 7 9 11 13 15 17]









$$\hat{y} = f(x_1 * w_1 + x_2 * w_2 + b) = f(X^T W + b)$$

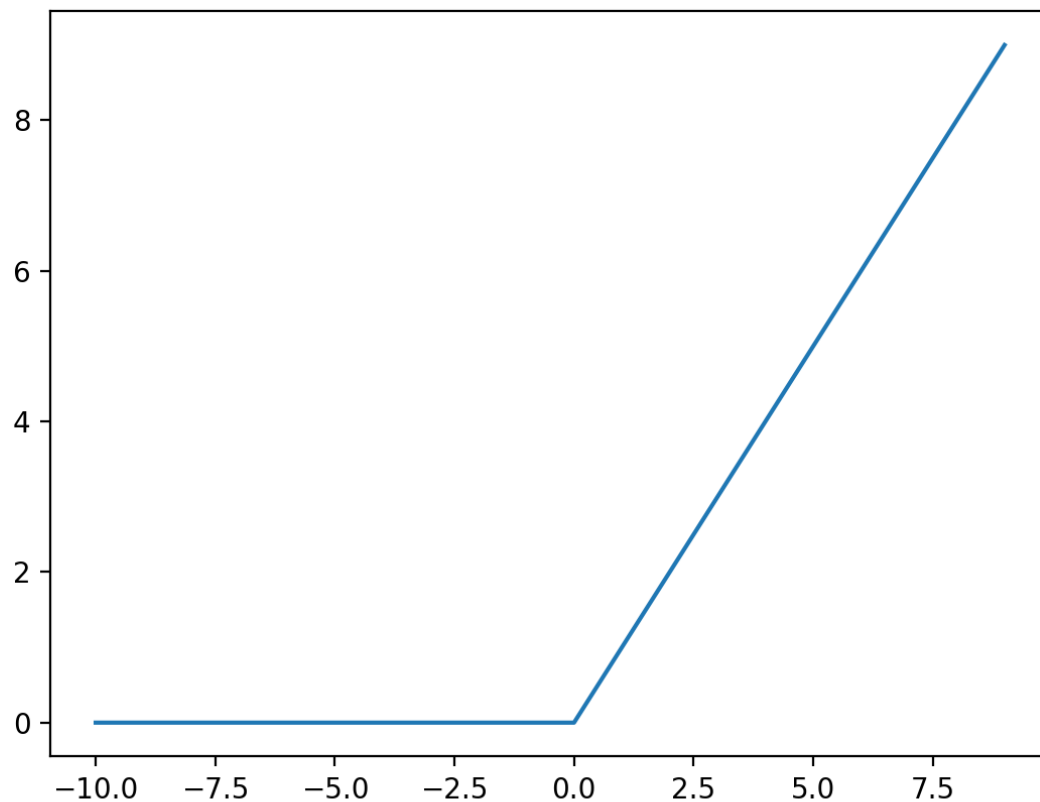
$$X = \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} \text{ and } W = \begin{bmatrix} w_1 \\ w_2 \end{bmatrix}$$

f

非线性函数

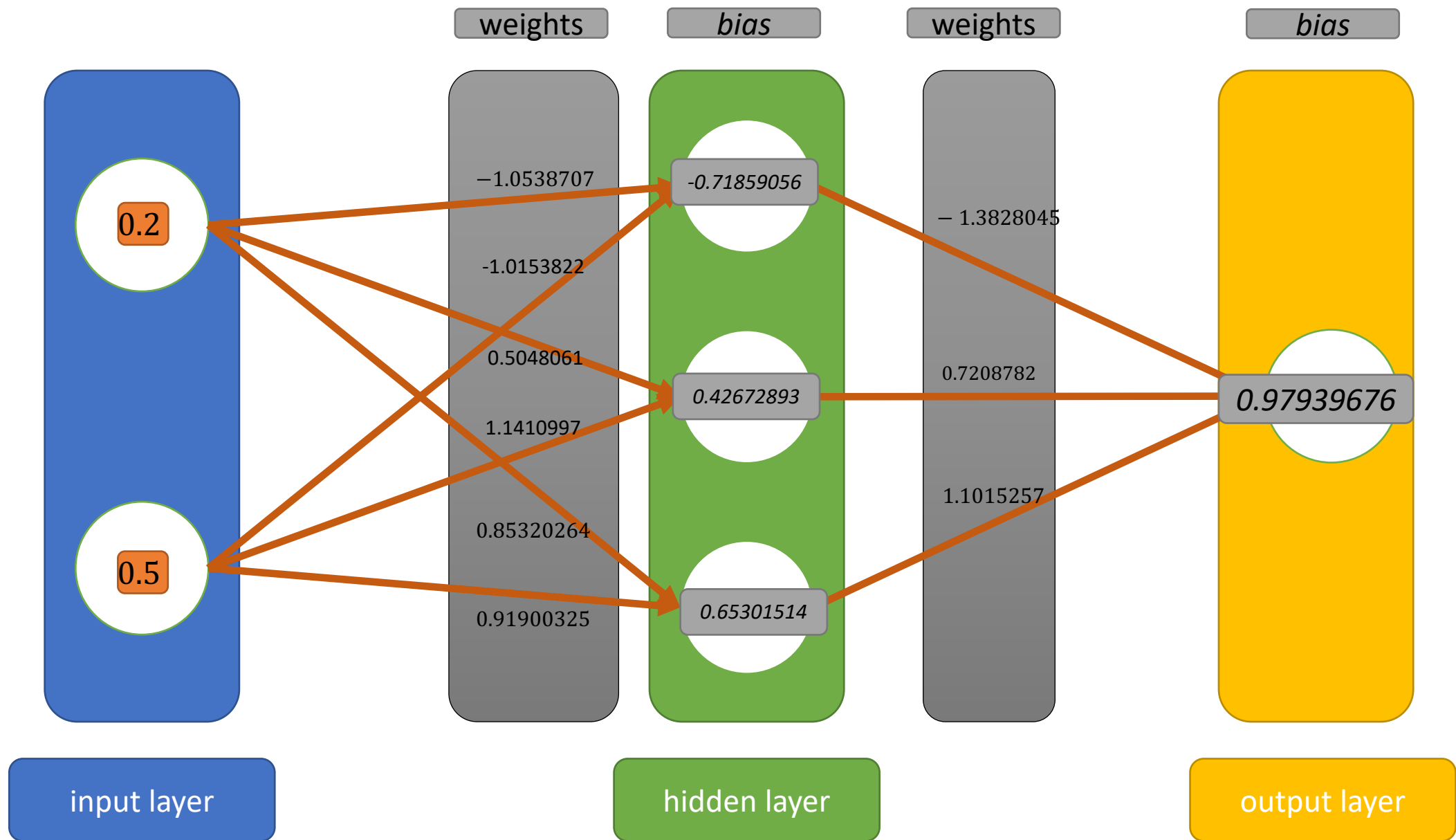
ReLU and sigmoid

$$\text{ReLU}(x) = \max(0, x)$$



$$X = \begin{bmatrix} 0.1 \\ 0.2 \end{bmatrix} \quad W = \begin{bmatrix} 1 \\ 2 \end{bmatrix} \quad b = 0.3 \quad f(x) = \text{ReLU}$$

$$\hat{y} = f(X^T W + b) = f(0.1 * 1 + 0.2 * 2 + 0.3) = f(0.8) = 0.8$$



$$f(x_1, x_2) = 2x_1 + 4x_2 + 3$$

$$X = \begin{bmatrix} 0.2 \\ 0.5 \end{bmatrix}$$

$$W1 = \begin{bmatrix} -1.0538707 & 0.5048061 & 0.85320264 \\ -1.0153822 & 1.1410997 & 0.91900325 \end{bmatrix}$$

$$b1 = [-0.71859056 \quad 0.42672893 \quad 0.65301514]$$

hidden layer

$$\begin{aligned} o1 &= X^T W1 + b \\ &= \begin{bmatrix} 0.2 \\ 0.5 \end{bmatrix}^T \begin{bmatrix} -1.0538707 & 0.5048061 & 0.85320264 \\ -1.0153822 & 1.1410997 & 0.91900325 \end{bmatrix} + [-0.71859056 \quad 0.42672893 \quad 0.65301514] \\ &= [-0.71846522 \quad 0.67151107 \quad 0.63014215] + [-0.71859056 \quad 0.42672893 \quad 0.65301514] \\ &= [-1.43705578 \quad 1.09824 \quad 1.28315729] \end{aligned}$$

$$o1 = \begin{bmatrix} -1.43705578 \\ 1.09824 \\ 1.28315729 \end{bmatrix}$$

$$W2 = \begin{bmatrix} -1.3828045 \\ 0.7208782 \\ 1.1015257 \end{bmatrix}$$

$$b2 = [0.97939676]$$

output layer

$$\begin{aligned} o2 &= o1^T W2 + b2 \\ &= \begin{bmatrix} -1.43705578 \\ 1.09824 \\ 1.28315729 \end{bmatrix}^T \begin{bmatrix} -1.3828045 \\ 0.7208782 \\ 1.1015257 \end{bmatrix} + [0.97939676] \\ &= [4.19229516] + [0.97939676] \\ &= [5.17169192] \end{aligned}$$

END



<https://www.streamingnology.com>

[@streamingnology](https://twitter.com/streamingnology)

<https://github.com/streamingnology>