



deeplearning.ai

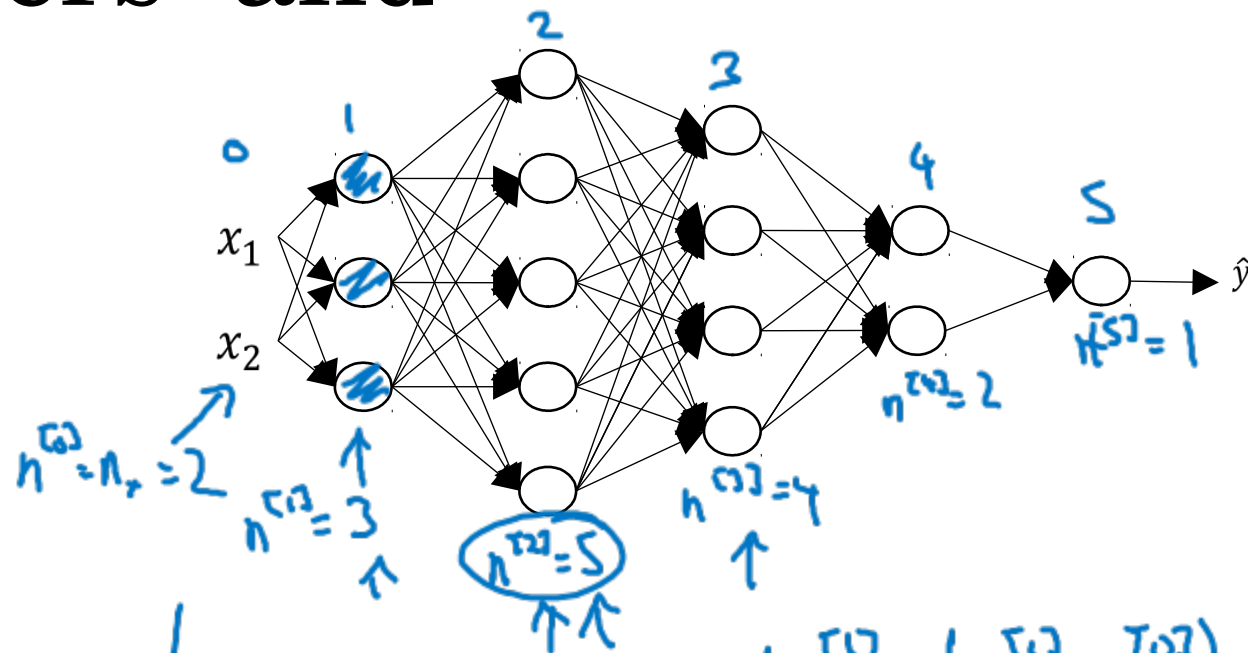
Deep Neural Networks

Getting your matrix
dimensions right

Parameters $W^{[l]}$ and $b^{[l]}$

$$z^{[l]} = g^{[l]}(a^{[l]})$$

$$a^{[l]} = W^{[l]} \cdot x + b^{[l]}$$



$$L = 5$$

$$\begin{cases} W^{[l]}: (n^{[l]}, n^{[l-1]}) \\ b^{[l]}: (n^{[l]}, 1) \\ dW^{[l]}: (n^{[l]}, n^{[l-1]}) \\ db^{[l]}: (n^{[l]}, 1) \end{cases}$$

$$z^{[1]} = \begin{bmatrix} W^{[1]} & \times \end{bmatrix} + \begin{bmatrix} b^{[1]} \end{bmatrix}$$

$$\begin{pmatrix} 3, 1 \end{pmatrix} \leftarrow \begin{pmatrix} 3, 2 \end{pmatrix} \begin{pmatrix} 2, 1 \end{pmatrix}$$

$$\begin{pmatrix} n^{[1]}, 1 \end{pmatrix} \leftarrow \begin{pmatrix} n^{[1]}, n^{[0]} \end{pmatrix} \begin{pmatrix} n^{[0]}, 1 \end{pmatrix}$$

$$\begin{bmatrix} : \\ : \\ : \end{bmatrix} = \begin{bmatrix} : & : \\ : & : \\ : & : \end{bmatrix} \begin{bmatrix} : \\ : \end{bmatrix}$$

$$W^{[1]}: (n^{[1]}, n^{[0]})$$

$$W^{[2]}: (5, 3) \quad (n^{[2]}, n^{[1]})$$

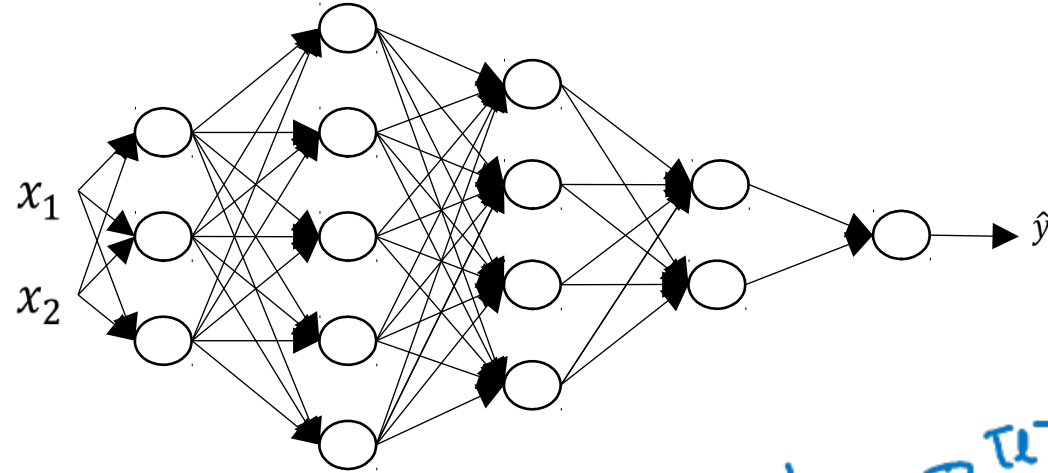
$$z^{[2]} = \begin{bmatrix} W^{[2]} & \cdot & a^{[1]} \end{bmatrix} + \begin{bmatrix} b^{[2]} \end{bmatrix}$$

$$\begin{matrix} \uparrow & \uparrow & \uparrow & \uparrow \\ \rightarrow (5, 1) & (5, 3) & (3, 1) & (5, 1) \\ & & & (n^{[2]}, 1) \end{matrix}$$

$$W^{[3]}: (4, 5)$$

$$W^{[4]}: (2, 4), \quad W^{[5]}: (1, 2)$$

Vectorized implementation



$$z^{[l]} = W^{[l]} \cdot x + b^{[l]}$$

$(n^{[l]}, 1)$ $(n^{[l]}, n^{[l-1]})$ $(n^{[l-1]}, 1)$ $(n^{[l]}, 1)$

$$[z^{[1]}, z^{[2]}, \dots, z^{[L]}]$$

$$Z^{[l]} = W^{[l]} \cdot X + b^{[l]}$$

$(n^{[l]}, m)$ $(n^{[l]}, n^{[l-1]})$ $(n^{[l-1]}, m)$ $(n^{[l]}, 1)$
 $(n^{[l]}, m)$

$$z^{[1]}, a^{[1]} : (n^{[1]}, 1)$$

$$z^{[2]}, A^{[2]} : (n^{[2]}, m)$$

$l=0 \quad A^{[0]} = X = (n^{[0]}, m)$

$$dz^{[2]}, dA^{[2]} : (n^{[2]}, m)$$