



**deeplearning.ai**

# Deep Neural Networks

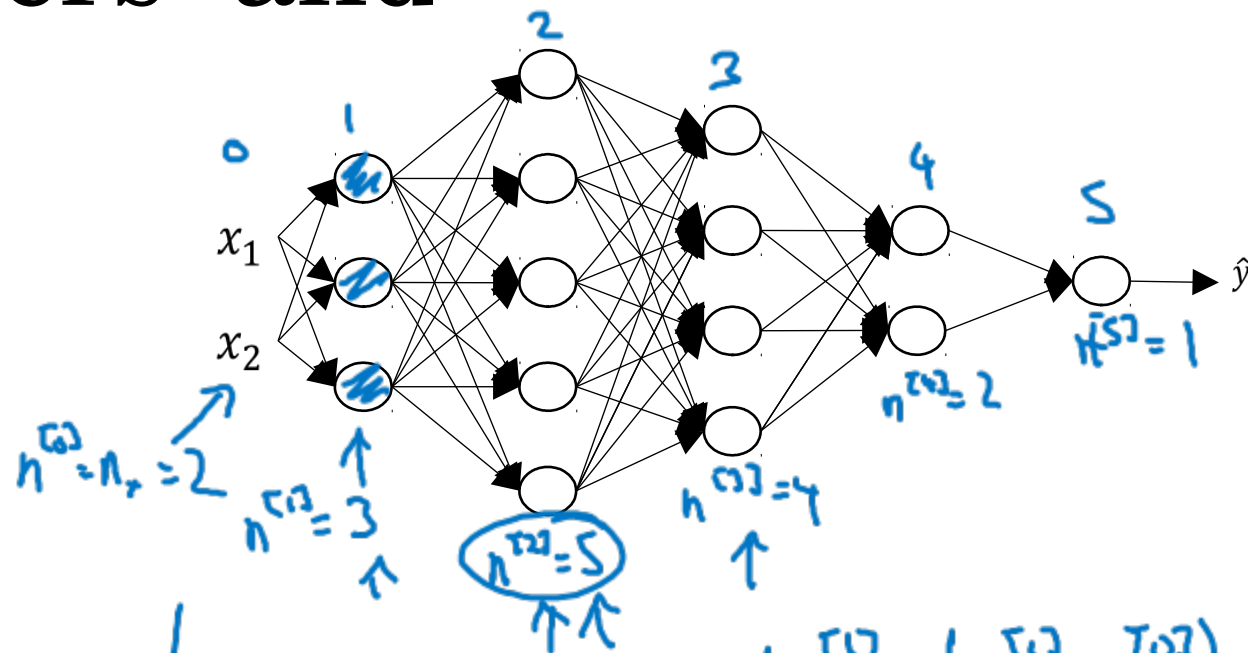
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Getting your matrix  
dimensions right

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

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

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



$$L = 5$$

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

$$z^{[1]} = W^{[1]} \cdot x + b^{[1]}$$

$$(3,1) \leftarrow (3,2) \quad (2,1)$$

$$(n^{[1]}, 1) \quad (n^{[1]}, n^{[0]}) \quad (n^{[0]}, 1)$$

$$\begin{bmatrix} \vdots \\ \vdots \end{bmatrix} = \begin{bmatrix} \vdots \\ \vdots \end{bmatrix} \begin{bmatrix} \vdots \\ \vdots \end{bmatrix}$$

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

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

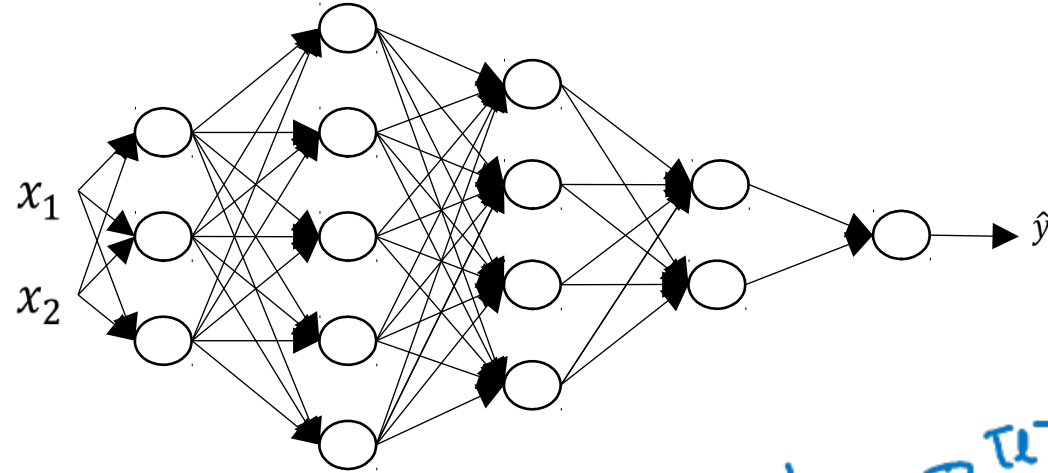
$$z^{[2]} = W^{[2]} \cdot a^{[1]} + b^{[2]}$$

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

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

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

# Vectorized implementation



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

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

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

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

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

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

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

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

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