



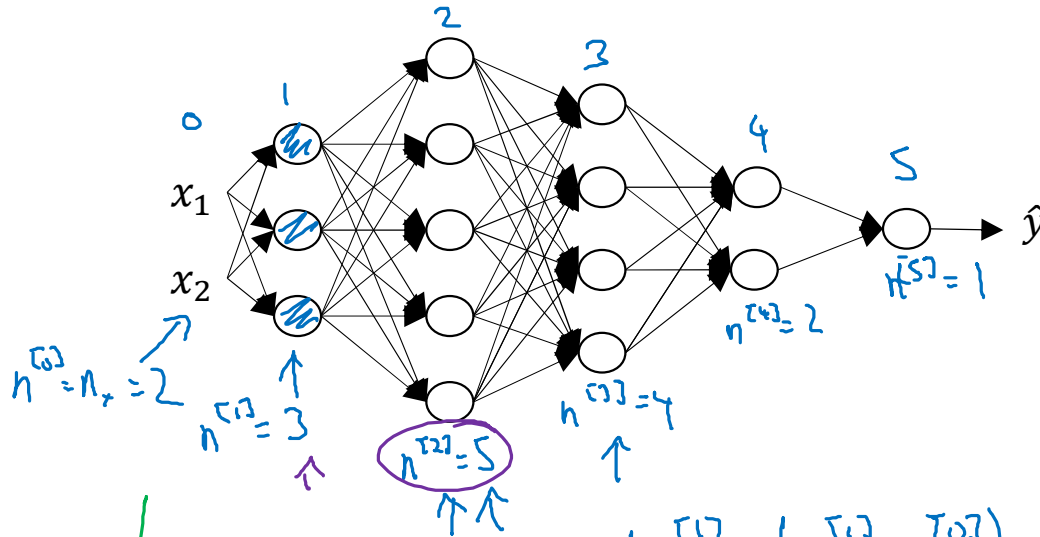
deeplearning.ai

Deep Neural Networks

Getting your matrix
dimensions right

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

$\downarrow z^{[L]} = g^{[L]}(a^{[L]})$
 \uparrow
 $\downarrow a^{[L]}$



$L = 5$

$\rightarrow W^{[L]}: (n^{[L]}, n^{[L-1]})$
 $\rightarrow b^{[L]}: (n^{[L]}, 1)$
 $\rightarrow \Delta W^{[L]}: (n^{[L]}, n^{[L-1]})$
 $\rightarrow \Delta b^{[L]}: (n^{[L]}, 1)$

$\downarrow z^{[1]} = \boxed{W^{[1]} \cdot x} + \boxed{b^{[1]}}$
 $(3, 1) \leftarrow (3, 2) \quad (2, 1)$
 $(n^{[1]}, 1) \quad (n^{[1]}, n^{[0]}) \quad (n^{[0]}, 1)$
 $(3, 1)$
 $(n^{[1]}, 1)$

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

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

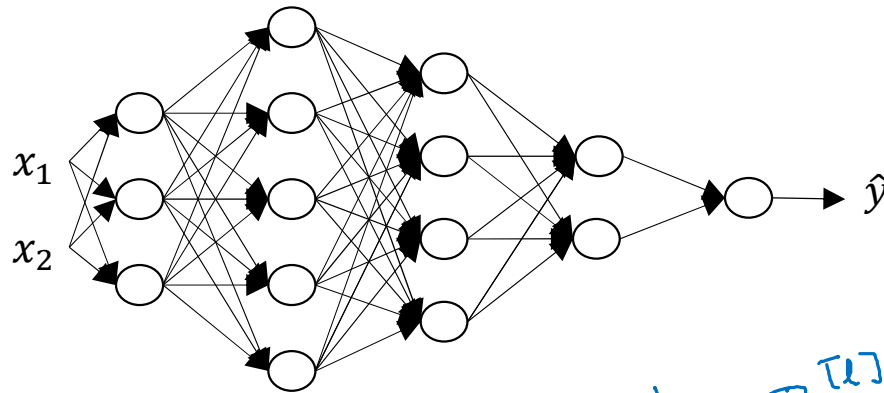
$W^{[2]}: (5, 3) \quad (n^{[2]}, n^{[1]})$

$z^{[2]} = \boxed{W^{[2]} \cdot a^{[1]}} + \boxed{b^{[2]}}$
 $\uparrow \quad \uparrow \quad \uparrow$
 $\rightarrow (5, 1) \quad (5, 3) \quad (3, 1)$
 $(5, 1)$
 $(n^{[2]}, 1)$

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

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

Vectorized implementation



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

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

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

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

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

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

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

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

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