deeplearning.ai

Deep Neural Networks

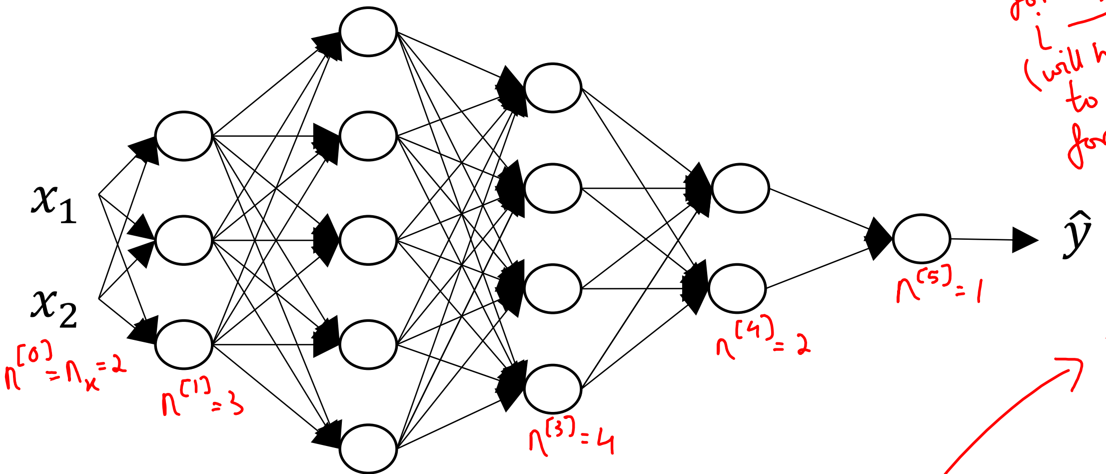
Getting your matrix dimensions right

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

a's dim should be same as z's dim

$a = g(z)$

ie, z's dim are $(n^{[l]} \times 1)$
a's " "



$L = 5$

$Z^{[l]} = W^{[l]} \cdot A^{[l-1]} + b^{[l]}$

for Layer l → $A^{[l]} = g^{[l]}(Z^{[l]})$

(will have to repeat for all layers of the NN)

What about dim of b?

$Z = WX + b$

⇒ z's dim has to match b's dim

ie, $b = (n^{[l]} \times 1)$

$Z^{[1]} = W^{[1]} \cdot X + b$

$Z^{[1]}$: (3×1), $(n^{[1]} \times 1)$

$W^{[1]}$: ?

X: (2×1), $(n^{[0]} \times 1)$

what is dim of $w^{[1]}$

$3 \times 1 = (m \times n) \cdot (2 \times 1)$

n must be 2

m must be 3

$\Rightarrow W^{[1]} = 3 \times 2$ or $(n^{[1]} \times n^{[0]})$

Another example

Find dims of $w^{[2]}$

$Z^{[2]} = w^{[2]} \cdot A^{[1]} + b^{[2]}$

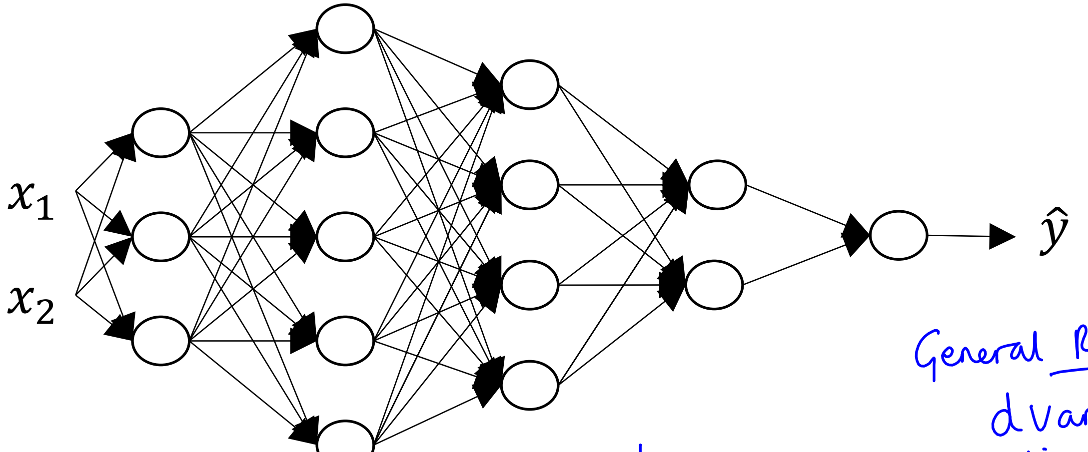
$(5 \times 1) = (m \times n) \times (3 \times 1)$

⇒ $m = 5$, $n = 3$ ⇒ $W^{[2]} = 5 \times 3$ or $(n^{[2]} \times n^{[1]})$

$\boxed{\text{In general } W^{[l]} = n^{[l]} \times n^{[l-1]}}$

Andrew Ng

Vectorized implementation



Since z is now stacked for m examples

$$Z^{[1]} = \begin{bmatrix} | & | & | & & | \\ z^{[1](1)} & z^{[1](2)} & z^{[1](3)} & \cdots & z^{[1](m)} \\ | & | & | & & | \end{bmatrix}$$

$\Rightarrow$ $Z^{[1]}$ becomes a $n^{[1]} \times m$ matrix

in general $\underline{Z^{[l]} = n^{[l]} \times m}$

$\Rightarrow$ $b^{[l]} = n^{[l]} \times m$

$\Rightarrow$ $A^{[l]} = n^{[l]} \times m$

w doesnt vary by the m samples
ie, for each new sample, we dont have
a diff w $\Rightarrow$ w is still $n^{[l]} \times n^{[l-1]}$

General Rule

dVar has the same dim as var does

$\Rightarrow$ $dZ^{[l]}$ will also be $n^{[l]} \times m$

$dA^{[l]}$ will be $n^{[l]} \times m$