



**deeplearning.ai**

# Deep Neural Networks

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Forward and backward  
propagation

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# Forward propagation for layer $l$



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

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

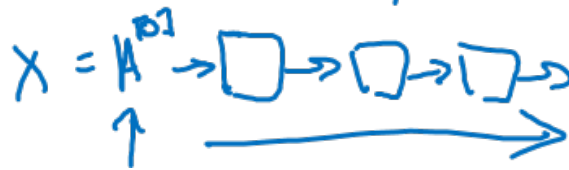
Vertically:

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

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

$$a^{[0]}$$

$$A^{[0]}$$



# Backward propagation for layer $l$

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$$\underline{dz}^{[l]} = \underline{da}^{[l]} * g^{[l]'}(z^{[l]})$$

$$\underline{dw}^{[l]} = \underline{dz}^{[l]} \cdot \underline{a}^{[l-1]}$$

$$\underline{db}^{[l]} = \underline{dz}^{[l]}$$

$$\underline{da}^{[l-1]} = \underline{w}^{[l]T} \cdot \underline{dz}^{[l]}$$

$$\underline{dz}^{[l-1]} = \underline{w}^{[l+1]T} \underline{dz}^{[l]} * g^{[l+1]'}(z^{[l-1]})$$

$$\underline{dz}^{[l]} = \underline{dA}^{[l]} * g^{[l]'}(z^{[l]})$$

$$\underline{dw}^{[l]} = \frac{1}{n} \underline{dz}^{[l]} \cdot A^{[l-1]T}$$

$$\underline{db}^{[l]} = \frac{1}{n} \text{np.sum}(\underline{dz}^{[l]}, \text{axis}=1, \text{keepdims}=\text{True})$$

$$\underline{dA}^{[l-1]} = \underline{w}^{[l]T} \cdot \underline{dz}^{[l]}$$

# Summary

