



**deeplearning.ai**

# Deep Neural Networks

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Forward and backward  
propagation

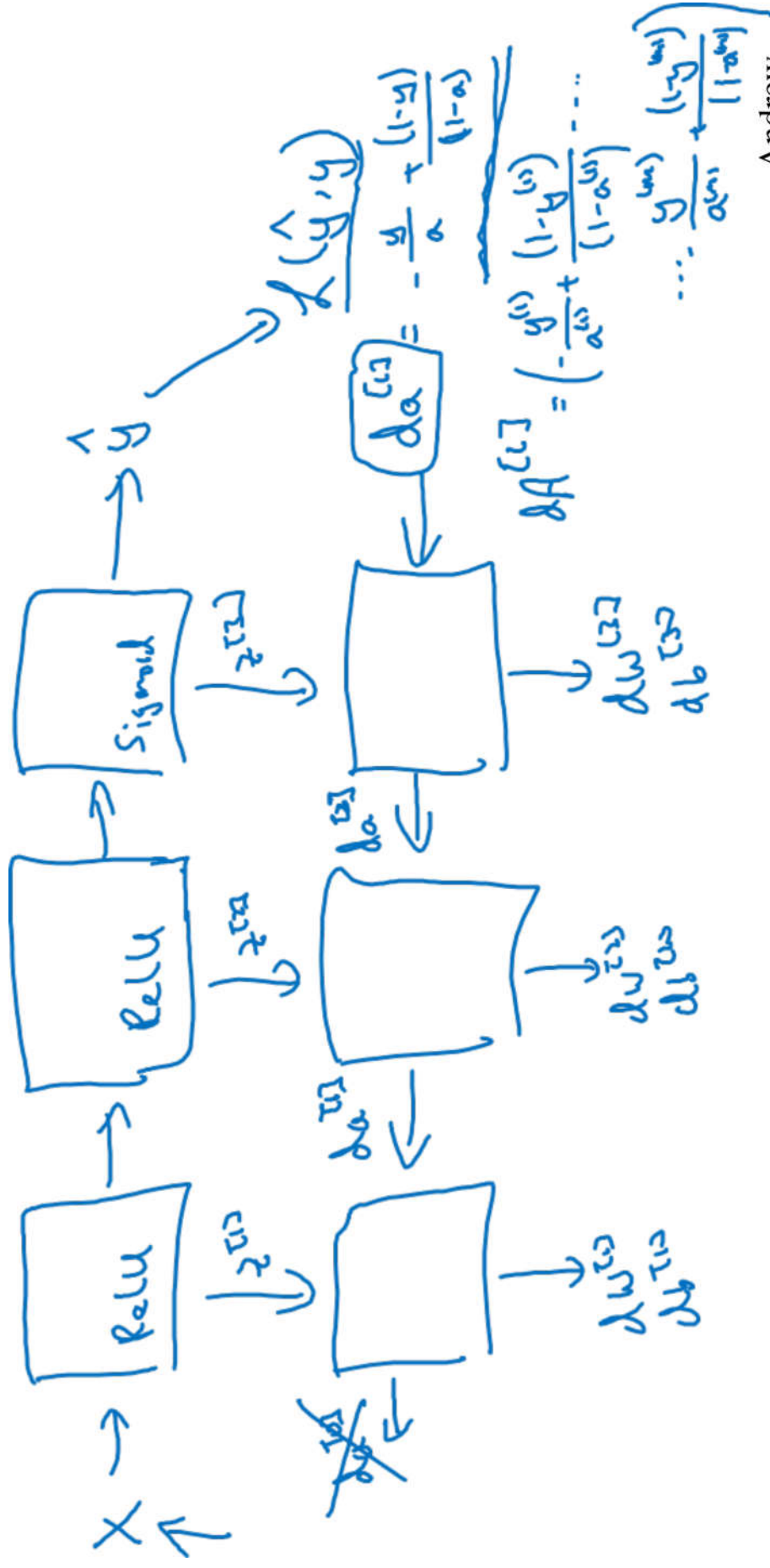


# Backward propagation for layer $l$

$$\begin{aligned}
 \frac{\partial z^{[l]}}{\partial z^{[l-1]}} &= \frac{\partial a^{[l]}}{\partial z^{[l-1]}} * g'(z^{[l]}) \\
 \frac{\partial w^{[l]}}{\partial z^{[l-1]}} &= \frac{\partial z^{[l]}}{\partial z^{[l-1]}} \cdot a^{[l-1]} \\
 \frac{\partial b^{[l]}}{\partial z^{[l-1]}} &= \frac{\partial z^{[l]}}{\partial z^{[l-1]}} \\
 \frac{\partial a^{[l-1]}}{\partial z^{[l-1]}} &= w^{[l]T} \cdot \frac{\partial z^{[l]}}{\partial z^{[l-1]}} \\
 \frac{\partial z^{[l]}}{\partial z^{[l-1]}} &= w^{[l+1]T} \frac{\partial z^{[l+1]}}{\partial z^{[l-1]}} * g'(z^{[l]})
 \end{aligned}$$

$$\begin{aligned}
 \frac{\partial z^{[l]}}{\partial z^{[l-1]}} &= \frac{\partial a^{[l]}}{\partial z^{[l-1]}} * g'(z^{[l]}) \\
 \frac{\partial w^{[l]}}{\partial z^{[l-1]}} &= \frac{1}{n} \frac{\partial z^{[l]}}{\partial z^{[l-1]}} \cdot A^{[l-1]T} \\
 \frac{\partial b^{[l]}}{\partial z^{[l-1]}} &= \frac{1}{n} \text{np.sum}(\frac{\partial z^{[l]}}{\partial z^{[l-1]}} \cdot \text{axis}=1, \text{keepdims}=\text{True}) \\
 \frac{\partial a^{[l-1]}}{\partial z^{[l-1]}} &= w^{[l]T} \cdot \frac{\partial z^{[l]}}{\partial z^{[l-1]}}
 \end{aligned}$$

# Summary



Andrew