



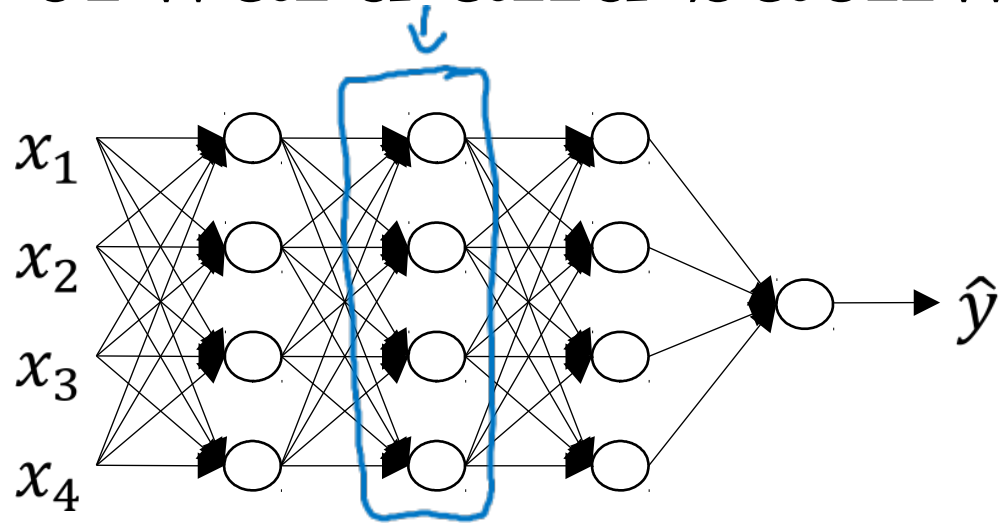
# Deep Neural Networks

---

**deeplearning.ai**

Building blocks of  
deep neural networks

# Forward and backward functions



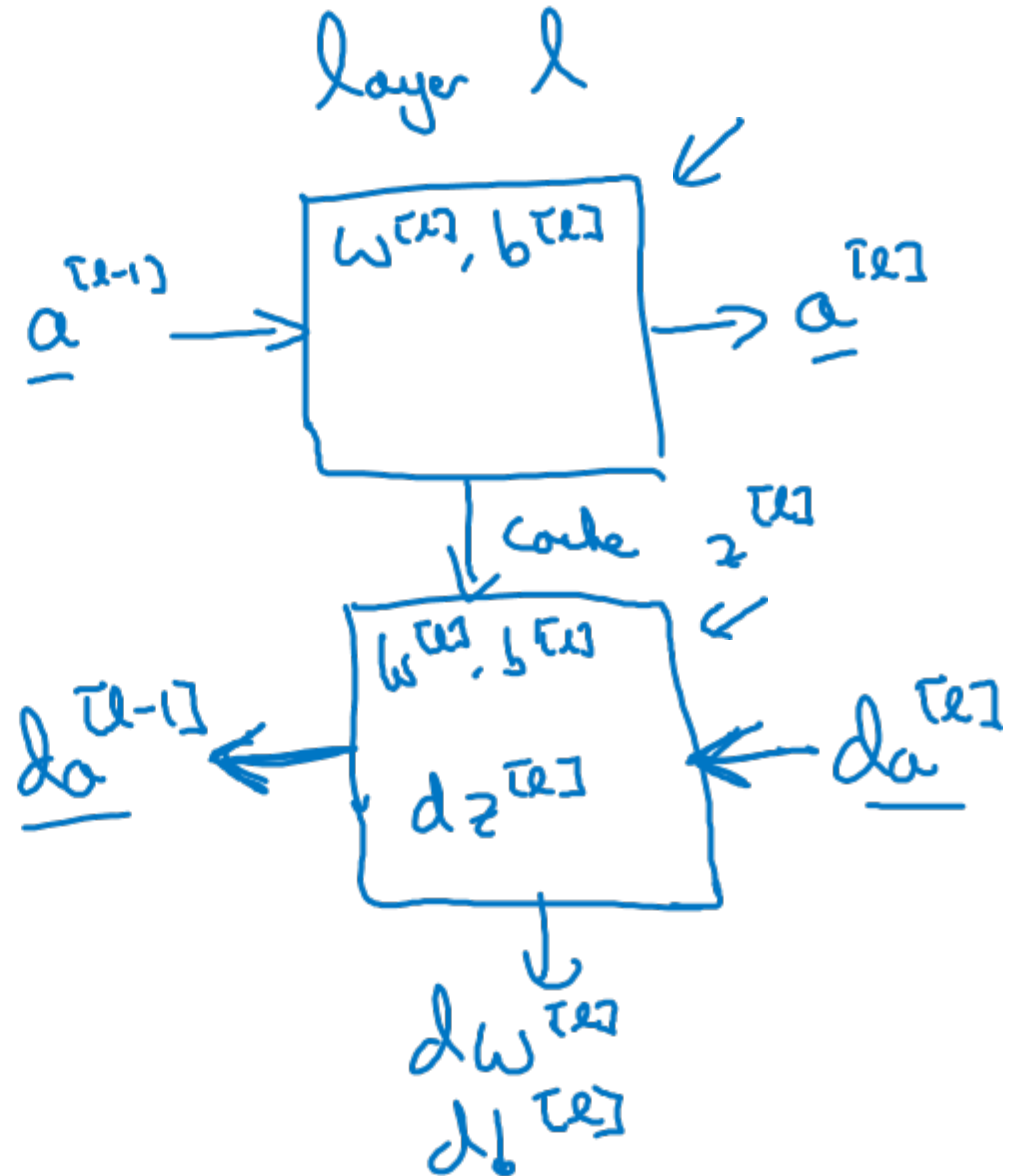
layer  $l$ :  $W^{[l]}, b^{[l]}$

→ Forward: Input  $a^{[l-1]}$ , output  $a^{[l]}$

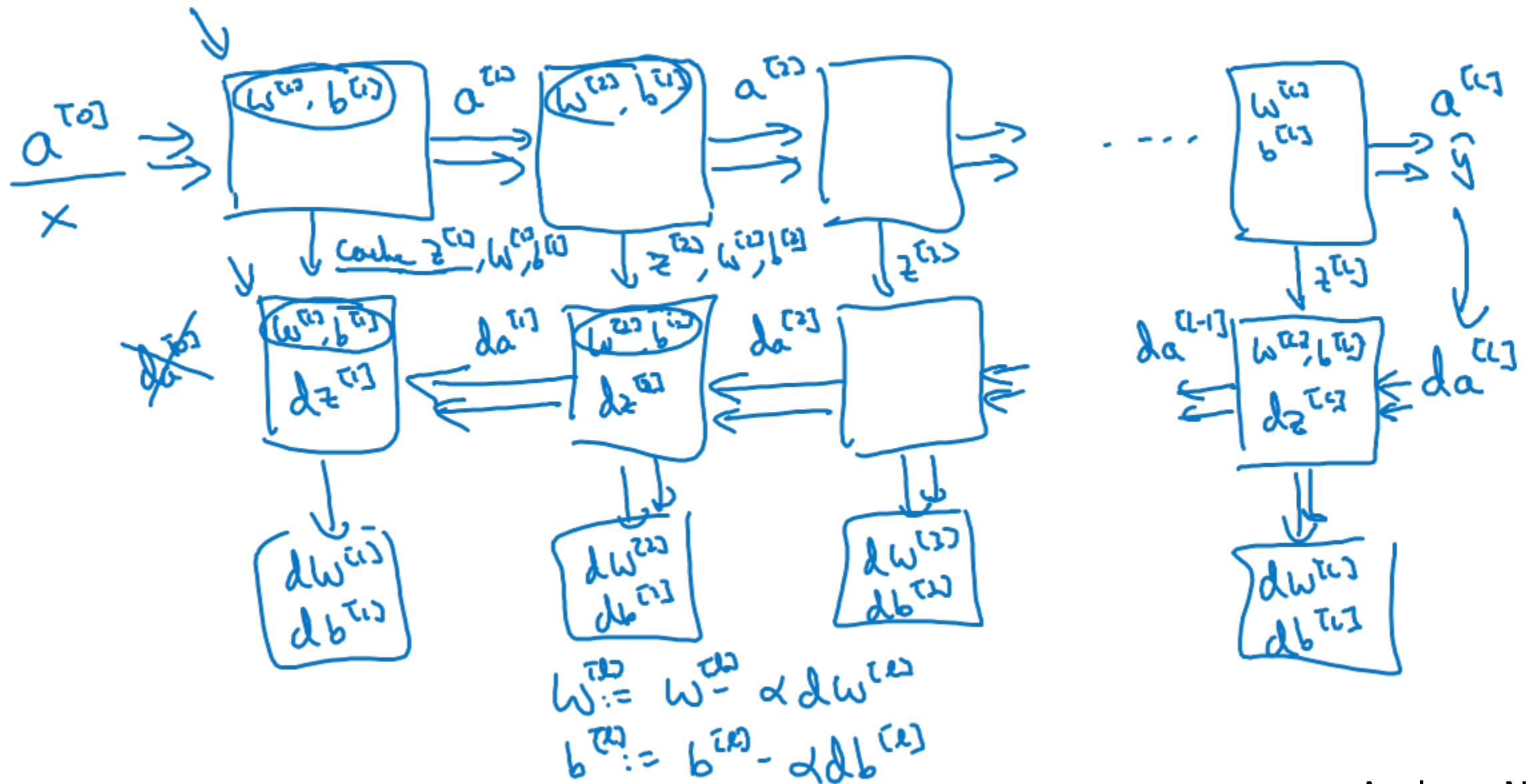
$$z^{[l]} = W^{[l]} a^{[l-1]} + b^{[l]} \quad \text{cache } z^{[l]}$$

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

→ Backward: Input  $da^{[l]}$ , output  $da^{[l-1]}$   
cache  $z^{[l]}$   
 $\frac{dW^{[l]}}{db^{[l]}}$



# Forward and backward functions





**deeplearning.ai**

# Deep Neural Networks

---

Forward and backward  
propagation

# Forward propagation for layer $l$

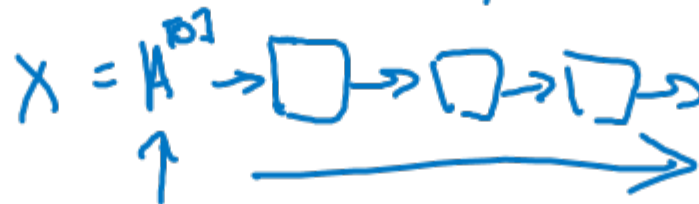
→ Input  $a^{[l-1]}$  ←

→ Output  $a^{[l]}$  ←  $W^{[l]}, b^{[l]}$

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

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

$a^{[0]}$   
 $A^{[0]}$



Verzweig:

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

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

# Backward propagation for layer $l$

→ Input  $a^{[l]}$

→ Output  $da^{[l-1]}$ ,  $dW^{[l]}$ ,  $db^{[l]}$

$$\begin{aligned}
 dz^{[l]} &= da^{[l]} * g^{[l]'}(z^{[l]}) \\
 dw^{[l]} &= dz^{[l]} \cdot \underline{a^{[l-1]}} \\
 db^{[l]} &= dz^{[l]} \\
 \underline{da^{[l-1]}} &= W^{[l]T} \cdot dz^{[l]} \\
 \underline{dz^{[l]}} &= W^{[l+1]T} dz^{[l+1]} * g^{[l+1]'}(z^{[l+1]})
 \end{aligned}$$

$$\begin{aligned}
 dz^{[l]} &= \underline{dA^{[l]}} * g^{[l]'}(z^{[l]}) \\
 \underline{dw^{[l]}} &= \frac{1}{n} dz^{[l]} \cdot A^{[l-1]T} \\
 \underline{db^{[l]}} &= \frac{1}{n} np.sum(dz^{[l]}, axis=1, keepdims=True) \\
 \underline{dA^{[l-1]}} &= W^{[l]T} \cdot dz^{[l]}
 \end{aligned}$$

# Summary

