

## Forward & Back Prop.

FORWARD

Input  $a^{[l-1]}$

Output  $a^{[l]}$ , cache  $(z^{[l]})$

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

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

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

Vectorised:

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

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

$a^{[0]}$

$A^{[0]}$

$$X = A^{[0]} \rightarrow \square \rightarrow \square \rightarrow \square \rightarrow$$

BACKWARD

Input  $da^{[l]}$

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

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

$$dW^{[l]} = dz^{[l]} a^{[l-1]}$$

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

$$da^{[l-1]} = W^{[l]T} dz^{[l]}$$

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

Vectorised:

$$dZ^{[l]} = dA^{[l-1]} * g^{[l]'}(Z^{[l]})$$

$$dW^{[l]} = \frac{1}{m} dZ^{[l]} A^{[l-1]T}$$

$$db^{[l]} = \frac{1}{m} \text{up.sum}(dZ^{[l]})$$

$$dA^{[l-1]} = W^{[l]T} dz^{[l]}$$

Summary:

