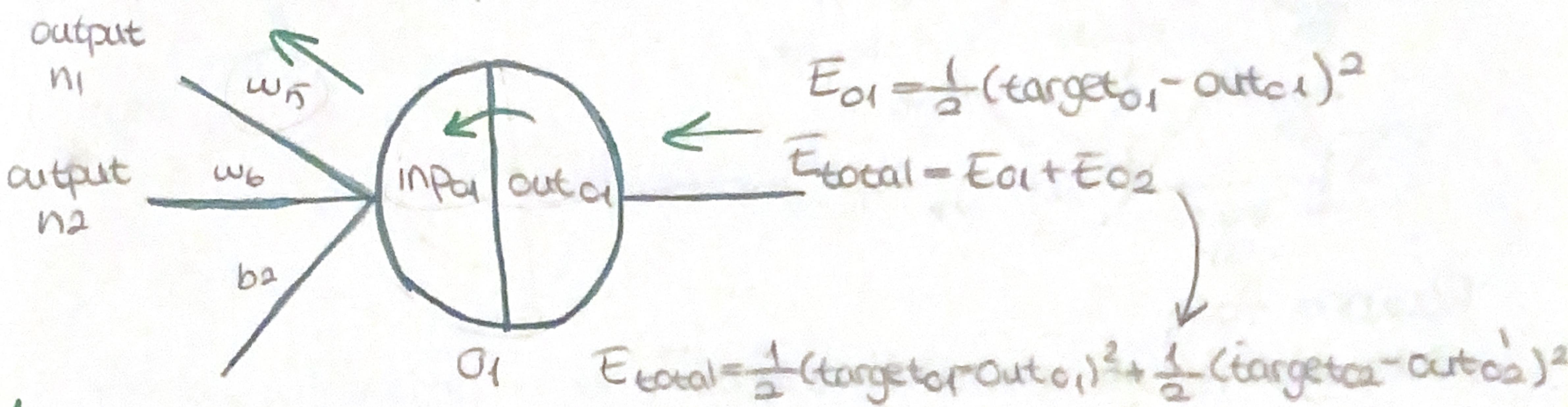


## Backprop + Chain Rule Visual

$$\frac{\partial \text{inp}_{01}}{\partial w_5} * \frac{\partial \text{out}_{01}}{\partial \text{inp}_{01}} * \frac{\partial E_{\text{total}}}{\partial \text{out}_{01}} = \frac{\partial E_{\text{total}}}{\partial w_5}$$



$$\frac{\partial E_{\text{total}}}{\partial \text{out}_{01}} = 2 * \frac{1}{2} (\text{target}_{01} - \text{out}_{01})^2 * (-1) + 0$$

$$= -(\text{target}_{01} - \text{out}_{01}) = 0.741$$

$$\frac{\text{out}_{01}}{\text{inp}} = \frac{1}{1 + e^{-\text{inp}}} \rightarrow \frac{\partial \text{out}_{01}}{\partial \text{inp}} = \text{out}_{01}(1 - \text{out}_{01}) = 0.186$$

$$3 \quad \text{inp}_{01} = w_5 * \text{out}_{n_1} + w_6 * \text{out}_{n_2} + b_2 * 1$$

$$\frac{\partial \text{inp}_{01}}{\partial w_5} = \text{out}_{n_1} = 0.593$$

$$\frac{\partial E_{\text{total}}}{\partial w_5} = \frac{\partial E_{\text{total}}}{\partial \text{out}_{01}} * \frac{\partial \text{out}_{01}}{\partial \text{inp}} * \frac{\partial \text{inp}_{01}}{\partial w_5} = 0.741 * 0.18 * 0.593 = 0.082$$

### Delta Rule

$$\frac{\partial E_{\text{total}}}{\partial w_5} = -(\text{target}_{01} - \text{out}_{01}) * \text{out}_{01}(1 - \text{out}_{01}) * \text{out}_{n_1} * \frac{\partial \text{out}_{01}}{\partial \text{inp}} * \frac{\partial \text{inp}_{01}}{\partial w_5}$$

Then update  $w := w - \alpha \frac{\partial J(w, b)}{\partial w}$

$$b := b - \alpha \cdot \frac{\partial J(w, b)}{\partial b}$$

