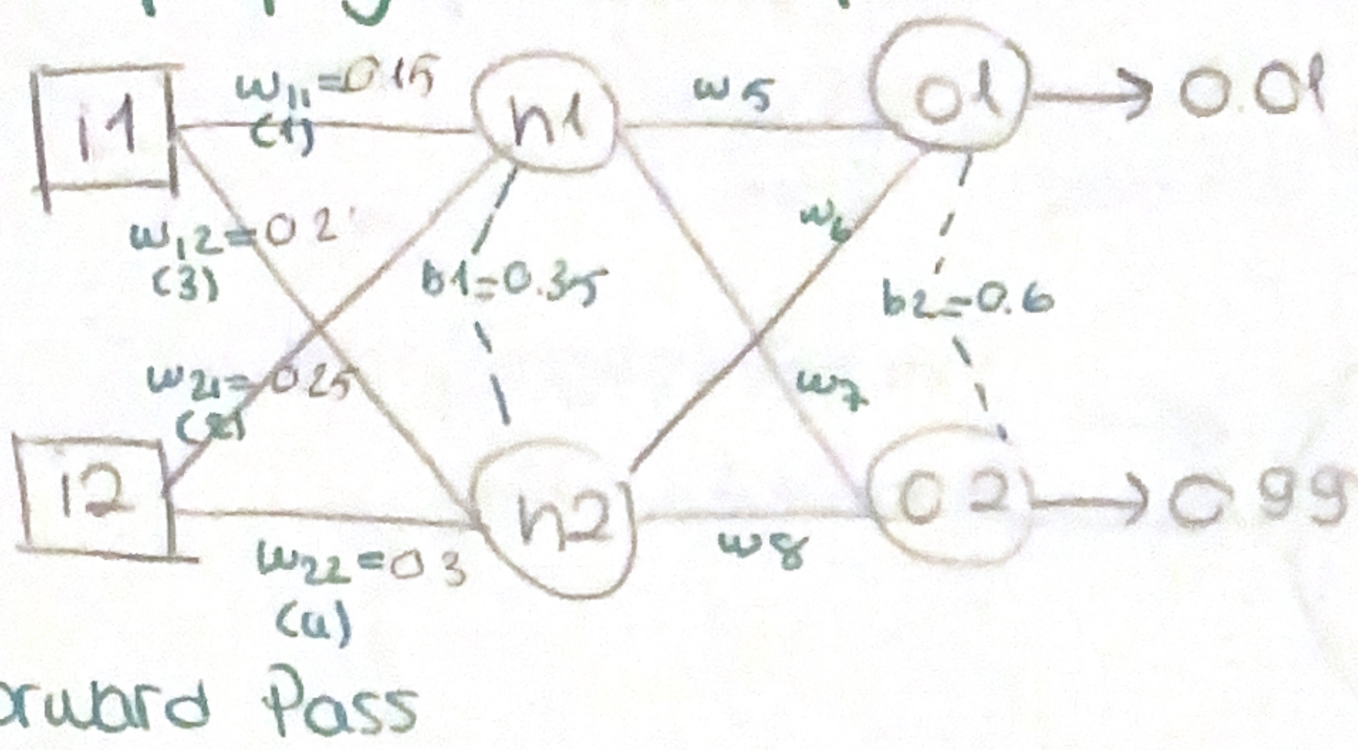
Backpropagation Example



$i_1 = 0.05$

$i_2 = 0.10$

$out_{o1} = g(input_{o1})$

Forward Pass

→ Input of h1: $w_1 \cdot i_1 + w_2 \cdot i_2 + b_1 = 0.15 * 0.05 + 0.2 * 0.1 + 0.35 = 0.3775$

← Output of h1: $\frac{1}{1+e^{-0.3775}} = 0.593$

← Output of h2: 0.596

→ Input of o1 : $w6 \times 0.596 + w5 \times 0593 + 0.6 = 1.105$

← Output of o1 = $\frac{1}{1+e^{-1.105}} = \boxed{0.751}$

← Output of o2 = $\boxed{0.772}$

Error Calculation

$$E_{total} = \sum \frac{1}{2} (target - output)^2$$

$$= \frac{1}{2}\left((0.01 - 0.751)^2 + (0.1 - 0.772)^2\right) = 0.298$$

↙ Total Error

Backward Pass

We want to know how much change in w5 affects total error $\left(\frac{\partial E_{total}}{\partial w_5}\right)$

Chain Rule

$$\frac{\partial E_{total}}{\partial w_5} = \frac{\partial E_{total}}{\partial out_{o1}} * \frac{\partial out_{o1}}{\partial input_{o1}} * \frac{\partial input_{o1}}{\partial w_5}$$