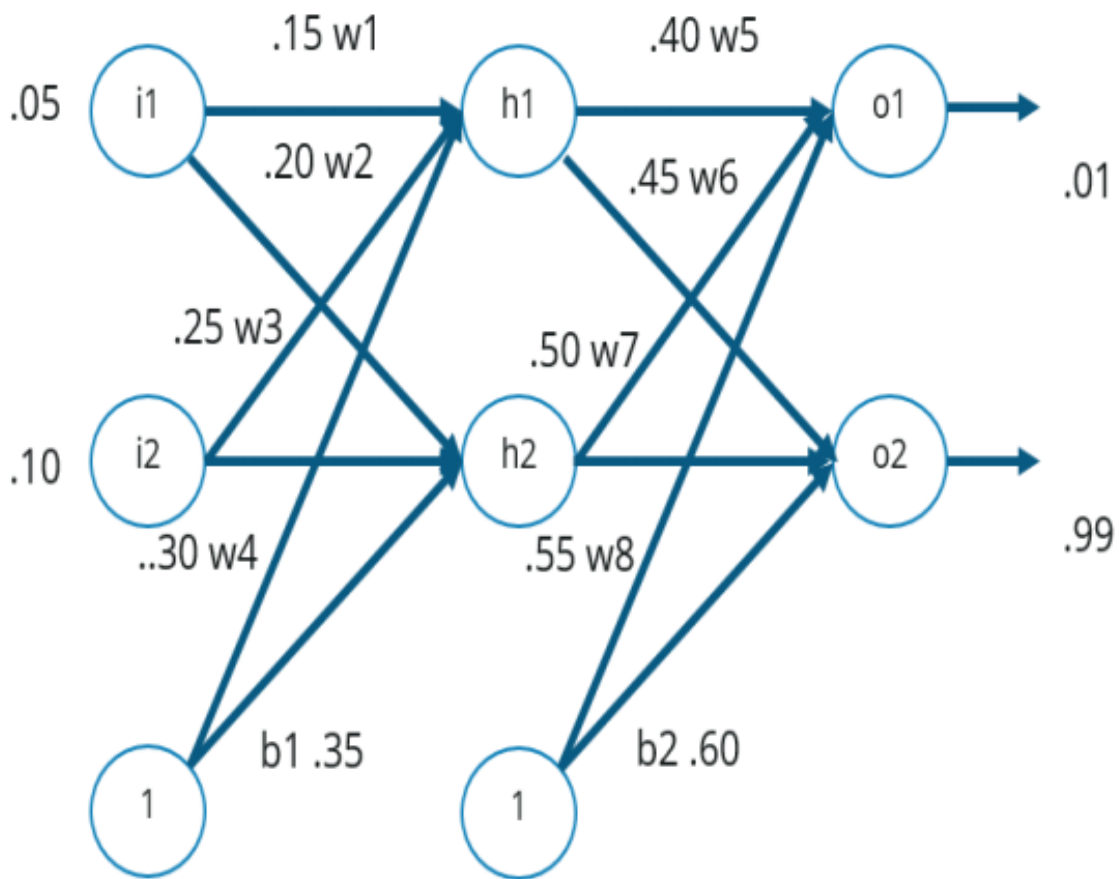


CSE 344: Computer Vision

Homework 17 ; Arka Sarkar 2018222

Question : Compute updated w_6 in the example discussed in the class.

Answer :



Calculations on next page :

① Forward Propagation

$$\text{net } h1 = 0.15 \times 0.05 + 0.2 \times 0.1 + 0.35 \times 1 = 0.3775$$

$$\text{out } h1 = \frac{1}{1 + e^{-0.3775}} = 0.593$$

$$\text{net } h2 = 0.25 \times 0.05 + 0.30 \times 0.1 + 0.25 \times 1 = 0.3925$$

$$\text{out } h2 = \frac{1}{1 + e^{-0.3925}} = 0.596$$

$$\text{net } o1 = 0.4 \times 0.593 + 0.45 \times 0.596 + 0.6 \times 1 = 1.105$$

$$\text{out } o1 = \frac{1}{1 + e^{-1.105}} = 0.751$$

$$\text{net } o2 = 0.5 \times 0.593 + 0.55 \times 0.596 + 0.6 \times 1 = 1.2243$$

$$\text{out } o2 = \frac{1}{1 + e^{-1.2243}} = 0.7728$$

④ Backward propagation

$$\frac{\partial E_{\text{total}}}{\partial w_6} = \frac{\partial E_{\text{total}}}{\partial \text{out } o1} \times \frac{\partial \text{out } o1}{\partial \text{net } o1} \times \frac{\partial \text{net } o1}{\partial w_6}$$

$$E_{\text{total}} = \frac{1}{2} (\text{target } o1 - \text{out } o1)^2 + \frac{1}{2} (\text{target } o2 - \text{out } o2)^2$$

$$\frac{\partial E_{\text{total}}}{\partial \text{out } o1} = -(\text{target } o1 - \text{out } o1) = -(0.01 - 0.751) = 0.741 \quad \text{--- (1)}$$

$$\frac{\partial \text{out } o1}{\partial \text{net } o1} = \text{out } o1 (1 - \text{out } o1) = 0.1969 \quad \text{--- (2)}$$

$$\frac{\partial \text{net } o1}{\partial w_6} = \frac{\partial (w_5 \times \text{outh1} + w_6 \times \text{outh2} + b_2 \times 1)}{\partial w_6}$$

$$\frac{\partial \text{net } o1}{\partial w_6} = 1 \times \text{outh2} = 0.596 \quad \text{--- (2)}$$

Using (1), (2) and (3):

$$\frac{\partial E_{\text{total}}}{\partial w_6} = \cancel{\text{error}} \times 0.741 \times 0.1869 \times 0.596$$

$$\boxed{\frac{\partial E_{\text{total}}}{\partial w_6} = 0.0825} \rightarrow \text{gradient.}$$

Updated weight.

$$w_b := w_6 - \eta \frac{\partial E_{\text{total}}}{\partial w_6}$$

$$\eta = 0.5$$

$$w_b := \cancel{w_6} \ 0.45 - 0.5 \times 0.0825$$

$$\boxed{w_b = 0.40875}$$

\rightarrow updated w_6

