Practice Problem 8

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Problem 1 — You pass in a training example that has the disease, and get outputs from all of the nodes as follows:

A1 = 0.2 B1 = 0.7 C1 = 0.4

A2 = 0.8 B2 = 0.5 C2 = 0.6

Backpropagate the error to adjust the indicated weight (w), using a learning rate of 1. What is the new w after backpropagation?

Answer

I'll label each edge starting from top to bottom then left to right for clarity.

$\frac{\partial E}{\partial w_3} = (\frac{\partial E}{\partial Y'1} \cdot \frac{\partial Y'1}{\partial net_{C1}} \cdot \frac{\partial net_{C1}}{\partial B1} + \frac{\partial E}{\partial Y'2} \cdot \frac{\partial Y'2}{\partial net_{C2}} \cdot \frac{\partial net_{C2}}{\partial B1}) \cdot \frac{\partial B1}{\partial net_{B1}} \cdot \frac{\partial net_{B1}}{\partial w_3}$

$\frac{\partial E}{\partial Y'1} = (Y'1 - Y)$

$\frac{\partial Y'1}{\partial net_{C1}} = Y'1(1 - Y'1)$

$\frac{\partial net_{C1}}{\partial B1} = w_7$

$\frac{\partial E}{\partial Y'2} = (Y'2 - Y)$

$\frac{\partial Y'2}{\partial net_{C2}} = Y'2(1 - Y'2)$

$\frac{\partial net_{C2}}{\partial B1} = w_8$

$\frac{\partial B1}{\partial net_{B1}} = B1(1 - B1)$

$\frac{\partial net_{B1}}{\partial w_3} = A2$

$\frac{\partial E}{\partial w_3} = ((0.4 - 0) \cdot 0.4(1 - 0.4) \cdot -0.4 + (0.6 - 1) \cdot 0.6(1 - 0.6) \cdot 0.7) \cdot 0.7(1 - 0.7) \cdot 0.2 = -0.0044352$

$w_3^{new} = w_3 - \alpha \frac{\partial E}{\partial w_3}$

$w_3^{new} = 0.3 - 1 \times -0.0044352 = 0.3044352$