



$$net_1 = w_1^1 x_1 + w_2^1 x_2 + w_3^1 x_3 + b_1^1 = (0.1 \times 0.3) + (0.2 \times 0.5) + (0.2 \times 0.6) + 0.2 = 0.49$$

$$\Rightarrow O_1^2 \Rightarrow \left. \begin{array}{l} \text{relu} \\ \text{net} \leq 0 \end{array} \right\} \Rightarrow O_2^1 = 0.49$$

$$w_{\text{neg}} = w_{12}^1 x_1 + w_{22}^1 x_2 + w_{32}^1 x_3 + b_2^1 = (0.4 \times 0.3) + (0.1 \times 0.5) + (0.2 \times 0.8) + 0.2 = 0.53$$

$$\Rightarrow \sigma_0^1 = 0.53$$

$$\Rightarrow \begin{aligned} \text{net}_3 &= w_{13}x_1 + w_{23}x_2 + w_{33}x_3 + b_3 = (0.1 \times 0.5) + (0.3 \times 0.5) + (0.1 \times 0.8) + 0.4 \\ &= 0.2 \times 0.5 + 0.3 \times 0.5 + 0.1 \times 0.8 + 0.4 \\ &= 0.1 + 0.15 + 0.08 + 0.4 \\ &= 0.73 \end{aligned}$$

$$+0.1 < 0.39 \Rightarrow 0_3 = 0.39$$

Question 2

$$MSE = \frac{1}{N} \sum_{i=1}^N (y_i - (w x_i + b))^2$$

$$\frac{\partial MSE}{\partial w} = -\frac{2}{N} \sum_{i=1}^N x_i (y_i - (w x_i + b)) \Rightarrow \frac{\partial MSE}{\partial w}$$

$$= -\frac{2}{3} [1.3 \times (2.7 - (1.5 \times 1.3 + 0.5)) + 2.1 \times (4.5 - (1.5 \times 2.1 + 0.5))]$$

$$+ 7.6 \times (14.9 - (1.6 \times 7.6 + 0.5))] = -\frac{2}{3} [0.325 + 1.785 + 22.8]$$

$$= -16.606$$

$$w_{new} = w_{old} - \alpha \frac{\partial MSE}{\partial w} = 1.5 - 0.1 \times (-16.606) = 3.1606$$

$$\Rightarrow w_{new} \approx 3.1606$$

$$\frac{\partial MSE}{\partial b} = -\frac{2}{N} \sum_{i=1}^N (y_i - (w x_i + b)) \Rightarrow \frac{\partial MSE}{\partial b} = -\frac{2}{3} [0.7 - (2.5 \times 1.3 + 0.5)]$$

$$+ (4.5 - (1.3 \times 2.1 + 0.5)) + (14.9 - (1.5 \times 7.6 + 0.5)) = -\frac{2}{3} [0.25 + 0.85 + 9] = -2.733$$

$$b_{new} = b_{old} - \alpha \frac{\partial MSE}{\partial b} = 0.5 - 0.1 \times (-2.733) = 1.3665$$

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$$b_{new} = 1.3665$$