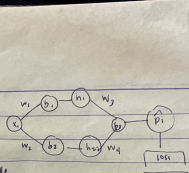
Olympia, Franchesska L. BSCS-ML 04-08-2025

1.) $\frac{d\,loss}{dw_4} = \frac{d\,loss}{d\hat{p}_i} \times \frac{d\hat{p}_i}{dw_4}$




$loss = \sum (y_i - \hat{p}_i)^2$

$\frac{d\hat{p}_i}{dw_4} \cdot \frac{dw_4}{dw_4}$ // chain rule

$= \sum -2(y_i - \hat{p}_i) \times 1 \times h_2$

$\left(\frac{d}{dw_4}(h_1w_3 + h_2w_4 + b_3)\right)$ // constants

$= h_2$

$h_2 = \ln(1 + e^{z_2})$

$\frac{d}{dx} = \ln(y) = \frac{1}{y}$

$\frac{d}{dx} e^x = e^x$

2.) $\frac{d\,loss}{db_2} = \frac{d\,loss}{d\hat{p}_i} \times \frac{d\hat{p}_i}{dh_{2i}} \times \frac{dh_{2i}}{dz_2} \times \frac{dz_2}{db_2}$

$= \sum -2(y_i - \hat{p}_i) \times 1 \times$

$\frac{d\,loss}{d\hat{p}_i} = \sum -2(y_i - \hat{p}_i) \times 1$

$\frac{d\hat{p}_i}{dh_{2i}} = h_2w_4 + h_1w_3 + b_3$

$\frac{dh_{2i}}{dz_2} = \frac{d}{dx} = \ln(1 + e^{z_2})$

$f(x) = \frac{1}{1+e^{z_2}} = \frac{1}{1+e^{z_2}} \cdot \frac{e^{z_2}}{1} = \frac{e^{z_2}}{1+e^{z_2}}$

$f(x) = \ln(1+e^{z_2})$, $g(x) = 1 + e^{z_2}$

$g(x) = e^{z_2}$

$\frac{dz_2}{db_2} = \frac{d}{db_2} w_2h_1 + b_2 = 1$

$\frac{d\,loss}{db_2} = \sum -2(y_i - \hat{p}_i) \times 1 \times w_4 \times \frac{e^{z_2}}{1+e^{z_2}} \times 1$