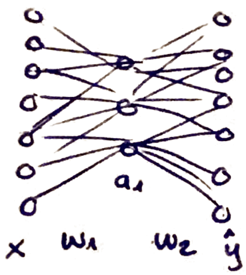

$$w_1 \begin{bmatrix} w_{1,1} \\ w_{1,2} \\ w_{1,3} \end{bmatrix} \qquad w_2 = \begin{bmatrix} w_{2,1} \\ w_{2,2} \\ w_{2,3} \end{bmatrix}$$

$$X = [x_1, x_2, x_3, x_4, x_5, x_6, x_7]$$

$$a_1 = \sigma(w_1 X + b_1) \quad \begin{bmatrix} a_{1,1} \\ a_{1,2} \\ a_{1,3} \end{bmatrix}$$

$$\hat{y} = \sum w_2 a_1 + b_2$$

$$\frac{\partial J}{\partial w_2} = \frac{\partial J}{\partial w_2} \frac{1}{2n} \sum (y - \hat{y})^2 = \frac{\partial J}{\partial \hat{y}} \frac{\partial \hat{y}}{\partial w_2}$$

$$\frac{\partial J}{\partial \hat{y}} = \frac{1}{n} \sum (y - \hat{y}) \cdot \frac{\partial \hat{y}}{\partial w_2} (y - \sum w_2 a_1 + b_2)$$

$$\frac{\partial J}{\partial w_2} = \frac{1}{n} \sum \left[(\hat{y} - y)\, \sigma(w_1 X + b_1) \right]$$

$$\frac{\partial J}{\partial b_2} = \frac{\partial J}{\partial \hat{y}} \frac{\partial \hat{y}}{\partial b_2} = \frac{1}{n} \sum (y - \hat{y})$$

$$\frac{\partial J}{\partial w_1} = \frac{\partial J}{\partial \hat{y}} \frac{\partial \hat{y}}{\partial a_1} \frac{\partial a_1}{\partial w_1}$$

$$\frac{\partial \hat{y}}{\partial a_1} = \left[\sigma(w_1 X + b_1)(1 - \sigma(w_1 X + b_1)) \right] w_2$$

$$\frac{\partial a_1}{\partial w_1} = X$$

$$\frac{\partial J}{\partial w_1} = \frac{1}{n} \sum (y - \hat{y}) \left[\sigma(w_1 X + b_1)(1 - \sigma(w_1 X + b_1)) \right] w_2 X$$

$$\frac{\partial J}{\partial b_1} = \frac{\partial J}{\partial \hat{y}} \frac{\partial \hat{y}}{\partial a_1} \frac{\partial a_1}{\partial b_1}$$

$$= \frac{1}{n} \sum (y - \hat{y}) \left[\sigma(w_1 X + b_1)(1 - \sigma(w_1 X + b_1)) \right] w_2$$