

$$\frac{\partial Cost}{\partial w_{jk}^{(4)}} = \frac{\partial Cost}{\partial a_j^{(4)}} * \frac{\partial a_j^{(4)}}{\partial z_j^{(4)}} * \frac{\partial z_j^{(4)}}{\partial w_{jk}^{(4)}} = (2a_j^{(4)} - 2y_j) * \sigma'(z_j^{(4)}) * a_k^{(3)}$$

$$\frac{\partial Cost}{\partial b_j^{(4)}} = \frac{\partial Cost}{\partial a_j^{(4)}} * \frac{\partial a_j^{(4)}}{\partial z_j^{(4)}} * \frac{\partial z_j^{(4)}}{\partial b_j^{(4)}} = (2a_j^{(4)} - 2y_j) * \sigma'(z_j^{(4)}) * 1$$

$$\frac{\partial Cost}{\partial a_k^{(3)}} = \sum_{j=0}^{n_4-1} \left(\frac{\partial Cost}{\partial a_j^{(4)}} * \frac{\partial a_j^{(4)}}{\partial z_j^{(4)}} * \frac{\partial z_j^{(4)}}{\partial a_k^{(3)}} \right) = \sum_{j=0}^{n_4-1} \left((2a_j^{(4)} - 2y_j) * \sigma'(z_j^{(4)}) * w_{jk}^{(4)} \right)$$

$$\frac{\partial Cost}{\partial w_{km}^{(3)}} = \frac{\partial Cost}{\partial a_k^{(3)}} * \frac{\partial a_k^{(3)}}{\partial z_k^{(3)}} * \frac{\partial z_k^{(3)}}{\partial w_{km}^{(3)}} = \frac{\partial Cost}{\partial a_k^{(3)}} * \sigma'(z_k^{(3)}) * a_m^{(2)}$$

$$\frac{\partial Cost}{\partial b_k^{(3)}} = \frac{\partial Cost}{\partial a_k^{(3)}} * \frac{\partial a_k^{(3)}}{\partial z_k^{(3)}} * \frac{\partial z_k^{(3)}}{\partial b_k^{(3)}} = \frac{\partial Cost}{\partial a_k^{(3)}} * \sigma'(z_k^{(3)}) * 1$$

$$\frac{\partial Cost}{\partial a_m^{(2)}} = \sum_{k=0}^{n_3-1} \left(\frac{\partial Cost}{\partial a_k^{(3)}} * \frac{\partial a_k^{(3)}}{\partial z_k^{(3)}} * \frac{\partial z_k^{(3)}}{\partial a_m^{(2)}} \right) = \sum_{k=0}^{n_3-1} \left(\frac{\partial Cost}{\partial a_k^{(3)}} * \sigma'(z_k^{(3)}) * w_{km}^{(3)} \right)$$

$$\frac{\partial Cost}{\partial w_{mt}^{(2)}} = \frac{\partial Cost}{\partial a_m^{(2)}} * \frac{\partial a_m^{(2)}}{\partial z_m^{(2)}} * \frac{\partial z_m^{(2)}}{\partial w_{mt}^{(2)}} = \frac{\partial Cost}{\partial a_m^{(2)}} * \sigma'(z_m^{(2)}) * a_t^{(1)}$$

$$\frac{\partial Cost}{\partial b_m^{(2)}} = \frac{\partial Cost}{\partial a_m^{(2)}} * \frac{\partial a_m^{(2)}}{\partial z_m^{(2)}} * \frac{\partial z_m^{(2)}}{\partial b_m^{(2)}} = \frac{\partial Cost}{\partial a_m^{(2)}} * \sigma'(z_m^{(2)}) * 1$$