

2. Want to show that: $\frac{\partial J}{\partial w_{ij}^l} = a_j^l \delta_i^{l+1}$

By definition: $\delta_i^{l+1} = \frac{\partial J}{\partial z_i^{l+1}}$

Noting: $z_i^{l+1} = \sum_k w_{ik}^l a_k^l + b_i^l$

Using Chain Rule:

$$\frac{\partial J}{\partial w_{ij}^l} = \frac{\partial J}{\partial z_i^{l+1}} \cdot \frac{\partial z_i^{l+1}}{\partial w_{ij}^l} = \frac{\partial J}{\partial z_i^{l+1}} \cdot a_j^l = a_j^l \delta_i^{l+1}$$

$$\therefore \frac{\partial J}{\partial w_{ij}^l} = a_j^l \delta_i^{l+1} = a_j^l \frac{\partial J}{\partial z_i^{l+1}}$$