Assignment Hw1 -p5

Understanding Backpropagation Equations from Michael A. Nielson

Assignment HW1-P5

Back-Propagation eqn :-

we know BP1 $\delta_j^L = \frac{\partial C}{\partial a_j^L} \sigma'(z_j^L)$ ...

BP2 $\delta^l = ((w^{l+1})^T \delta^{l+1}) \odot \sigma'(z^l)$,

$\therefore$ BP1 a $\delta^L = \nabla_a C \odot \sigma'(z^L)$

~~BP1a~~

BP3

$$\frac{\partial C}{\partial b_j^l} = \Sigma_k \frac{\partial C}{\partial z_k^l} \cdot \frac{\partial z_k^l}{\partial b_j^l} = \boxed{\frac{\partial C}{\partial z_j^l} = \sigma_j^l}$$

we know that ~~it~~

$$z_m^l = \Sigma_n w_{mn}^L a_n^{l-1} + b_m^l$$

and $\frac{\partial z_K^L}{\partial b_j^l} = \frac{\partial C}{\partial z_j^l}$ is 1 only when $k = j$ ~~of~~ otherwise its 0.

Hence BP3

~~δl~~ $\boxed{\delta_j^L = \frac{\partial C}{\partial z_j^l} = \frac{\partial C}{\partial b_j^l}}$ ... BP3

BP4 $$\frac{\partial C}{\partial w^l_{jk}} = \Sigma_m \frac{\partial C}{\partial z^l_m} \cdot \frac{\partial z^l_m}{\partial w^l_{jk}}$$

because

$$z^l_m = \Sigma_n w^l_{mn} a^{l-1}_n + b^l_m$$

and when and only when $m=j$, $n=k$ the derivative is not 0,

$$\therefore \frac{\partial C}{\partial w^l_{jk}} = \frac{\partial C}{\partial z^l_j} \cdot a^{l-1}_k = \delta^l_j a^{l-1}_k$$

$$\boxed{\frac{\partial C}{\partial w^l_{jk}} = \cancel{\delta} . a^{l-1}_k \delta^l_j} \quad \text{---- BP4}$$