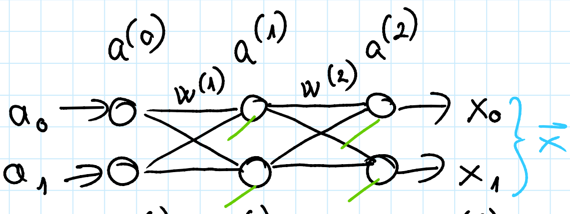
Network 2

Tuesday, May 31, 2022 16:29



expect: $\left.\begin{matrix} y_0 \\ y_1 \end{matrix}\right\} \vec{y}$

$$w^{(1)} = \begin{bmatrix} w^{(1)}_{1,1} & w^{(1)}_{1,2} \\ w^{(1)}_{2,1} & w^{(1)}_{2,2} \end{bmatrix} \qquad w^{(2)} = \begin{bmatrix} w^{(2)}_{1,1} & w^{(2)}_{1,1} \\ w^{(2)}_{2,1} & w^{(2)}_{2,2} \end{bmatrix}$$

$$b^{(1)} = \begin{bmatrix} b^{(1)}_1 \\ b^{(1)}_1 \end{bmatrix} \qquad b^{(2)} = \begin{bmatrix} b^{(2)}_1 \\ b^{(2)}_2 \end{bmatrix}$$

$$E^{(0)}(w^{(1)}, \vec{b}^{(1)}, w^{(2)}, \vec{b}^{(2)}) = (\vec{x}^{(0)} - \vec{y}^{(0)})^2 =$$

$$\begin{bmatrix} x^{(0)}_0 - y^{(0)}_0 \\ x^{(0)}_1 - y^{(0)}_1 \end{bmatrix}$$

$$= (\vec{x}^{(0)} - \vec{y}^{(0)}) \cdot (\vec{x}^{(0)} - \vec{y}^{(0)}) =$$

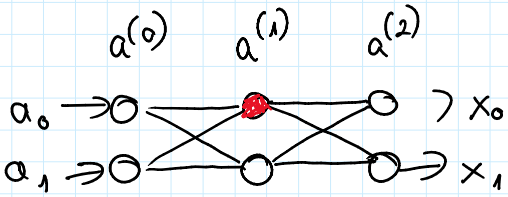
$$= (x^{(0)}_0 - y^{(0)}_0)^2 + (x^{(0)}_1 - y^{(0)}_1)^2$$

$$\partial_{x^{(0)}_0} E^{(0)} = 2(x^{(0)}_0 - y^{(0)}_0) \qquad \partial_{x^{(0)}_1} E^{(0)} = 2(x^{(0)}_1 - y^{(0)}_1)$$

↳ change to $a^{(L)}_0$ ↳ change to $a^{(L)}_1$

$$a^{(L)}_0 = \sigma(z^{(L)}_0)$$

$$z^{(L)}_0 = w^{(L)}_{0,0} a^{(L-1)}_0 + w^{(L)}_{0,1} a^{(L-1)}_1 + b^{(L)}_0$$



How much should $a^{(1)}_0$ change? We know how much $z^{(2)}_0$ and $z^{(2)}_1$ should change.

$$E^{(0)} = (x^{(0)}_0 - y^{(0)}_0)^2 + (x^{(0)}_1 - y^{(0)}_1)^2 = (a^{(2)}_0 - y^{(0)}_0)^2 + (a^{(2)}_1 - y^{(0)}_1)^2$$

$$= (\sigma(z^{(2)}_0) - y^{(0)}_0)^2 + (\sigma(z^{(2)}_1) - y^{(0)}_1)^2$$

$$= (\sigma(w^{(2)}_{0,0} a^{(1)}_0 + \dots) - y^{(0)}_0)^2 + (\sigma(w^{(2)}_{1,0} a^{(1)}_0 + \dots) - y^{(0)}_1)^2$$

$$\partial_{a^{(1)}_0} E^{(0)} = \Delta^{(2)}_0 \cdot w^{(2)}_{0,0} + \Delta^{(2)}_1 \cdot w^{(2)}_{0,1} = \Delta^{(2)} \cdot w^{(2)}_0 \qquad \Delta^{(1)} = \begin{bmatrix} \Delta^{(2)} \cdot w^{(2)}_0 \\ \Delta^{(2)} \cdot w^{(2)}_1 \end{bmatrix}$$