$$z^{(0)}(i) = a^{(0)} x^{(0)} + b^{(0)}$$

$$a^{(1)(i)} = \sigma(z^{(1)(i)}) = \sigma(z^{(0)(i)})$$

$$z^{(2)(i)} = a^{(1)} z^{(1)(i)} + b^{(2)}$$

$$a^{(2)(i)} = \sigma(z^{(2)(i)}) = \sigma(z^{(1)(i)})$$

$$a^{(3)(i)} = \sigma(z^{(3)(i)}) = \sigma(z^{(2)(i)})$$

$$z^{(4)(i)} = a^{(3)} z^{(3)(i)} + b^{(4)}$$

$$a^{(4)(i)} = \sigma(z^{(4)(i)}) = \sigma(z^{(3)(i)})$$

$$y^{(i)} = a^{(4)} z^{(4)(i)}$$
\[ y_i \approx y_i^{(i)} \quad \forall \ i \in 1..N \]

Do this by adjusting parameters \( y \in [0,1]^3 \)

\[
L(\hat{y}, y) = y \log(\hat{y}) + (1 - y) \log(1 - \hat{y})
\]

\[
\frac{\partial L}{\partial w^{(2)}} = \frac{\partial L}{\partial \hat{y}} \cdot \frac{\partial \hat{y}}{\partial z^{(2)}} \cdot \frac{\partial z^{(2)}}{\partial w^{(2)}}
\]

1. \[
\frac{\partial}{\partial \hat{y}} y \log(\hat{y}) + (1 - y) \log(1 - \hat{y}) = \frac{y}{\hat{y}} - \frac{1 - y}{1 - \hat{y}}
\]

2. \[
\frac{\partial}{\partial z^{(2)}} \sigma(z^{(2)}) = \sigma(z^{(2)})(1 - \sigma(z^{(2)}))
\]

3. \[
\frac{\partial}{\partial w^{(2)}} a^{(1)} w^{(2\rightarrow 1)} + b^{(2)} = a^{(1)}
\]

4. \[
\frac{\partial L}{\partial b^{(2)}} = \frac{\partial L}{\partial \hat{y}} \cdot \frac{\partial \hat{y}}{\partial z^{(2)}} \cdot \frac{\partial z^{(2)}}{\partial b^{(2)}}
\]

5. \[
\frac{\partial}{\partial b^{(2)}} a^{(1)} w^{(2\rightarrow 1)} + b^{(2)} = 1
\]
\[
\frac{\partial y}{\partial w_0} = -\frac{\partial y}{\partial w_0} \cdot \frac{\partial y}{\partial w} \cdot \frac{\partial y}{\partial z} \cdot \frac{\partial z}{\partial c_0} \cdot \frac{\partial a}{\partial c_0} \cdot \frac{\partial z}{\partial w_0}
\]

6. \[\frac{\partial w_0}{\partial a} c_0 w_0 + b c_0 = w c_0\]

2. \[\frac{\partial a}{\partial z} c_0 = a c_0 (1 - a c_0)\]

6. \[\frac{\partial a}{\partial w_0} c_0 w_0 + b c_0 = a c_0\]

\[\frac{\partial y}{\partial b c_0} = z c_0\]