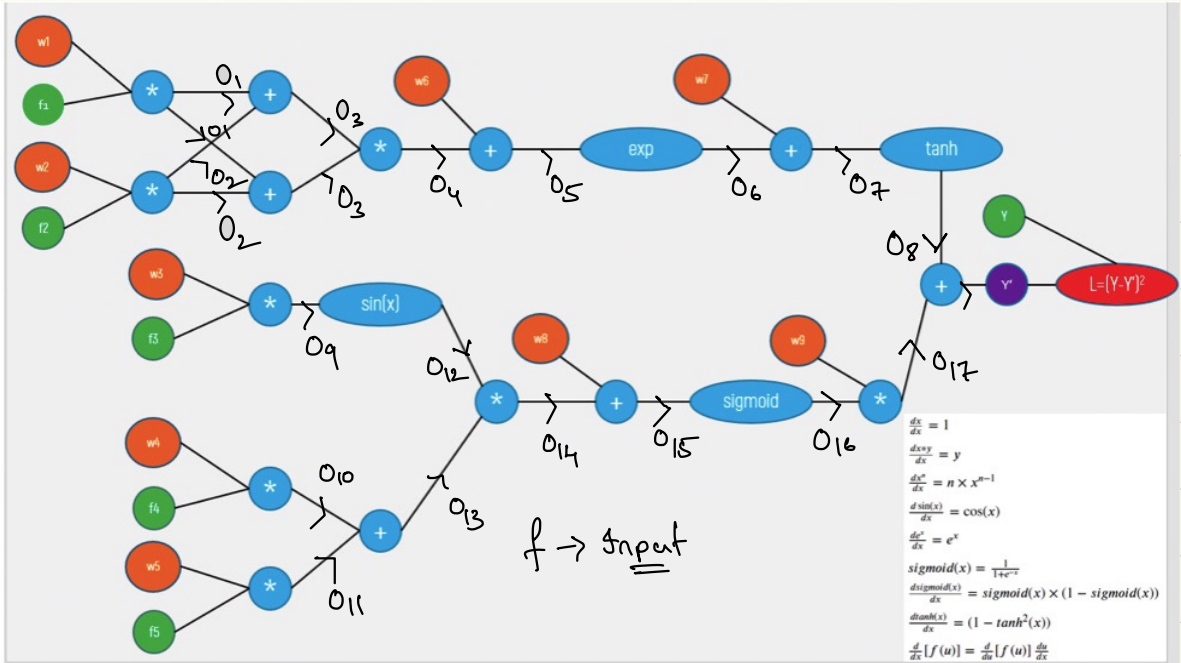

$\frac{dx}{dx} = 1$

$\frac{dxy}{dx} = y$

$\frac{dx^n}{dx} = n \times x^{n-1}$

$\frac{d\sin(x)}{dx} = \cos(x)$

$\frac{de^x}{dx} = e^x$

$sigmoid(x) = \frac{1}{1+e^{-x}}$

$\frac{dsigmoid(x)}{dx} = sigmoid(x) \times (1 - sigmoid(x))$

$\frac{d\tanh(x)}{dx} = (1 - \tanh^2(x))$

$\frac{d}{dx}[f(u)] = \frac{d}{du}[f(u)]\frac{du}{dx}$

$$\frac{\partial L}{\partial w_1} = \frac{\partial L}{\partial o_8} \cdot \frac{\partial o_8}{\partial o_7} \cdot \frac{\partial o_7}{\partial o_6} \cdot \frac{\partial o_6}{\partial o_5} \cdot \frac{\partial o_5}{\partial o_4} \left(\frac{\partial o_4}{\partial o_3} \cdot \frac{\partial o_3}{\partial o_1} \right) \frac{\partial o_1}{\partial w_1}$$

1) $\frac{\partial (y - o_8 - o_{17})^2}{\partial o_8} = -2\left(y - o_8 - o_{17}\right)$

2) $\frac{\partial o_8}{\partial o_7} = \frac{d}{do_7}(\tanh o_7) = 1 - \tanh^2(o_7)$

3) $\frac{\partial o_7}{\partial o_6} = 1$

4) $\frac{\partial o_6}{\partial o_5} = e^{o_5} \Rightarrow o_6$

5) $\frac{\partial o_5}{\partial o_4} = 1$

6) $\frac{\partial o_4}{\partial o_3} = \frac{do_3^2}{do_3} = 2o_3$

7) $\frac{\partial o_3}{\partial o_1} = 1$

8) $\frac{\partial o_1}{\partial w_1} = f_1$

remaining derivatives

$$\frac{\partial o_3}{\partial o_2} = 1$$

$$\frac{\partial o_2}{\partial w_2} = f_2$$

$$\frac{\partial L}{\partial w_2} = \frac{\partial L}{\partial o_{17}} \frac{\partial o_{17}}{\partial o_{16}} \frac{\partial o_{16}}{\partial o_{15}} \frac{\partial o_{15}}{\partial o_{14}} \frac{\partial o_{14}}{\partial o_{12}} \cdot \frac{\partial o_{12}}{\partial o_9} \frac{\partial o_9}{\partial w_3}$$

$\frac{\partial L}{\partial o_{17}} = -2(y - o_8 - o_{17})$

$\frac{\partial o_{17}}{\partial o_{16}} = w_9$

$\frac{\partial o_{16}}{\partial o_{15}} = \frac{\partial(sig(o_{15}))}{\partial o_{15}} = sig(o_{15})(1 - sig(o_{15}))$

$\frac{\partial o_{15}}{\partial o_{14}} = 1$

$\frac{\partial o_{14}}{\partial o_{12}} = o_{13}$

$\frac{\partial o_{12}}{\partial o_9} = \cos(o_9)$

$\frac{\partial o_9}{\partial w_3} = f_3$

remaining derivatives

$\frac{\partial o_{14}}{\partial o_{13}} = o_{12}$

$\frac{\partial o_{13}}{\partial o_{11}} = 1$

$\frac{\partial o_{13}}{\partial o_{10}} = 1$

$\frac{\partial o_{10}}{\partial w_4} = f_4$

$\frac{\partial o_{11}}{\partial w_5} = f_5$