Calculate $\frac{\partial L}{\partial w_1}$

$$\frac{\partial L}{\partial w_1} = \frac{\partial L}{\partial \hat{y}} \times \frac{\partial \hat{y}}{\partial z'} \times \frac{\partial z'}{\partial z} \times \frac{\partial z}{\partial w_1}$$

$$L = -\left[y \log \hat{y} + (1-y) \log (1-\hat{y})\right]$$

$$\frac{\partial L}{\partial \hat{y}} = -\left[\frac{y}{\hat{y}} + \frac{(1-y)}{(1-\hat{y})}(-1)\right]$$

$$\left[\frac{\partial L}{\partial \hat{y}} = -\left[\frac{y}{\hat{y}} - \frac{1-y}{1-\hat{y}}\right]\right] \quad — ①$$

$$\hat{y} = \sigma(z') = \frac{1}{1+e^{-z}}$$

$$\left[\frac{\partial \hat{y}}{\partial z'} = \frac{e^{-z'}}{(1+e^{-z'})^2}\right] \quad — ②$$

$$z' = z \cdot w_2 + b_2$$

$$\left[\frac{\partial z'}{\partial z} = w_2\right] \quad — ③$$

$$z = x \cdot w_1 + b_1$$

$$\left[\frac{\partial z}{\partial w_1} = x\right] \quad — ④$$

$$\frac{\partial L}{\partial w_1} = -\left[\frac{y}{\hat{y}} - \frac{(1-y)}{(1-\hat{y})}\right]\left[\frac{e^{-z'}}{(1+e^{-z'})^2}\right]\left[w_2\right]\left[x\right]$$

Calcullate $\frac{\partial L}{\partial b_1}$

$$\frac{\partial L}{\partial b_1} = \frac{\partial L}{\partial \hat{y}} \times \frac{\partial \hat{y}}{\partial z'} \times \frac{\partial z'}{\partial z} \times \frac{\partial z}{\partial b_1}$$

$$z = x \cdot w_1 + b_1$$

$$\left[\frac{\partial z}{\partial b_1} = 1\right] \quad — \quad 5$$

from 1, 2, 3, 4, 5

$$\frac{\partial L}{\partial b_1} = -\left[\frac{y}{\hat{y}} - \frac{(1-y)}{(1-\hat{y})}\right]\left[\frac{e^{-z'}}{(1+e^{-z'})^2}\right][w_2]$$

Calculate $\frac{\partial L}{\partial w_2}$

$$\frac{\partial L}{\partial w_2} = \frac{\partial L}{\partial \hat{y}} \times \frac{\partial \hat{y}}{\partial z'} \times \frac{\partial z'}{\partial w_2}$$

$$z' = z \cdot w_2 + b_2$$

$$\boxed{\frac{\partial z'}{\partial w_2} = z} \quad - \quad 6$$

from 1, 2, 6

$$\frac{\partial L}{\partial w_2} = -\left[\frac{y}{\hat{y}} - \frac{(1-y)}{(1-\hat{y})}\right]\left[\frac{e^{-z'}}{(1+e^{-z'})^2}\right][z]$$

Calculate $\frac{\partial L}{\partial b2}$

$$\frac{\partial L}{\partial b_2} = \frac{\partial L}{\partial \hat{y}} \times \frac{\partial \hat{y}}{\partial z'} \times \frac{\partial z'}{\partial b2}$$

$$z' = z \cdot w2 + b2$$

$$\left[\frac{\partial z'}{\partial b_2} = 1\right] \text{ —— } 7$$

from 1, 2, 7

$$\frac{\partial L}{\partial b_2} = -\left[\frac{y}{\hat{y}} - \frac{(1-y)}{(1-\hat{y})}\right]\left[\frac{e^{-z'}}{(1+e^{-z'})^2}\right]$$