Giriadient Descent

$$L = \underset{w_1 w_2 b}{\arg\min} \frac{1}{n} \sum_{i=1}^{n} \max(0, -y_i f(x_i))$$

Where, $f(x_i) = w_1 x_{i1} + w_2 x_{i2} + w_3 x_{i3}$

for i in epochs:

$$w_1 = w_1 - \eta \frac{\partial L}{\partial w_1}$$

$$w_2 = w_2 - \eta \frac{\partial L}{\partial w_2}$$

$$b = b - \eta \frac{\partial L}{\partial b}$$

Pantial Derivatives (3)

$$\frac{\partial L}{\partial w_1}, \quad \frac{\partial L}{\partial w_2}, \quad \frac{\partial L}{\partial b}$$

$$\frac{\partial L}{\partial w_1} = \frac{\partial L}{\partial f(x_i)} \cdot \frac{\partial f(x_i)}{\partial w_1}$$

$$\frac{\partial L}{\partial f(x_i)} = \begin{cases} 0 & \text{if } y_i f(x_i) \geq 0 \\ -y_i & \text{if } y_i f(x_i) < 0 \end{cases}$$

$$\frac{\partial f(x_i)}{\partial w_1} = \frac{\partial}{\partial w_1} = w_1 x_{i1} + w_2 x_{i2} + w_3 x_{i3}$$

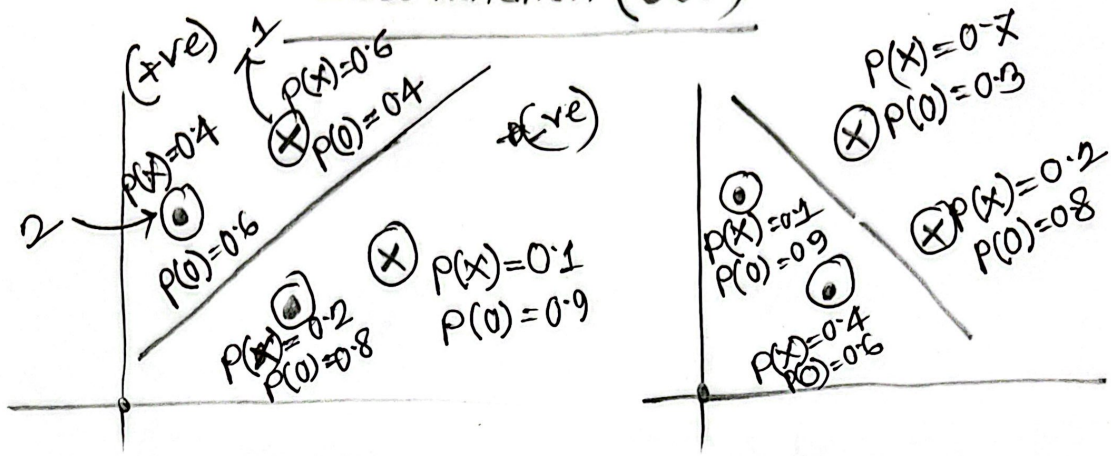
$$= x_{i1}$$

$$\therefore \frac{\partial L}{\partial w_1} = \begin{cases} 0 & \text{if } y_i f(x_i) \geq 0 \\ -y_i x_{i1} & \text{if } y_i f(x_i) < 0 \end{cases}$$

$$\frac{\partial L}{\partial w_2} = \begin{cases} 0 & \text{if } y_i f(x_i) \geq 0 \\ -y_i x_{i2} & \text{if } y_i f(x_i) < 0 \end{cases}$$

$$\frac{\partial L}{\partial b} = \begin{cases} 0 & \text{if } y_i f(x_i) \geq 0 \\ -y_i & \text{if } y_i f(x_i) < 0 \end{cases}$$

Loss function (BCE)



Model-1 Model-2

point-1 $\Rightarrow y_1 = 1$

$\Rightarrow y_1 \log \hat{y}_1 - (1-y_1)\log(1-\hat{y}_1)$

$\Rightarrow -\log(\hat{y}_1) = -\log(0.6)$

point 2 $y_2 = 0$

$-y_2 \log \hat{y}_2 - (1-y_2)\log(1-\hat{y}_2)$

$\Rightarrow -\log(1-\hat{y}_2) = -\log(0.6)$

$$\Downarrow$$

$$L = \sum_{i=1}^{n} -y_i \log(\hat{y}_i) - (1-y_i)\log(1-\hat{y}_i)$$

$$\boxed{L = -\frac{1}{n}\sum_{i=1}^{n} y_i \log(\hat{y}_i) + (1-y_i)\log(1-\hat{y}_i)}$$

Log Loss Error

Binary Cross Entropy