(06) SVM - Weight And Bias Update Rule :

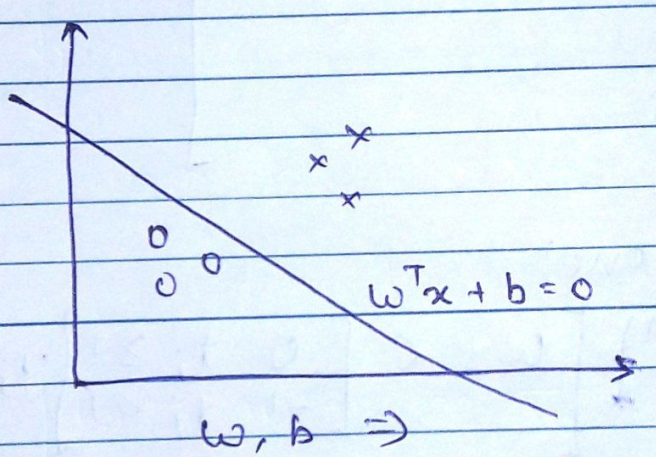
SVM Final Update Rule

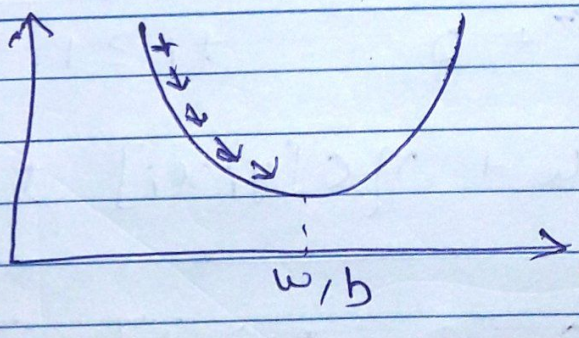
Weight Update Rule

$$L(w) = \frac{1}{2} w^T w + C \sum_{i=1}^{m} \max(0, 1 - t_i)$$

$$t_i = y^i (w^T x^i + b)$$

Convex loss function





$$w = w - \eta \nabla_w L$$

$$b = b - \eta \nabla_b L$$

Gradient Descent

$$\nabla_w L = w + C \begin{bmatrix} 0 & t_i \geq 1 \\ -1 & t < 1 \end{bmatrix} y_i x_i$$

$$\nabla_b L = 0 + C \begin{bmatrix} 0 & t_i \geq 1 \\ -1 & t_i < 1 \end{bmatrix} y_i$$

$$\boxed{\begin{aligned} \nabla_b t_i &= \nabla_b \, y_i (w^T x^{(i)} + b) \\ &= y_i \end{aligned}}$$

. Update rule : (final one)

$$\Rightarrow w = w - \eta \left[w + C \begin{bmatrix} 0 & t_i \geq 1 \\ -1 & t_i < 1 \end{bmatrix} y_i x_i \right]$$

$$\boxed{\begin{aligned} w &= w - \eta w + 0 \qquad t_i \geq 1 \\ &\text{and } w - \eta w + \eta C [y_i x_i] \quad t_i < 1 \end{aligned}}$$

$$\Rightarrow b = b - \eta \left[C \begin{bmatrix} 0 & t_i \geq 1 \\ -1 & t_i < 1 \end{bmatrix} y_i \right]$$

$$\boxed{\begin{aligned} b &= b + 0 \quad \text{if } t_i \geq 1 \\ &\text{and } \quad b + \eta C y_i \quad \text{if } t_i < 1 \end{aligned}}$$

final formulas for weight update rule