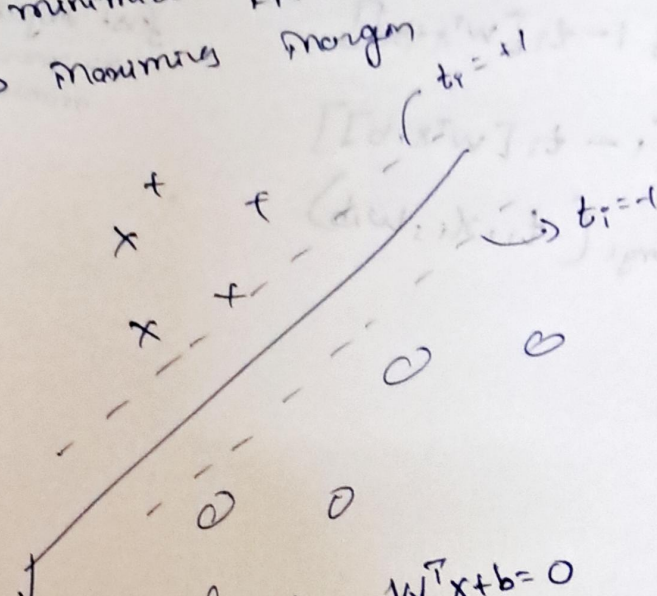


Support Vector Machine

23/09

Svm minimize $ER = \text{struc. Risk}$
 \Rightarrow Maximizing Margin



separating plane: $W^T x + b = 0$

Max. w.b $[\min_i \|W^T x_i + b\|^2]$

sub $\forall i \quad 1 \leq i \leq n \quad [W^T x_i + b] \geq 0$
 $2 \|W\| = 1$

$t_i = \{-1, 1\}$

Minimize $W, b \quad \|W\|^2 \leq t$

$\forall i, t_i (W^T x_i + b) \geq 1$

① margin: ϵ to be maximized $\{W: \|W\|^2 \text{ is const.}\}$

② margin = 1 \rightarrow constant $\{W: \|W\|^2 \text{ is min.}\}$

$$\frac{\vec{W}}{b} = \frac{\vec{v}}{c}$$

$$(3) \min \left(\sum_i \max [0, 1 - t_i [w^T x + b]] + \lambda \|w\|^2 \right)$$

$$\max [0, 1 - t_i [w^T x + b]]$$

$$= [1 - t_i [w^T x + b]]$$

$$= \text{hinge}(t_i, x_i, w, b)$$

✓
 ignore this till
 first objective can
 no more be
 minimized

$$\begin{aligned} & \text{swap } w \text{ and } b \\ & \text{swap } x \text{ and } t \\ & \text{swap } w \text{ and } b \\ & \text{swap } x \text{ and } t \end{aligned}$$

$$t_i = 1 - \frac{1}{2}$$

$$t_i = 1 - \frac{1}{2}$$

$$t_i = 1 - \frac{1}{2}$$

$$\text{swap } w \text{ and } b$$

$$\text{swap } x \text{ and } t$$