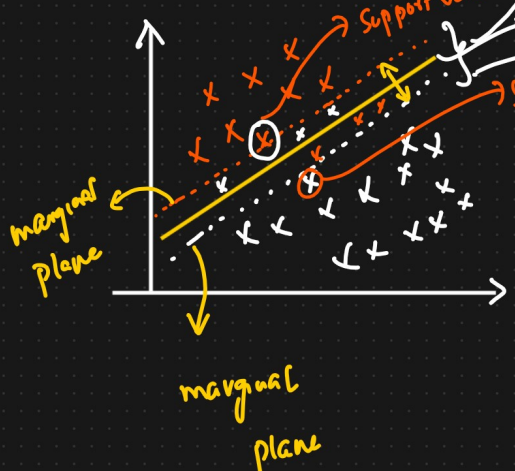
SVM (Support Vector Machines) ML Algorithms

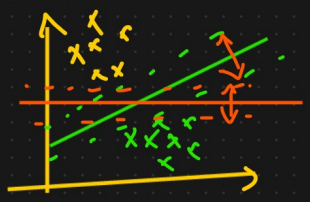
Tasks

① Classification ✓ ② Regression

Support Vector Classifier



Arm



$y = mx + c$ $\quad y = \theta_0 + \theta_1 x \quad y = \beta_0 + \beta_1 x$

$y = w_1x_1 + w_2x_2 + w_3x_3 + b$

$y = w^Tx + b$

$y = mx + c$

$\Updownarrow$

$ax + by + c = 0$ → Equation of a straight line

$by = -ax - c$

$y = -\frac{a}{b}(x) - \frac{c}{b}$

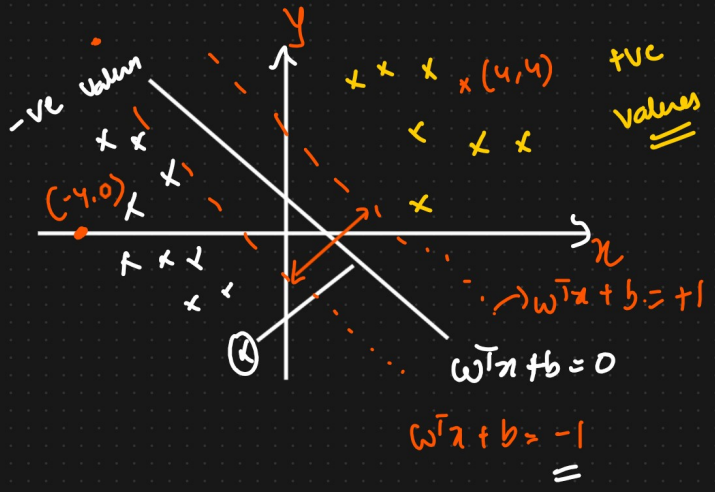
$m = \frac{-a}{b}$

$c = \frac{-c}{b}$

$3(4) + 2(4) + 4 = 0$

$12 + 8 + 4$

$24 \Rightarrow$ +ve



$3x + 2y + 4 = 0$

$3(-4) + 2(0) + 4$

$-12 + 0 + 4$

$= -8$

2 components

$w \rightarrow$ magnitude, vectors

$\vec{w}$

$$w^T x_1 + b = +1$$

$$w^T x_2 + b = -1$$

(-) 2 (-) (+)

$$\vec{w} \quad \frac{w^T(x_1 - x_2)}{\|w\|} = \frac{2}{\|w\|} \Rightarrow \text{Maximize}$$

$$\underset{(w,b)}{\text{Maximize}} = \frac{2}{\|w\|} \Rightarrow \text{Marginal plane distance}$$

Constraint Such that $y_i = \begin{cases} +1 & w^T x + b \geq 1 \\ -1 & w^T x + b \leq -1 \end{cases}$

For all annate datapoint

$$\boxed{y * (w^T x_i + b) \geq 1} \Rightarrow \text{Constraint}$$

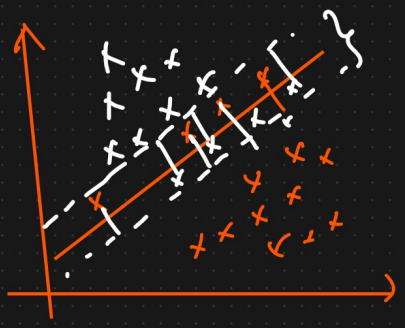
$$\underset{(w,b)}{\text{Maximize}} = \frac{2}{\|w\|} \Rightarrow \boxed{\underset{(w,b)}{\text{Minimize}} = \frac{\|w\|}{2}}$$

Cost function : $\underset{(w,b)}{\text{Minimize}} \frac{\|w\|}{2} + C_1 \sum_{i=1}^{n} \xi_i$

ξ_i : {Summation of the distance of misclassification points from marginal plane}

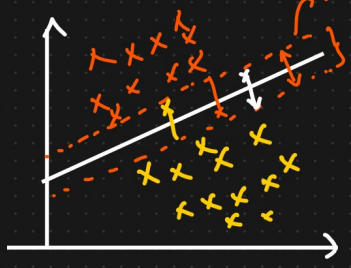
C : {How many points we can}

$C = 8$



avoid misclassification

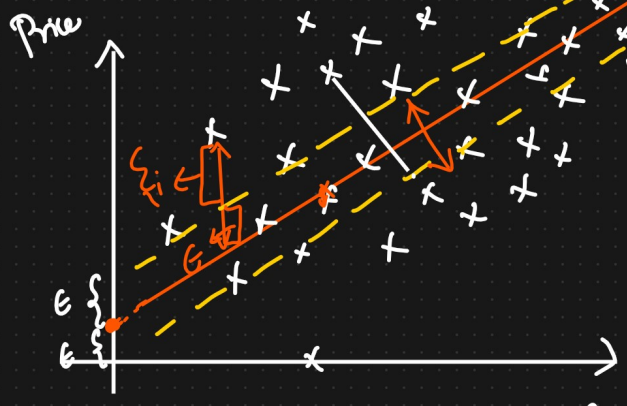
SVC



Cost func : Minimize $_{w,b}$ $\frac{\|w\|}{2} + \boxed{C \sum_{i=1}^{n} \xi_i}$ ← 16TA

↳ Hyperparameter

Support Vector Regression



SVR

Cost func

Minimize $_{(w,b)}$ $\frac{\|w\|}{2}$

Constraint (MSE)

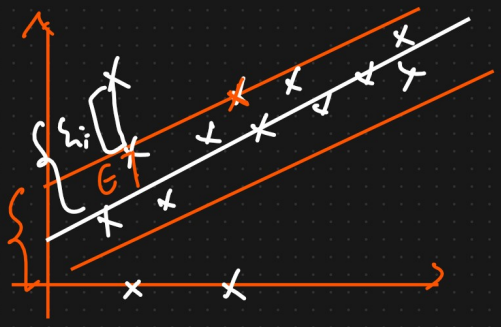
↳ $|y_i - w^Tx_i| \leq \epsilon$ → It is very good

ϵ → Hinge loss → Hyperparameter

Cost func : Minimize $_{(w,b)}$ $\frac{\|w\|}{2} + \boxed{C \sum_{i=1}^{n} |\xi_i|}$ → Hyperparameter

Constraint

$$|y_i - w_i x_i| \leq \epsilon + |\xi_i|$$


ξ_i
GT