Support Vector Machine - A Supervisid machine learning algo. used for classification and regression (at

Idea - Find the best decision boundary (hyperplane) that seperate different classes with the maximum margin.

key terms -

Hyperplane - Line/plane that divides data.

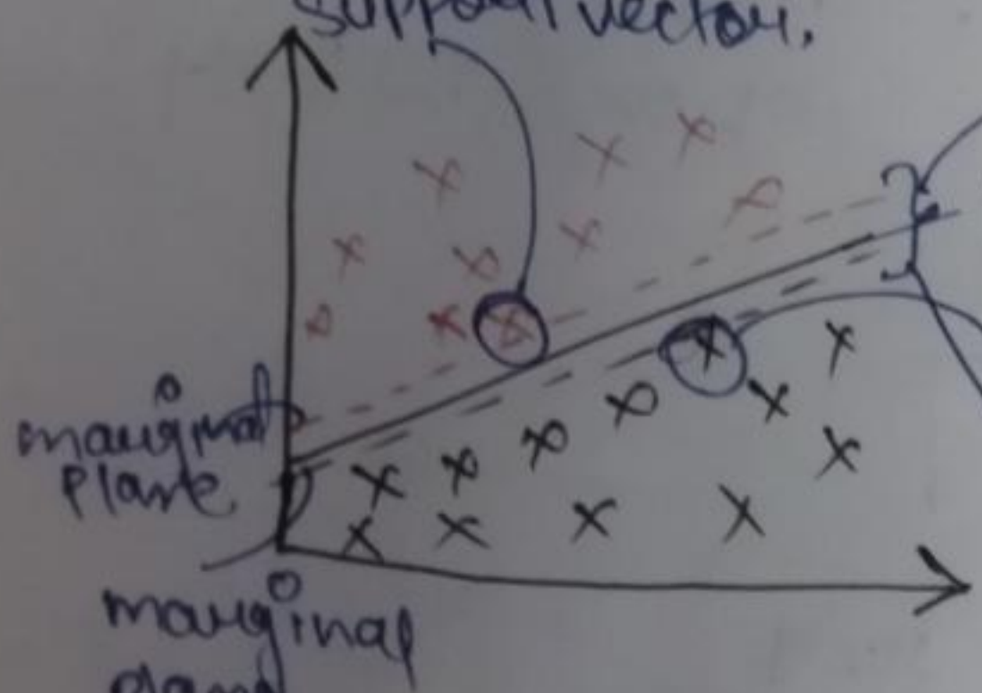
Support vector - DataPoints closest to the hyperplane, (Critical in defining boundary)

Margin - Distance between hyperplane and nearest data points (Support vectors)

Types -

Linear SVM - Work when data is linearly seperable

Non-Linear SVM - Use kernal trick (polynomial, RBF, etc) to handle Complex data.



eg: of Straight line

$ax + by + c = 0 \Leftrightarrow y = mx + c$

$by = -ax - c$

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

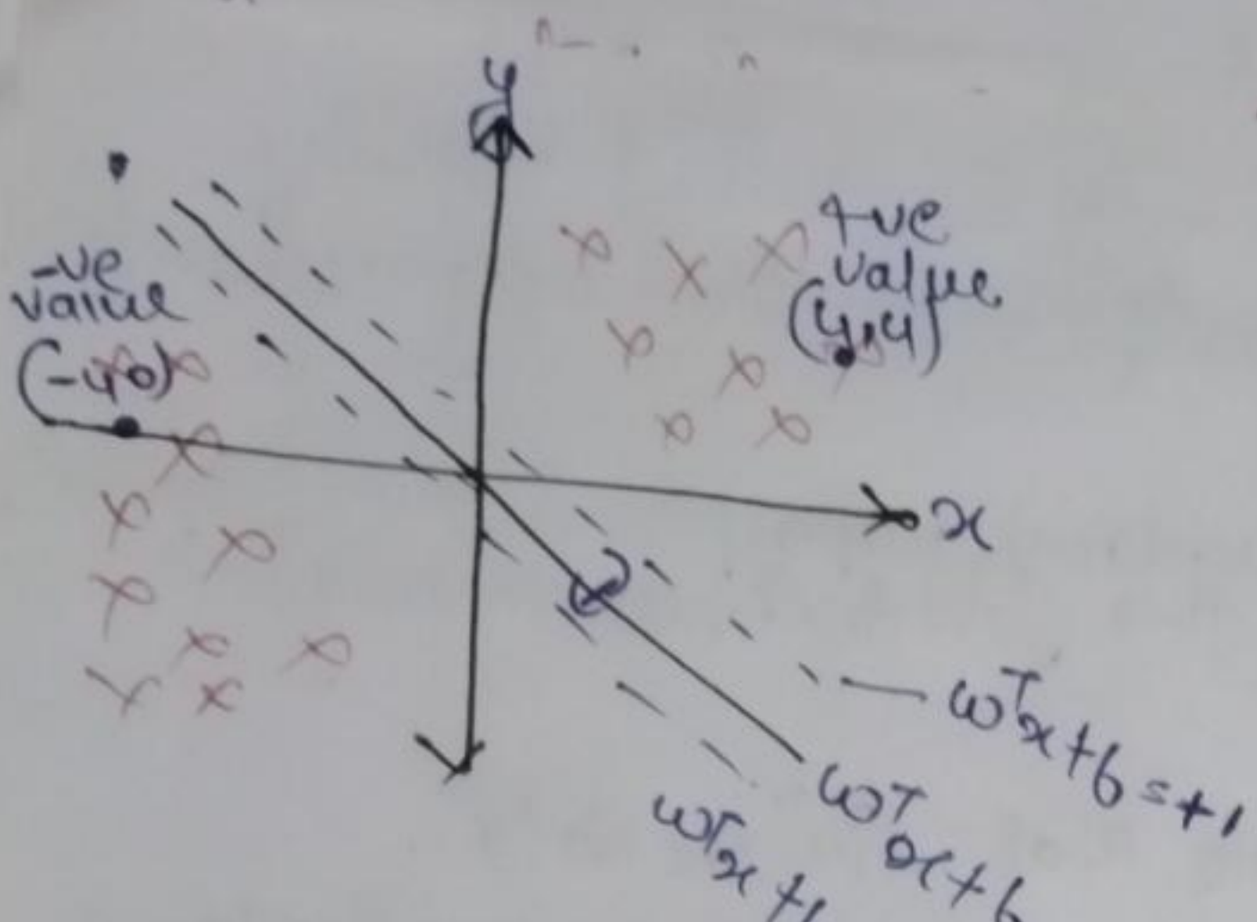
$\boxed{y = mx + c}$ $y = \theta_0 + \theta_1 x$

$y = \beta_0 + \beta_1 x$

$y = \omega_0 x_1 + b$

$y = \omega_0 x_1 + \omega_2 x_2 + \omega_3 x_3 + b$

$\boxed{y = w^T x + b}$



$3x+2y+4=0$

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

$-12+0+4$

$=\boxed{-8}$

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

$12+8+4$

$=\boxed{24}$ +ve

$w \Rightarrow$ Magnitude
↳ Vector

$$\vec{w} = \frac{w^T x(x_1-x_2)=2}{\|w\|} \Big\} \Rightarrow \text{Maximimize (mean distance is high)}$$

$$\frac{w^T x+b=+1}{(-)\,w^T x+b=-1}$$

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

Constraints - Such that $\begin{cases} +1 & \text{when } w^T x+b \geq 1 \\ -1 & \text{when } w^T x+b \leq -1 \end{cases}$

For all accurate data point

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

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

$$\text{Cost function} = \text{Minimize}_{(w,b)} \frac{\|w\|}{2} + C_i \sum_{i=1}^{w} \xi_i$$

ξ_i → Summation of the distance of misclassification Point from marginal plane

↓

How many point we can avoid misclassification