22-02-2022

Tuesday, February 22, 2022 4:56 PM

Support Vector Machines (SVM)

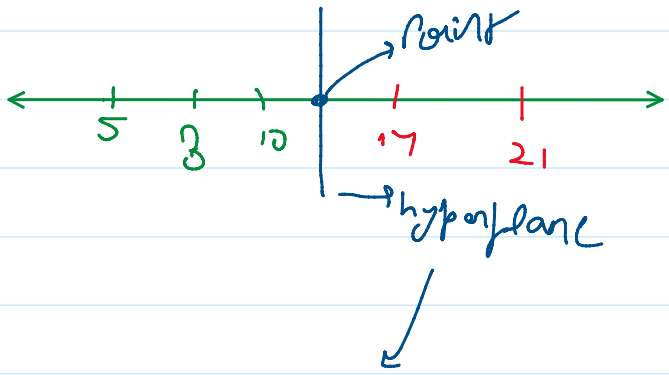
→ Supervised → Classification
→ Regression

Each ex. plotted in n dimensional space
→ Find a hyperplane that separates all +ve ex. from -ve ex.

Ex:

x	y
10	+ve
5	+ve
14	-ve
21	-ve
8	+ve

2D line



If x_1 x_2 y → 2D Plane → Line

hyperplane → (n-1) d

for 3D space → 2D plane - hyperplane

Eq. of hyperplane passing through origin:

$$w^T x = 0$$

If not through origin:

$$\{w^T x + b = 0\}$$

$w \rightarrow$ set of ~~constants~~ coefficients
$\rightarrow$ vector $\perp$ to the hyperplane

if $b > 0$, hyperplane moving towards w

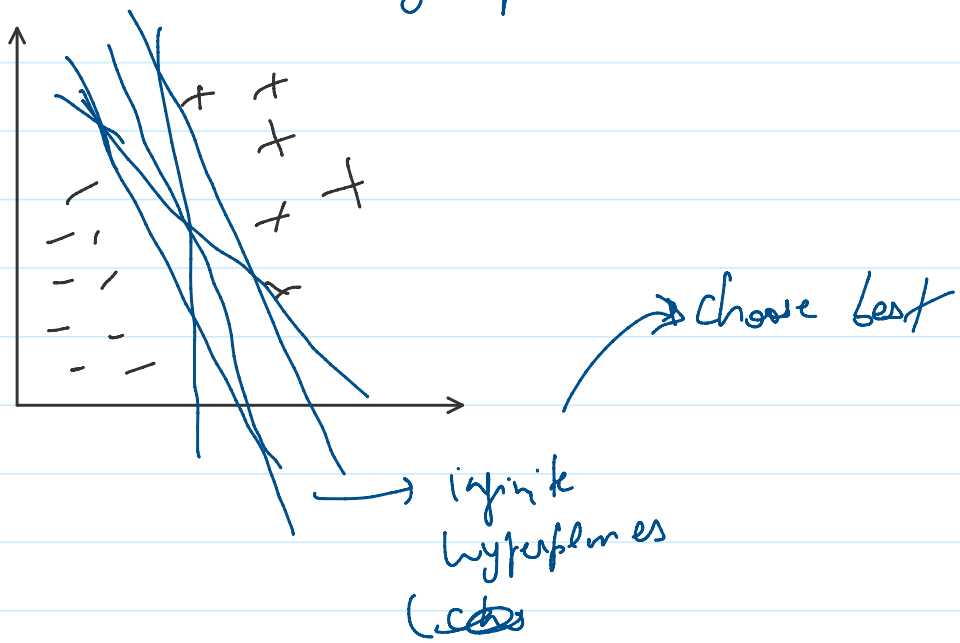
$b < 0$, " going in opp. dir^n of w

$\therefore$ for 2D

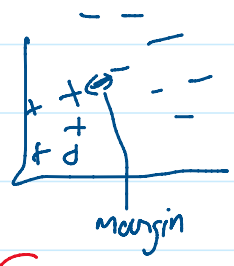
$$w_1 x_1 + w_2 x_2 + b = 0$$

Now,

Assume - 2D dataset
- Linearly separable (Line)



i) Selects hp with max. margin



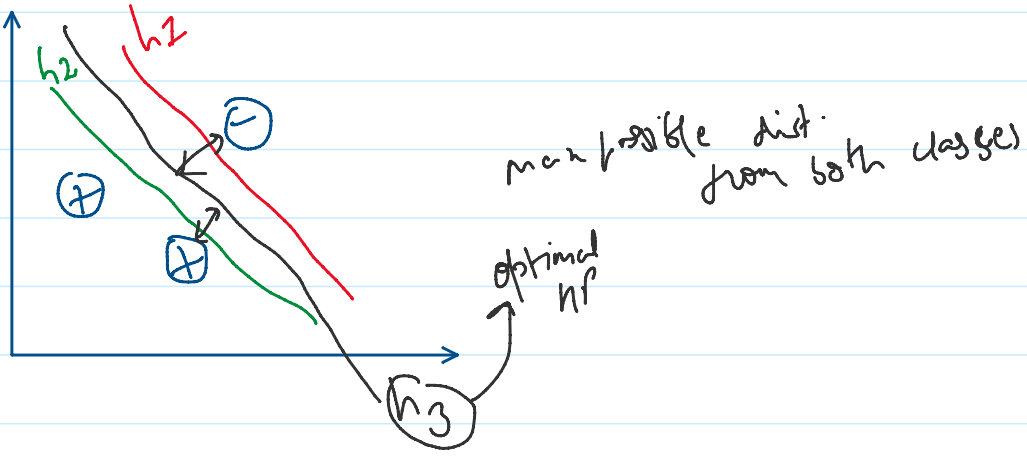
→ Each pt. is a vector from origin

∴ need at in +ve & -ve class → vectors

{ margin – dist b/w the closest vectors in the +ve side & closest in -ve side.

origin

class lecture.

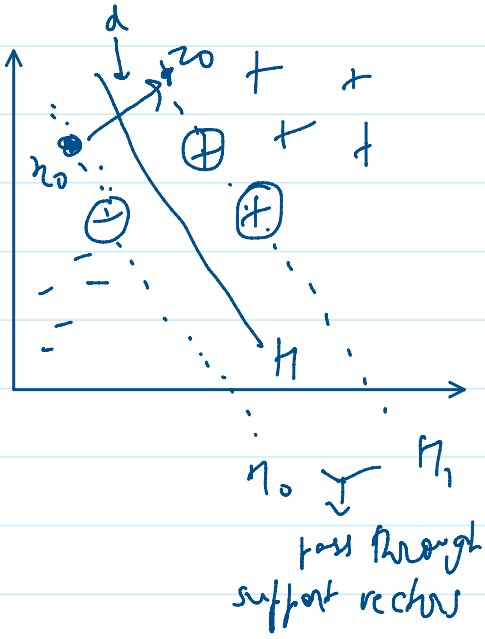


max possible dist. from both classes

ii) Selects hp that classifies the classes accurately

Support vectors : ?

Let $w^T x + b = 0$ be eqn of optimal HP



$H_0 \Rightarrow \quad w x + b = -k$

$H_1 \Rightarrow \quad w x + b = +k$

let $k = 1$

$H_0 \Rightarrow \quad w x + b = 1$

$H_1 \Rightarrow \quad w x + b \leq 1$

Let x_0 be a pt. on H_0

Adding 'd' to x_0 will lead to a pt in H_1 z_0