SMAI Constraint derivation 2019101040 N.V. Sree Harsha Reddy

* Linear SVM searches for a hyperplane with maximal margin from datapoints to classify data. Known as Maximal margin classifer.

Dataset → X, y ↳ labels.
↳ datapoints.

Now we need to get hyperplane.

Hyperplane eqn ⇒ $w_1x_1 + w_2x_2 + \dots w_m x_m + b = 0$

$x_1, x_2 \dots$ are feature of datapoint

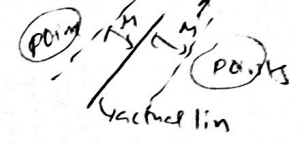
The matrix form is

$w^T x + b = 0 \Rightarrow w = [w_1, w_2 \dots w_m]$

$x = (x_1, x_2 \dots x_m)$.

↳ these are learnable.

as we need to do maximal margin. then the inequality will be margin.

i.e 

$||w|| = 1$ and $y_i(w^T x_i + b) \geq M$ ↳ is the margin.

$y_i\left(\frac{w^T x_i}{M} + \frac{b}{M}\right) \geq 1$. let $\frac{w}{M} = w'$, $\frac{b}{M} = b'$.

$\Rightarrow y_i(w'x_i + b') \geq 1$.

we know that we need to maximise 'M'

i.e we need to minimse $||w||$

because $w' = \frac{w}{M}$ so, $M \uparrow w^T \downarrow$.

i.e we need to maximise 'M' so we have to minimise $||w'|| = \frac{||w||}{M} \to 1$.

so $||w'|| = \frac{1}{M}$.

So, the constraints are

$||w|| \rightarrow$ minimise

subject to $y_i(w'x_i + b') \geq 1$

$\forall i \in$ dataset