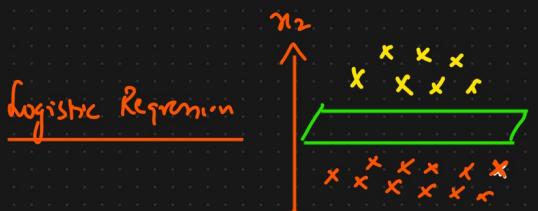
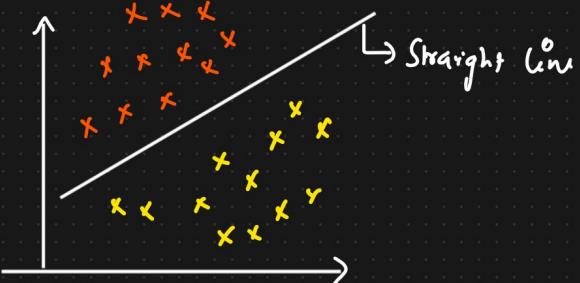


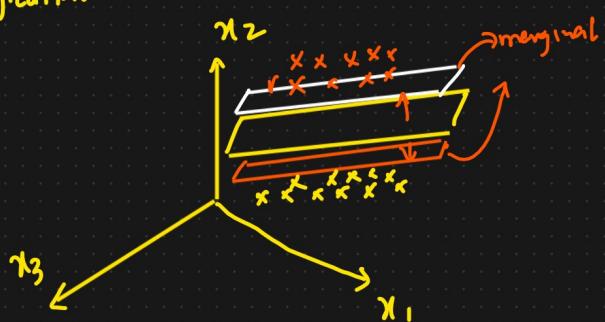
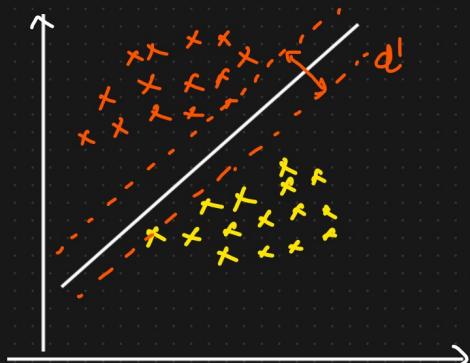
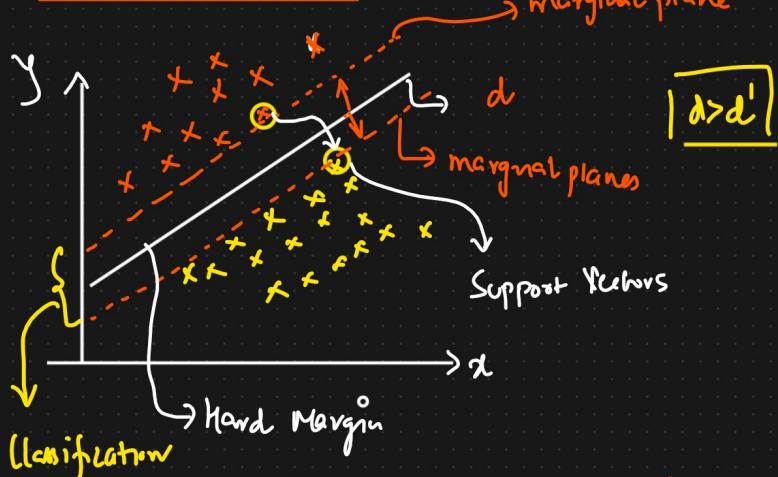
Support Vector Machines ML Algorithms.

① SVC (Support Vector Classifier)

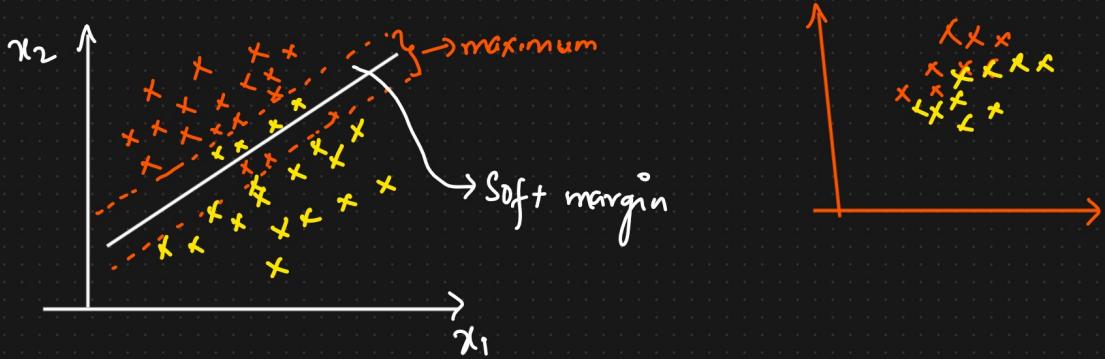
② SVR (Support Vector Regressor)



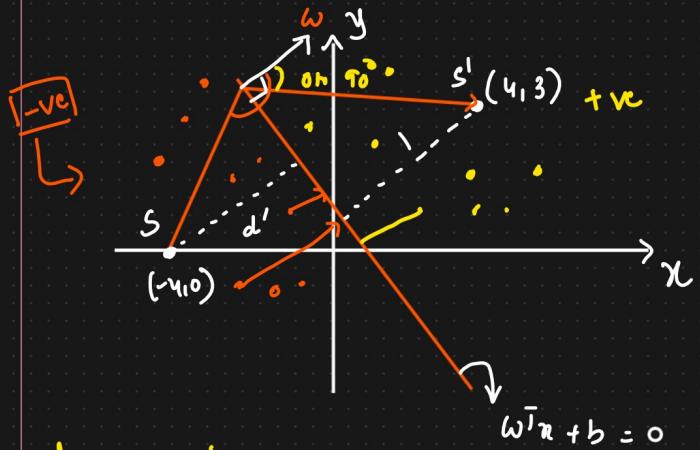
① Support Vector Machine (SVC)



Soft Margin And Hard Margin In SVM



④ Support Vector Machines (SVC) Maths Intuition



$$ax+by+c=0$$

\Downarrow

$$w_1x_1 + w_2x_2 + b = 0$$

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

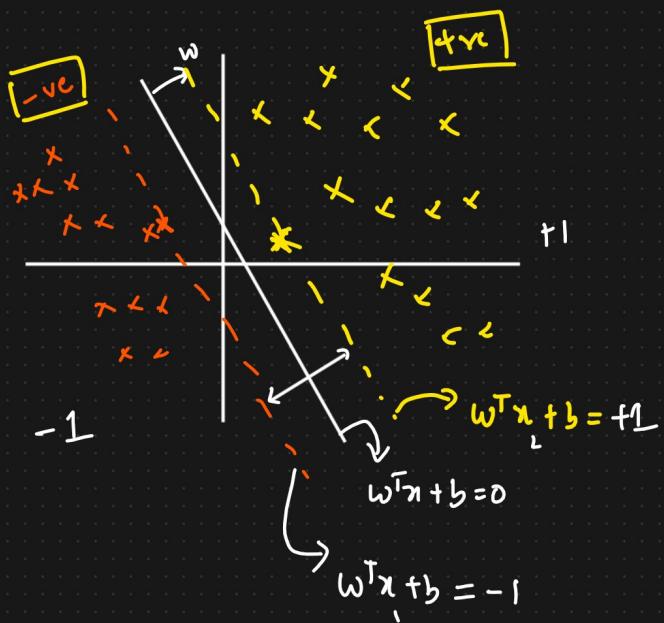
\Downarrow

$$b=0$$

$$\boxed{w^T x = 0}$$

$d = -ve$ below plane

$d = +ve$ above plane



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

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

(-) (+) (+)

$$\frac{w^T(x_1 - x_2)}{\|w\|} = \frac{+2}{\|w\|}$$

Unit vector {Magnitude of the vector is 1}

Cost function

Maximize $\frac{2}{\|w\|} \Rightarrow$ Distance between Marginal plane
 w, b classified point

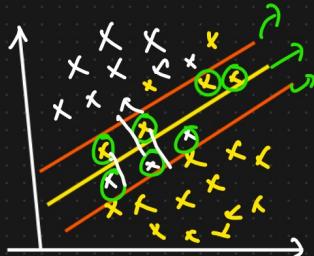
Constraint such that $y_i \begin{cases} +1 & w^T x + b \geq 1 \\ -1 & w^T x + b \leq -1 \end{cases}$

For all correct points

Constraint $\rightarrow [y_i \cdot (w^T x + b) \geq 1]$

Maximize $\frac{2}{\|w\|} \Rightarrow \min_{(w,b)} \frac{\|w\|}{2}$

$|c_i=6| \checkmark$



Cost function of SVM (SVC)

$$\min_{w,b} \frac{\|w\|}{2} + \left[\sum_{i=1}^n \max_{l_i} \{0, l_i - y_i(w^T x_i + b)\} \right] \Rightarrow \text{Hinge loss}$$

{ summation of the }

{ Now many distance of the }

{ points we want incorrur data points }

{ to avoid misclassification from the marginal }

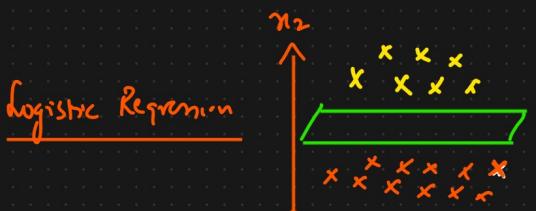
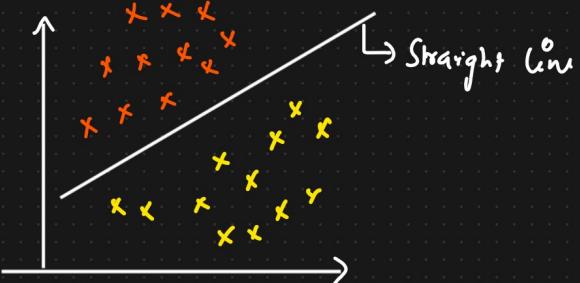
{ plane }

Soft Margin

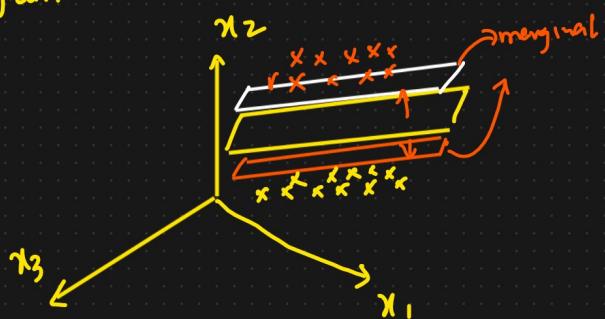
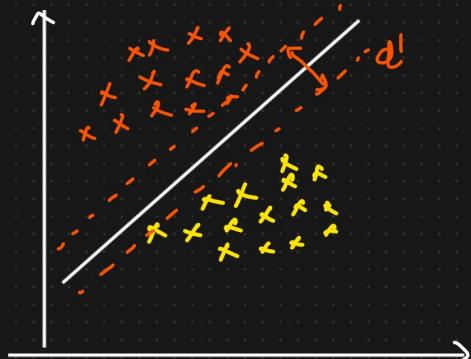
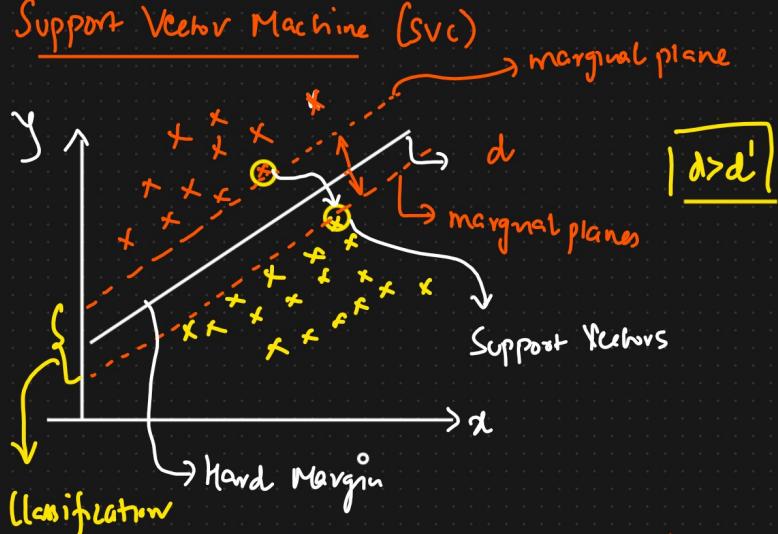
Support Vector Machines ML Algorithms.

① SVC (Support Vector Classifier)

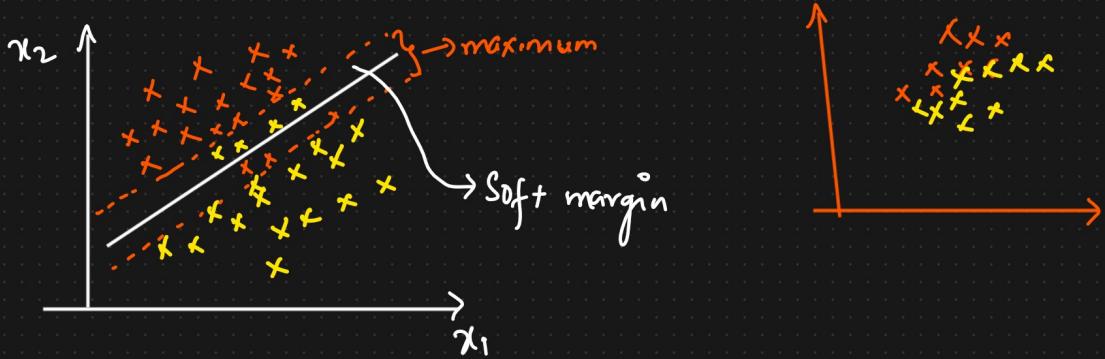
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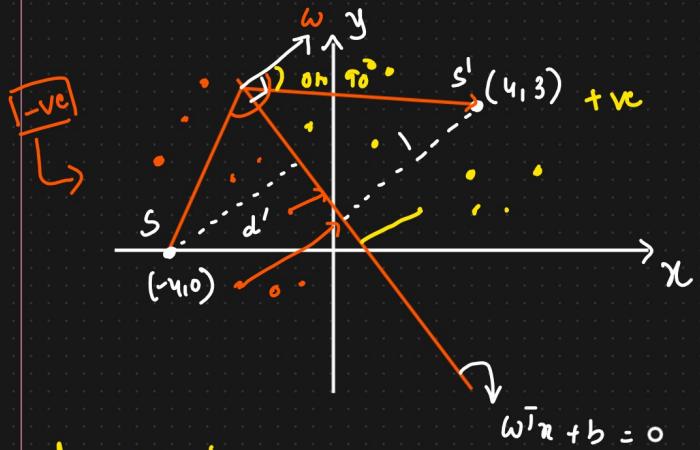
① Support Vector Machine (SVC)



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\Downarrow

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

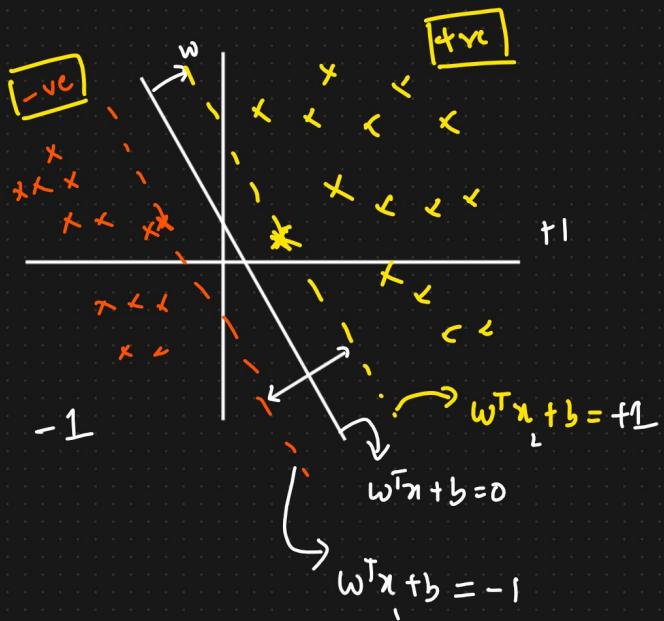
\Downarrow

$$b=0$$

$$\boxed{w^T x = 0}$$

$d = -vc$ below plane

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

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$$\frac{w^T(x_1 - x_2)}{\|w\|} = \frac{+2}{\|w\|}$$

Unit vector {Magnitude of the vector is 1}

Cost function

Maximize $\frac{2}{\|w\|} \Rightarrow$ Distance between Marginal plane
 w, b classified point

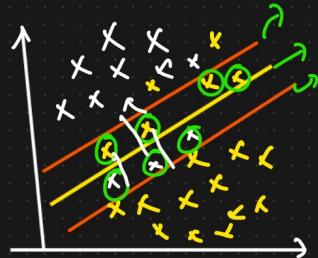
Constraint such that $y_i \begin{cases} +1 & w^T x + b \geq 1 \\ -1 & w^T x + b \leq -1 \end{cases}$

For all correct points \uparrow predicted points

Constraint $\rightarrow [y_i \times (w^T x + b) \geq 1]$

Maximize $\frac{2}{\|w\|} \Rightarrow \boxed{\min_{(w,b)} \frac{\|w\|}{2}}$

$\boxed{C_i=6} \checkmark$



Cost function of SVM (SVC)

$$\min_{w,b} \frac{\|w\|}{2} + \boxed{\sum_{i=1}^n \max\{0, 1 - y_i(w^T x_i + b)\}} \Rightarrow \text{Hinge loss}$$

\downarrow summation of the

{ Now many distance of the }

points we want incorrur data points

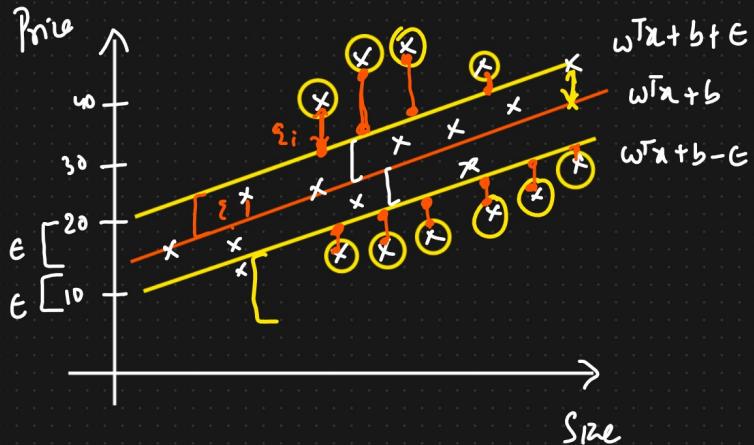
to avoid misclassification from the marginal

plane }

Soft Margin

Support Vector Regression

ϵ : Marginal Error



Cost function

$$\text{Min}_{w,b} \frac{\|w\|}{2} + C \sum_{i=1}^n \xi_i \rightarrow \text{Hinge Loss}$$

Hyperparameter

Constraint =

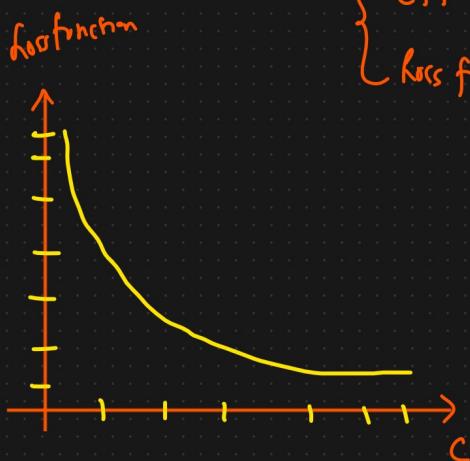
$$|y_i - w_i x_i| \leq \epsilon + \xi_i$$

\Downarrow
loss function

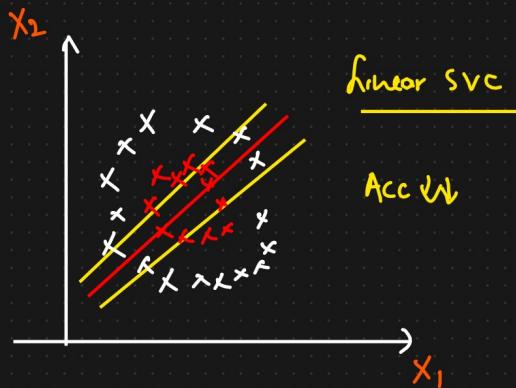
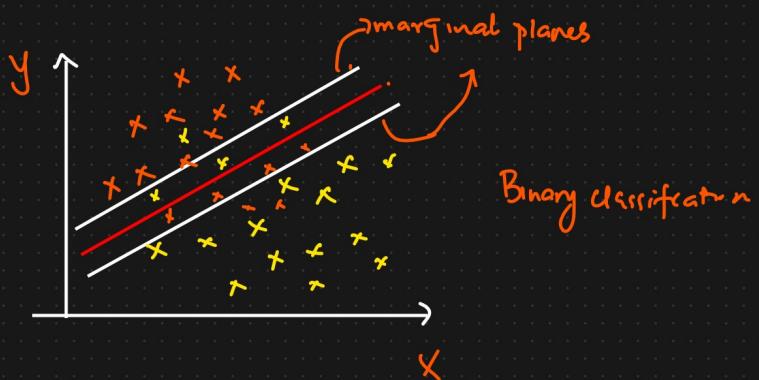
Relationship
 { C↑↑
 loss function ↑↑ }

ϵ → margin error

ξ_i → error above the margin

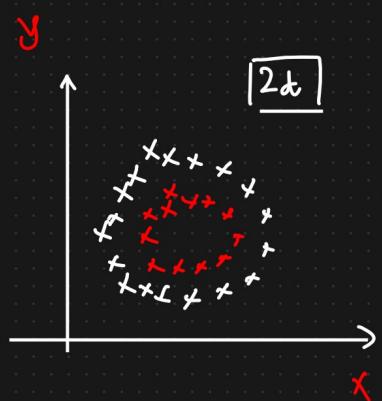


SVM KERNELS



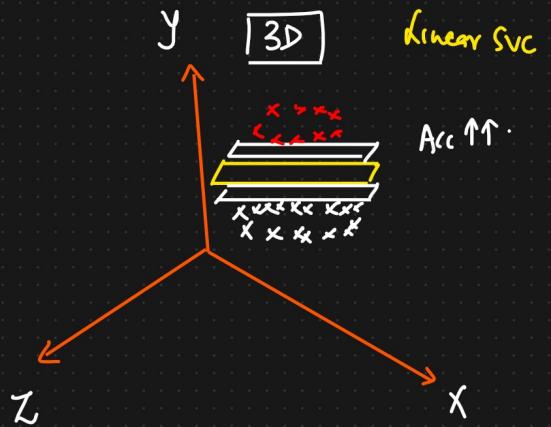
Linear SVC

SVM Kernels



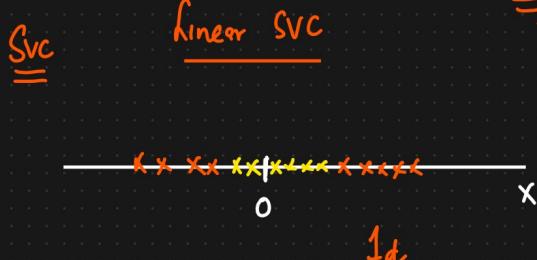
⇒
⇒ Transformations
↓

Mathematical
formula



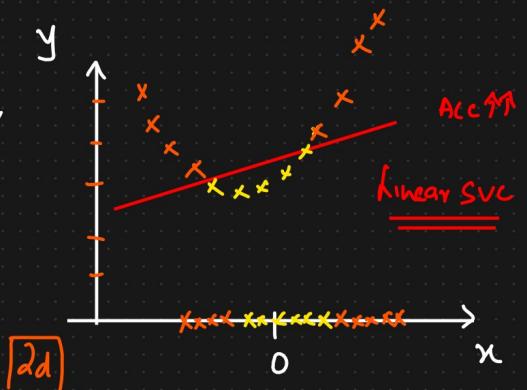
Dataset : 1d

SVM Kernel



⇒ Transformation

$$y = n^2$$



① Polynomial Kernel

② RBF Kernel

③ Sigmoid Kernel