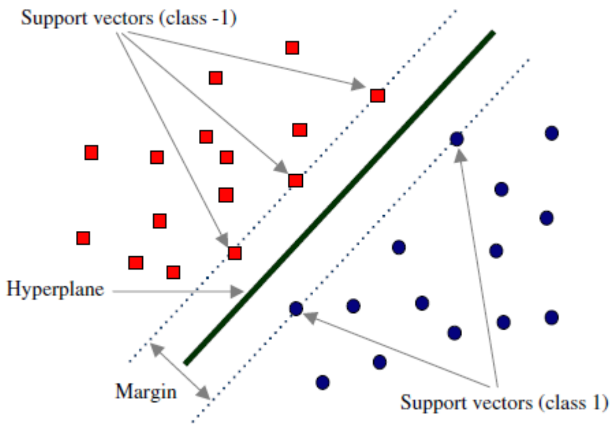
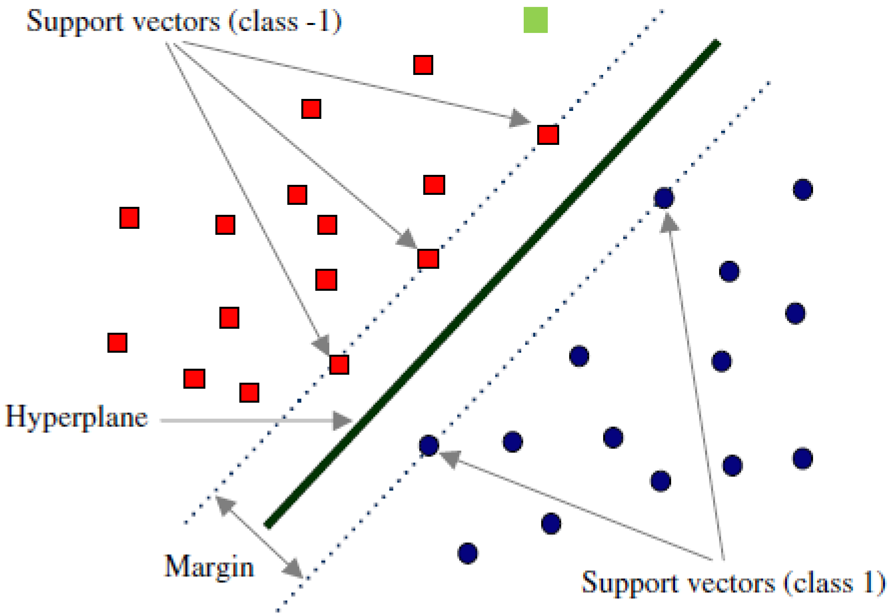
Siddhardhan

Loss Function for Support Vector Machine Classifier

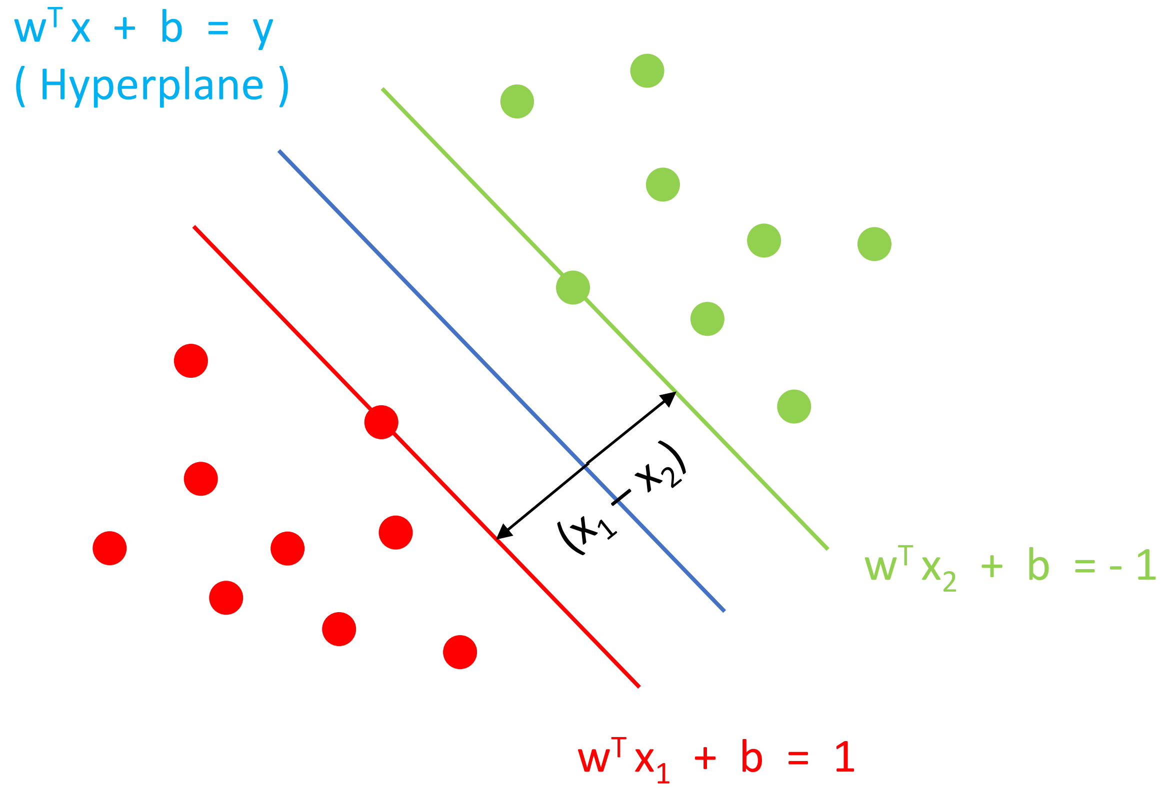


Support Vector Machine Classifier



- Hyperplane
- Support Vectors
- Margin
- Linearly separable data

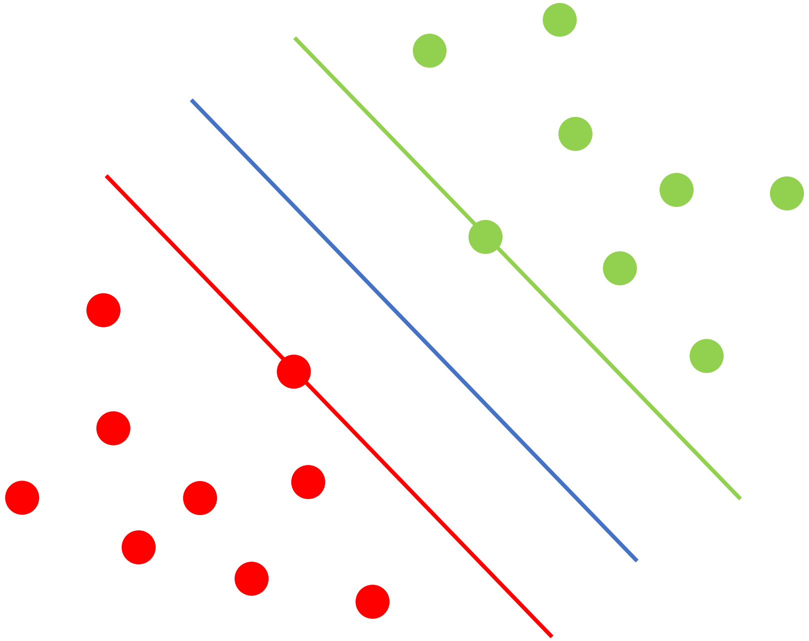
Support Vector Machine Classifier



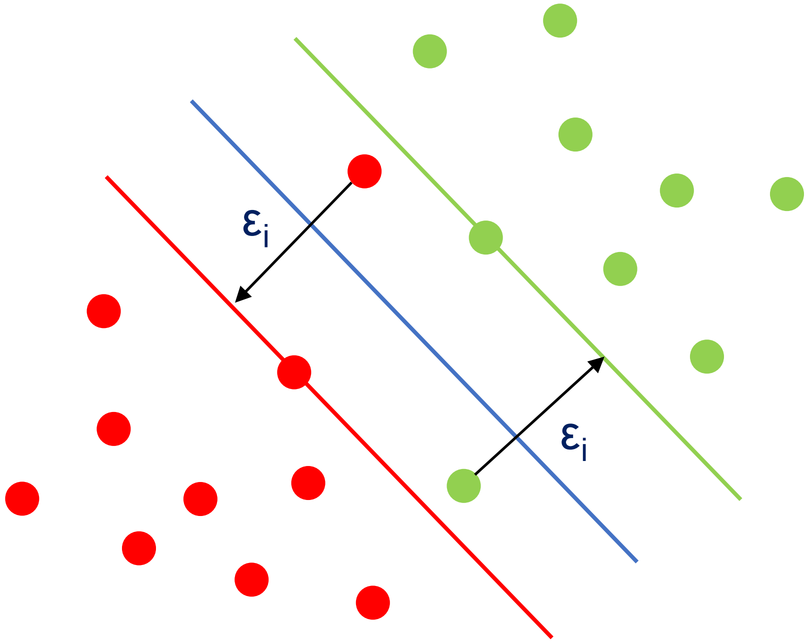
$$\max \left(\frac{2}{\| w \|} \right) \quad \text{(margin)}$$

$$\hat{y}_i = \begin{cases} -1, & w^T x_1 + b \leq -1 \\ 1, & w^T x_1 + b \geq 1 \end{cases}$$

Support Vector Machine Classifier



Hard Margin



Soft Margin

Loss Function

Loss function measures how far an estimated value is from its true value.

It is helpful to determine which model performs better & which parameters are better.

$$\textbf{Loss} = \frac{1}{n}\sum_{i=1}^{n}(Y_i - \hat{Y}_i)^2$$

For Support Vector Machine Classifier "Hinge Loss" is used as the Loss Function.

Hinge Loss

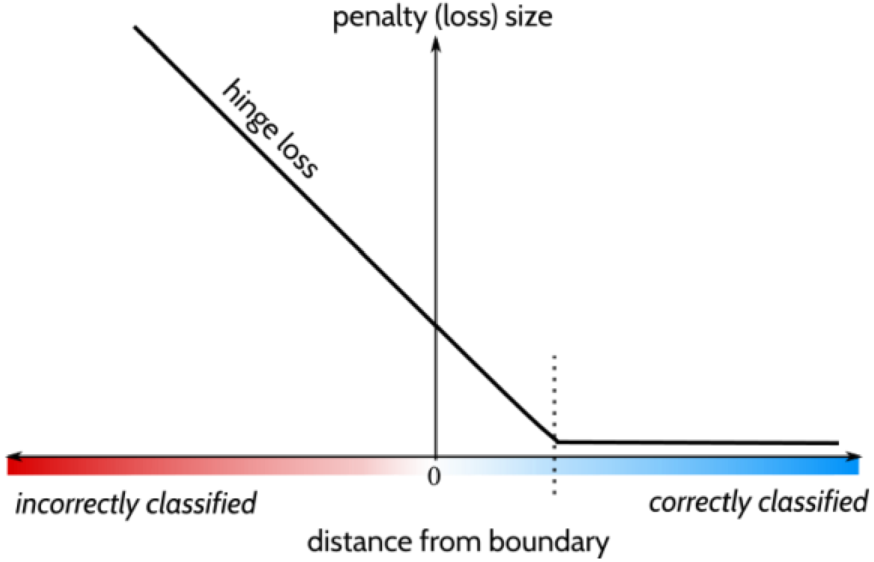
Hinge Loss is one of the types of Loss Function, mainly used for maximum margin classification models.

Hinge Loss incorporates a margin or distance from the classification boundary into the loss calculation. Even if new observations are classified correctly, they can incur a penalty if the margin from the decision boundary is not large enough.

$$L = \max(0, 1 - y_i (w^T x_i + b))$$

0 - for correct classification

1 - for wrong classification



Hinge Loss

Misclassification :

$y_i = 1 \quad \hat{y}_i = -1$

$L = (1 - (1)(-1)$

$L = (1 + 1)$

$L = 2$ (High loss Value)

$y_i = -1 \quad \hat{y}_i = 1$

$L = (1 - (-1)(1)$

$L = (1 + 1)$

$L = 2$ (High loss Value)

$L = \max(0, 1 - y_i (w^T x_i + b))$

0 - for correct classification

1 - for wrong classification

Correct classification :

$y_i = 1 \quad \hat{y}_i = 1$

$L = (0 - (1)(1)$

$L = (0 - 1)$

$L = -1$ (Low loss Value)

$y_i = -1 \quad \hat{y}_i = -1$

$L = (0 - (-1)(-1)$

$L = (0 - 1)$

$L = -1$ (Low loss Value)