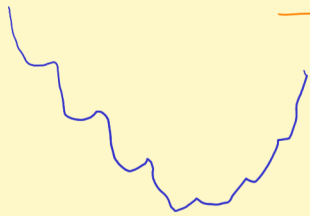
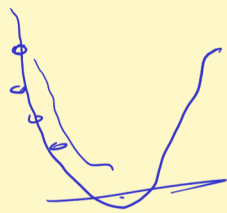


$$\max d \quad \text{s.t.} \quad y_i(x_i w^T + b) \geq 1$$

$$d = \frac{1}{\|w\|}$$



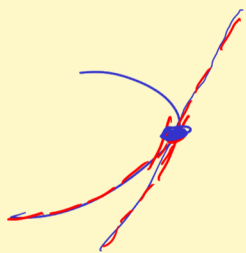
$$\max \frac{2}{\|w\|} \quad \text{s.t.} \quad y_i(x_i w^T + b) \geq 1$$



$$\min \frac{\|w\|}{2} \quad \text{s.t.} \quad y_i(x_i w^T + b) \geq 1 \quad \forall i \in \{0, 1\}$$

$$\min \frac{\|w\|^2}{2} \quad \text{s.t.} \quad y_i(x_i w^T + b) \geq 1$$

$$\min F(x) \quad \text{s.t.} \quad g(x) \geq c$$



$$\frac{\partial F}{\partial x} = \lambda \frac{\partial g}{\partial x}$$

$$\frac{\partial}{\partial w} \left[\sum_{i=0}^n \lambda_i y_i (x_i w^T + b) \right] \geq 1$$

$$\frac{\partial}{\partial w} \left(\frac{\|w\|^2}{2} \right) =$$

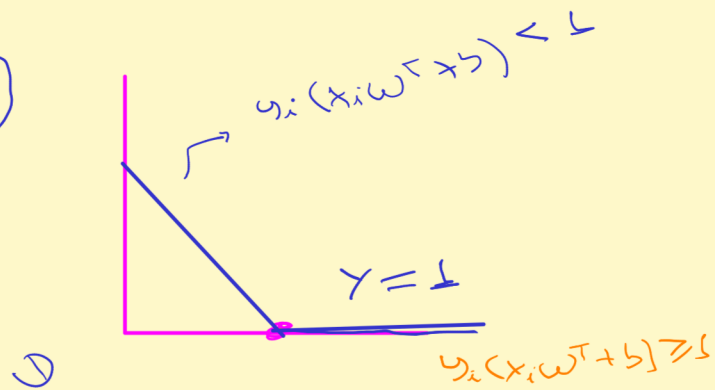
$$w = \sum_{i=0}^n \lambda_i y_i x_i$$

$$x w^T + b = 0$$

$$b = \frac{1}{n} \sum_{i=0}^n \lambda_i y_i x_i x_i$$

$$\text{Loss} = \frac{\sum_{i=0}^n w^2}{2} + C \sum_{i=0}^n \max(0, 1 - y_i(x_i w^T + b))$$

$$= \sum_{i=0}^n \sum_{j=0}^n w_{ij}^2 + \frac{w^2}{2}$$



$$\text{Loss} = \frac{w^2}{2} + C \sum_{i=0}^n \max(0, 1 - y_i(x_i w^T + b))$$

$$\frac{\partial L}{\partial w} = \begin{cases} w - C \sum_{i=0}^n y_i x_i & \text{if } y(x w^T + b) < 1 \\ 0 & \text{if } y(x w^T + b) \geq 1 \end{cases}$$

$$\frac{\partial L}{\partial b} = \begin{cases} 0 & \text{if } y(x w^T + b) \geq 1 \\ -y_i & \text{if } y(x w^T + b) < 1 \end{cases}$$

$$w = w - 2 \left(\frac{\partial L}{\partial w} \right)$$

$$b = b - 2 \left(\frac{\partial L}{\partial b} \right)$$

def Train(X, Y, alpha, epoch, C):

$\epsilon = []$
for i in range(epoch):

$dw, db = \text{GetDerivods}(X, Y, C, w)$

$w, b = \text{changeParam}(w, b, dw, db)$

Error = $\frac{w^2}{2} + C \sum_{i=0}^n \max(0, 1 - y_i(x_i w^T + b))$

$\epsilon.append(\text{Error})$

$$L = \frac{W^2}{2} + \left(\sum_{i=0}^n \max(0, 1 - y_i [x_i W^T + b]) \right)$$

$$y_i (\overbrace{x_i W^T + b}^{\text{mode}}) = 1$$



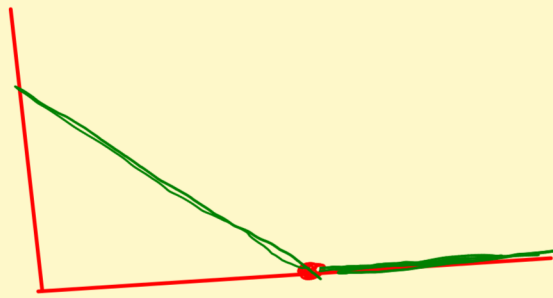
$$1 - \overbrace{y_i}^{-1} (\overbrace{x_i W^T + b}^{-1}) = 0$$

- mode

$$\max(0, 1 - \overbrace{y_i [x_i W^T + b]}^{\geq 1})$$

$\geq 1 - 1$

Error



$$\overbrace{y_i [x_i W^T + b]}^{\text{mode}} \geq 1$$