

02-03-2022

Wednesday, March 2, 2022 2:00 PM

12th - online class → Recording

$$\min L(\omega, b, \alpha) = \frac{1}{2} \omega^T \omega - \sum_{i=1}^N \alpha (y_i (\omega^T x_i + b) - 1)$$

$\alpha_i \geq 0$

$$= \frac{1}{2} \omega^T \omega - \sum_{i=1}^N \alpha_i y_i \omega^T x_i - \sum_{i=1}^N \alpha_i y_i b + \sum_{i=1}^N \alpha_i$$

$$= \frac{1}{2} \omega^T \omega - \omega^T \underbrace{\sum_{i=1}^N \alpha_i y_i x_i}_{\omega} - b \underbrace{\sum_{i=1}^N \alpha_i y_i}_{0} + 11$$

$$= \frac{1}{2} \omega^T \omega - \omega^T \omega - b \times 0 + \sum_{i=1}^N \alpha_i$$

$$= -\frac{1}{2} \omega^T \omega + \sum_{i=1}^N \alpha_i \quad \text{--- (3)}$$

$$Q(\alpha) = \sum_{i=1}^N \alpha_i - \frac{1}{2} \sum_{i=1}^N \alpha_i y_i x_i \sum_{j=1}^N \alpha_j y_j x_j$$

$\alpha_i \geq 0$ &
 $\sum_{i=1}^N \alpha_i y_i = 0$

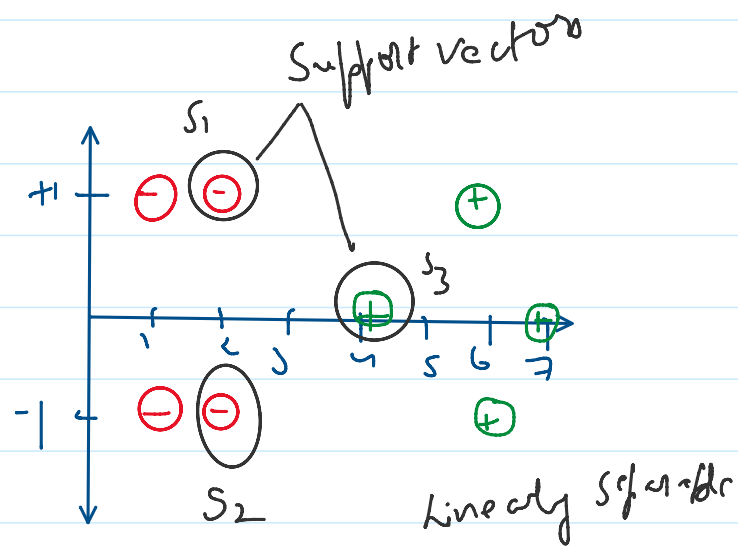
$$\therefore \left\{ Q(\alpha) = \sum_{i=1}^N \alpha_i - \frac{1}{2} \sum_{i=1}^N \sum_{j=1}^N \alpha_i \alpha_j y_i y_j x_i x_j \right\}$$

⇒ dual form

⇒ Missing stuff - Revise class

Ex:

x_1	x_2	y
2	0	+1
6	-1	+1
1	1	-1
1	-1	-1
6	1	+1
4	0	+1
2	1	-1
0	-1	-1



$$s_1 = \begin{pmatrix} 2 \\ +1 \end{pmatrix} \quad s_2 = \begin{pmatrix} 2 \\ -1 \end{pmatrix} \quad s_3 = \begin{pmatrix} 4 \\ 0 \end{pmatrix}$$

$$\begin{array}{ccc} 2 & 1 & -1 \\ 2 & -1 & -1 \end{array}$$

$$s_1 = \begin{pmatrix} 2 \\ 1 \\ 1 \end{pmatrix} \quad s_2 = \begin{pmatrix} 2 \\ -1 \\ 1 \end{pmatrix} \quad s_3 = \begin{pmatrix} 4 \\ 0 \\ 1 \end{pmatrix}$$

$$\tilde{s}_1 = \begin{pmatrix} 2 \\ 1 \\ 1 \end{pmatrix} \quad \tilde{s}_2 = \begin{pmatrix} 2 \\ -1 \\ 1 \end{pmatrix} \quad \tilde{s}_3 = \begin{pmatrix} 4 \\ 0 \\ 1 \end{pmatrix}$$

$$\begin{aligned} \alpha_1 s_1 s_1 + \alpha_2 s_1 s_2 + \alpha_3 s_1 s_3 &= -1 \\ \alpha_1 s_1 s_2 + \alpha_2 s_2 s_2 + \alpha_3 s_2 s_3 &= -1 \\ \alpha_1 s_1 s_3 + \alpha_2 s_2 s_3 + \alpha_3 s_3 s_3 &= +1 \end{aligned} \quad \left. \begin{array}{l} \text{ } \\ \text{ } \\ \text{ } \end{array} \right\} \begin{array}{l} \text{-ve support} \\ \text{vec} \\ \text{+ve support} \\ \text{vec} \end{array}$$

$$\begin{aligned} \alpha_1 6 + 4\alpha_2 + 9\alpha_3 &= -1 \\ 4\alpha_1 + 6\alpha_2 + 9\alpha_3 &= -1 \\ 9\alpha_1 + 9\alpha_2 + 17\alpha_3 &= +1 \end{aligned} \quad \left. \begin{array}{l} \text{ } \\ \text{ } \\ \text{ } \end{array} \right\} \text{solve}$$

$$\alpha_1 = \alpha_2 = -3.25$$

$$\alpha_3 = 3.5$$

$$\begin{aligned} w &= \sum_{i=1}^N \alpha_i s_i = \alpha_1 \begin{pmatrix} 2 \\ 1 \\ 1 \end{pmatrix} + \alpha_2 \begin{pmatrix} 2 \\ -1 \\ 1 \end{pmatrix} + \alpha_3 \begin{pmatrix} 4 \\ 0 \\ 1 \end{pmatrix} \\ &= -3.25 \begin{pmatrix} 2 \\ 1 \\ 1 \end{pmatrix} + 3.25 \begin{pmatrix} 2 \\ -1 \\ 1 \end{pmatrix} + 3.5 \begin{pmatrix} 4 \\ 0 \\ 1 \end{pmatrix} = \begin{pmatrix} 1 \\ 0 \\ -3 \end{pmatrix} \end{aligned}$$

$$w = \begin{pmatrix} 1 \\ 0 \end{pmatrix} \quad \& \quad b = -3$$

$$\underline{\underline{f = wx + b}}$$

test data with $a = 5 - 1$

$$y = \begin{pmatrix} 1 \\ 0 \end{pmatrix} (5 - 1) - 3$$

$= 2$ +ve class //