

SVM - f9 - 316

$$L(a) = -\frac{1}{\gamma} \sum_{i \in G} a_i a_j y_i y_j [w_i \cdot w_j] + \sum_i a_i$$

$$L(a) = -\frac{1}{\gamma} (a_1 a_r x + a_r x [-1 \quad \gamma] \begin{bmatrix} \gamma - 1 \\ \gamma \end{bmatrix}) +$$

$$a_1 a_r x + a_r x [-1 \quad \gamma] \begin{bmatrix} \gamma - 1 \\ \gamma \end{bmatrix} +$$

$$a_r a_1 x - a_r x [-1 \quad \gamma] \begin{bmatrix} \gamma - 1 \\ \gamma \end{bmatrix} +$$

$$a_r a_1 x + a_r x [-1 \quad \gamma] \begin{bmatrix} \gamma - 1 \\ \gamma \end{bmatrix} +$$

$$(a_1 + a_r) =$$

$$-\frac{1}{\gamma} (\partial a_1 + \gamma a_1 a_r + \gamma a_r a_1 + \gamma a_r) + a_1 + a_r$$

$$- \gamma a_1 - \gamma a_r \quad \boxed{I}$$

$$\text{Constraint } \sum_i a_i y_i = 0 \Rightarrow a_1 - a_r = 0 \Rightarrow a_1 = a_r \quad \boxed{II}$$

$$\boxed{1}$$

put \boxed{II} in \boxed{I} :

$$-\frac{1}{r} (\cancel{2a_1^r} + 1 \cancel{\varepsilon a_1^r} + 1 \cancel{4a_1^r} - \cancel{1a_1} - \cancel{1a_1}) \stackrel{d/d a_1 = 0}{\Rightarrow} -\varepsilon a_1$$

$$10a_1 + 14a_1 + 14a_1 - \varepsilon = 0 \Rightarrow 4\varepsilon a_1 = \varepsilon \Rightarrow a_1 = \frac{1}{14}$$

from \boxed{II} : $a_1 = a_1 = \frac{1}{14}$ ①

$$\boxed{w = \sum_i a_i y_i x_i} \Rightarrow a_1 y_1 x_1 + a_2 y_2 x_2 = w \Rightarrow$$

$$w = \frac{1}{14} x + 1 x \begin{bmatrix} -1 \\ 1 \end{bmatrix} + \frac{1}{14} x - 1 x \begin{bmatrix} 1 \\ -1 \end{bmatrix} = \frac{1}{14} \begin{bmatrix} -1 - 1 \\ 1 + 1 \end{bmatrix} = \begin{bmatrix} -\frac{1}{7} \\ \frac{1}{7} \end{bmatrix}$$

$$\boxed{y_i (w \cdot x_i + b) - 1 = 0} \Rightarrow +1 x \left(\begin{bmatrix} -\frac{1}{7} \\ \frac{1}{7} \end{bmatrix} \cdot \begin{bmatrix} -1 \\ 1 \end{bmatrix} + b \right) - 1 = 0$$

$$\frac{1}{7} + \frac{1}{7} + b - 1 = 0 \Rightarrow b = \frac{1}{7} \quad \text{②} \quad \left[-\frac{1}{7} \quad \frac{1}{7} \right] \begin{bmatrix} -1 \\ 1 \end{bmatrix} + b$$

$\boxed{2}$