

**Input:** $C$ : regularization parameter $tol$ : numerical tolerance $max\_passes$ : max # of times to iterate over  $\alpha$ 's without changing $(x^{(1)}, y^{(1)}), \dots, (x^{(m)}, y^{(m)})$ : training data**Output:** $\alpha \in \mathbb{R}^m$ : Lagrange multipliers for solution $b \in \mathbb{R}$ : threshold for solution

- Initialize  $\alpha_i = 0, \forall i, \quad b = 0$ .

- Initialize  $passes = 0$ .

$$f(x) = \langle \omega, x \rangle + b$$

$$\omega = \sum_{i=1}^m \alpha_i y^{(i)} x^{(i)}$$

- for**  $i = 1, \dots, m$ ,

- Calculate  $E_i = f(x^{(i)}) - y^{(i)}$  using (2).

- if**  $((y^{(i)} E_i < -tol \quad \&\& \quad \alpha_i < C) \parallel (y^{(i)} E_i > tol \quad \&\& \quad \alpha_i > 0))$

- Select  $j \neq i$  randomly.

- Calculate  $E_j = f(x^{(j)}) - y^{(j)}$  using (2).

- Save old  $\alpha$ 's:  $\alpha_i^{(\text{old})} = \alpha_i, \alpha_j^{(\text{old})} = \alpha_j$ .

- Compute  $L$  and  $H$  by (10) or (11).

- if**  $(L == H)$

- continue** to next  $i$ .

- Compute and clip new value for  $\alpha_j$

- if**  $(|\alpha_j - \alpha_j^{(\text{old})}| < 10^{-5})$

- continue** to next  $i$ .

- Determine value for  $\alpha_i$

- Compute  $b$