Input:

C: regularization parameter
tol: numerical tolerance
max_passes: max # of times to iterate over α's without changing
$(x^{(1)}, y^{(1)}), \ldots, (x^{(m)}, y^{(m)})$: training data

Output:

$\alpha \in \mathbb{R}^m$: Lagrange multipliers for solution
$b \in \mathbb{R}$: threshold for solution

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

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

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

  - **for** $i = 1, \ldots m$,
    - Calculate $E_i = f(x^{(i)}) - y^{(i)}$ using (2).
    - **if** $((y^{(i)} E_i < -tol \ \ \&\& \ \ \alpha_i < C) \ || \ (y^{(i)} E_i > tol \ \ \&\& \ \ \alpha_i > 0))$
      - Select $j \neq i$ randomly.
      - Calculate $E_j = f(x^{(j)}) - y^{(j)}$ using (2).
      - Save old α'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 α_j
      - **if** $(|\alpha_j - \alpha_j^{(\text{old})}| < 10^{-5})$
        continue to next i.
      - Determine value for α_i

$$\sum_{i=1}^{m} \alpha_i y^{(i)} = 0$$