Homework 2

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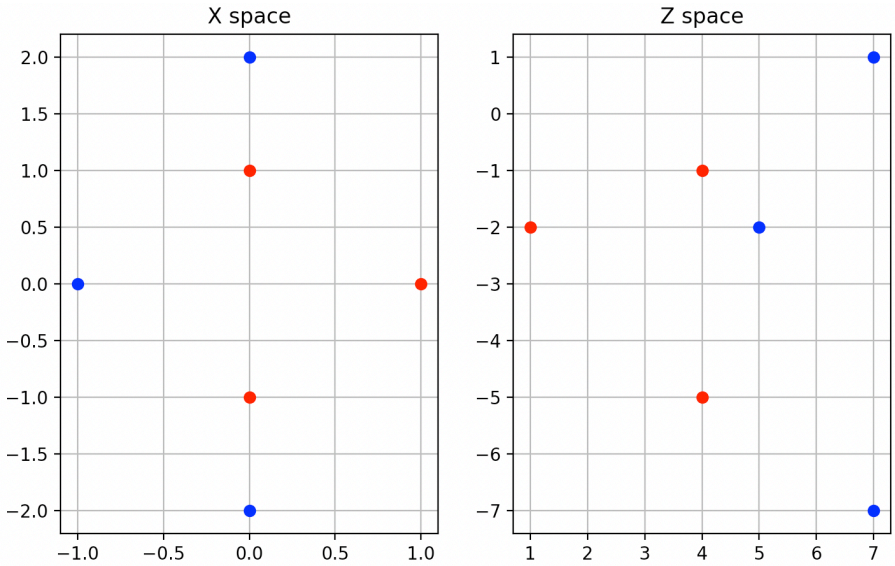
1 SVM

(1)

$$Z_1 = (1, -2)^T, Z_2 = (4, -5)^T, Z_3 = (4, -1)^T$$
$$Z_4 = (5, -2)^T, Z_5 = (7, -7)^T, Z_6 = (7, 1)^T$$



(2)

Z 空间中的支持向量是 $Z_2 = (4, -5)^T, Z_3 = (4, -1)^T, Z_4 = (5, -2)^T$

X 空间的决策函数：$f(x_1, x_2) = \text{sign}(x_2^2 - 2x_1 - \frac{3}{2})$

(3)

对偶问题：

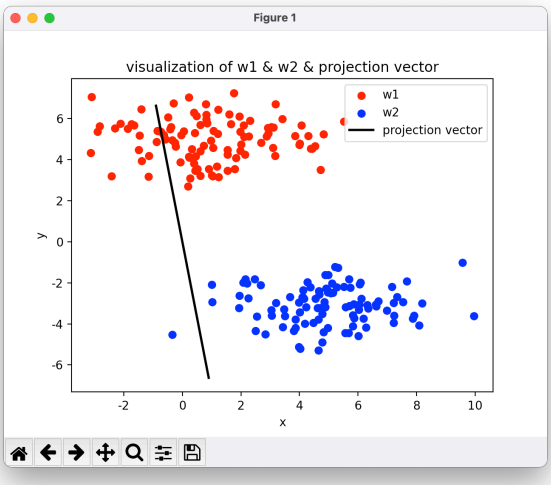
$$\max \sum_{i=1}^{n} \alpha_i - \frac{1}{2} \sum_{i=1}^{n} \sum_{j=1}^{n} \alpha_i \alpha_j y_i y_j K(\mathbf{x}_i, \mathbf{x}_j)$$
$$= \max \sum_{i=1}^{n} \alpha_i - \frac{1}{2} \sum_{i=1}^{n} \sum_{j=1}^{n} \alpha_i \alpha_j y_i y_j (1 + \mathbf{x}_i^T \mathbf{x}_j)^2$$
$$s.t.\ 0 \le \alpha_i \le C;\ \sum_{i=1}^{n} \alpha_i y_i = 0$$

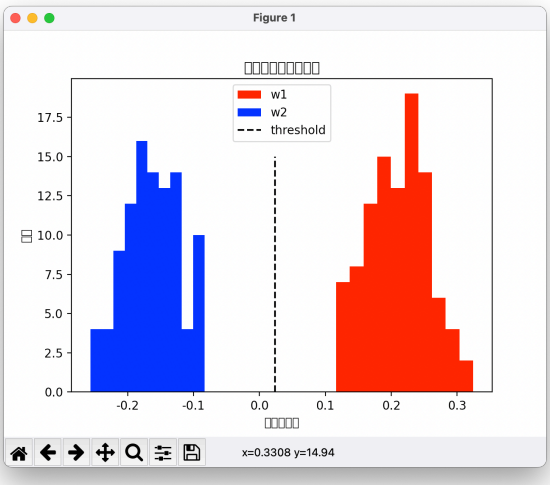
约束条件：

$$
\begin{aligned}
&\alpha_i \geq 0 \\
&y_i(w_i \cdot x_i + b) - 1 \geq 0 \\
&\alpha_i(y_i(w_i \cdot x_i + b) - 1) = 0
\end{aligned}
$$

2 Fisher

代码见 src/





$\omega = (-0.00588497 0.04332736)^T$，$\omega_0 = 0.02329897219452969$，线性判别的准确率为 1.0