Lecture4 习题作业

1，已知两类样本的数据如下：

$\omega_1: \{(5,37),(7,30),(10,35),(11.5,40),(14,38),(12,31)\}$

$\omega_2: \{(35,21.5),(39,21.7),(34,16),(37,17)\}$

试用 Fisher 判别函数法，求出最佳投影方向 W，及分类阈值 y_0

解：由题意知：

$$\mu_1 = \frac{1}{6}\sum_{n=1}^{6} X_n^{(1)} = (9.92\ 35.17)^T$$

$$\mu_0 = \frac{1}{4}\sum_{n=1}^{4} X_n^{(0)} = (36.25\ 19.05)^T$$

则可计算出类内离差阵：

$$\Sigma_1 = \sum_{n=1}^{6}(X_n^{(1)} - \mu_1)\cdot(X_n^{(1)} - \mu_1)^T = \begin{pmatrix} 56.21 & 16.58 \\ 16.58 & 78.83 \end{pmatrix}$$

$$\Sigma_0 = \sum_{n=1}^{4}(X_n^{(0)} - \mu_0)\cdot(X_n^{(0)} - \mu_0)^T = \begin{pmatrix} 14.75 & 9.55 \\ 9.55 & 26.53 \end{pmatrix}$$

$$S_w = \Sigma_1 + \Sigma_0 = \begin{pmatrix} 70.96 & 26.13 \\ 26.13 & 105.36 \end{pmatrix}$$

$$S_w{}^{-1} = \begin{pmatrix} 0.0155 & -0.0038 \\ -0.0038 & 0.0104 \end{pmatrix}$$

从而可计算出最佳投影方向：

$$W^* = S_w{}^{-1}(\mu_1 - \mu_0) = (-0.4704, 0.2696)^T$$

$$y_0 = W^{*T}\frac{(\mu_1 + \mu_0)}{2} = -3.55$$