

## 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:

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

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