

Maximize  $D^2/S$ .

$D$  is distance between class means.

$S$  is within-class scatter (i.e. variance).

Maximize  $D^2/S$ .

$D$  is distance between class means.

$S$  is within-class scatter (i.e. variance).

Equivalently, *minimize*  $S/D^2$ .

Minimize:

$$S/D^2$$

Minimize:

$$S/D^2$$

$$\frac{\sum_{i \in C_1} (\mathbf{m}_{c=1} - \mathbf{x}_i)^2 + \sum_{i \in C_0} (\mathbf{m}_{c=0} - \mathbf{x}_i)^2}{(\mathbf{m}_{c=1} - \mathbf{m}_{c=0})^2}$$

Minimize:

$$S/D^2$$

$$\frac{\sum_{i \in C_1} (\mathbf{m}_{c=1} - \mathbf{x}_i)^2 + \sum_{i \in C_0} (\mathbf{m}_{c=0} - \mathbf{x}_i)^2}{(\mathbf{m}_{c=1} - \mathbf{m}_{c=0})^2}$$

$$\frac{\sum_{i \in C_1} (\mu_{c=1} - \mathbf{T}\mathbf{x}_i)^2 + \sum_{i \in C_0} (\mu_{c=0} - \mathbf{T}\mathbf{x}_i)^2}{(\mu_{c=1} - \mu_{c=0})^2}$$

Minimize:

$$S/D^2$$

$$\frac{\sum_{i \in C_1} (\mathbf{m}_{c=1} - \mathbf{x}_i)^2 + \sum_{i \in C_0} (\mathbf{m}_{c=0} - \mathbf{x}_i)^2}{(\mathbf{m}_{c=1} - \mathbf{m}_{c=0})^2}$$

$$\frac{\sum_{i \in C_1} (\mu_{c=1} - \mathbf{T}\mathbf{x}_i)^2 + \sum_{i \in C_0} (\mu_{c=0} - \mathbf{T}\mathbf{x}_i)^2}{(\mu_{c=1} - \mu_{c=0})^2}$$

$$\sum_{i \in C_1} (\mu_{c=1} - \mathbf{T}\mathbf{x}_i)^2 + \sum_{i \in C_0} (\mu_{c=0} - \mathbf{T}\mathbf{x}_i)^2$$

Minimize:

$$S/D^2$$

$$\frac{\sum_{i \in C_1} (\mathbf{m}_{c=1} - \mathbf{x}_i)^2 + \sum_{i \in C_0} (\mathbf{m}_{c=0} - \mathbf{x}_i)^2}{(\mathbf{m}_{c=1} - \mathbf{m}_{c=0})^2}$$

$$\frac{\sum_{i \in C_1} (\mu_{c=1} - \mathbf{T}\mathbf{x}_i)^2 + \sum_{i \in C_0} (\mu_{c=0} - \mathbf{T}\mathbf{x}_i)^2}{(\mu_{c=1} - \mu_{c=0})^2}$$

$$\sum_{i \in C_1} (\mu_{c=1} - \mathbf{T}\mathbf{x}_i)^2 + \sum_{i \in C_0} (\mu_{c=0} - \mathbf{T}\mathbf{x}_i)^2$$

$$\sum (\mu_i - \mathbf{T}\mathbf{x}_i)^2$$

Minimize:

$$S/D^2$$

$$\frac{\sum_{i \in C_1} (\mathbf{m}_{c=1} - \mathbf{x}_i)^2 + \sum_{i \in C_0} (\mathbf{m}_{c=0} - \mathbf{x}_i)^2}{(\mathbf{m}_{c=1} - \mathbf{m}_{c=0})^2}$$

$$\frac{\sum_{i \in C_1} (\mu_{c=1} - \mathbf{T}\mathbf{x}_i)^2 + \sum_{i \in C_0} (\mu_{c=0} - \mathbf{T}\mathbf{x}_i)^2}{(\mu_{c=1} - \mu_{c=0})^2}$$

$$\sum_{i \in C_1} (\mu_{c=1} - \mathbf{T}\mathbf{x}_i)^2 + \sum_{i \in C_0} (\mu_{c=0} - \mathbf{T}\mathbf{x}_i)^2$$

$$\sum (\mu_i - \mathbf{T}\mathbf{x}_i)^2$$

$$\sum (\mu_i - a_1 x_{i,1} - \dots - a_n x_{i,n} - a_{n+1} 1)^2$$