Tutorial 3: Dimensionality Reduction

Rui Zhao

rzhao@ee.cuhk.edu.hk

Feb. 6, 2014

Outline

Outline

1. Generalized Rayleigh Quotient

Fisher Criterion

$$J(\mathbf{w}) = \frac{\mathbf{w}^t \mathbf{S}_B \mathbf{w}}{\mathbf{w}^t \mathbf{S}_W \mathbf{w}} \tag{1}$$

$J(\mathbf{w})$ is the generalized Rayleigh quotient. A vector $\mathbf{w}$ that maximizes $J(\cdot)$ must satisfy

$$\mathbf{S}_B \mathbf{w} = \lambda \mathbf{S}_W \mathbf{w} \tag{2}$$

for some constant λ.

1. Generalized Rayleigh Quotient

Maximizing $J(\mathbf{w})$ is equivalent to

$$\max_{\mathbf{w}} \quad \mathbf{w}^t \mathbf{S}_B \mathbf{w} \tag{3}$$

$$s.t. \quad \mathbf{w}^t \mathbf{S}_W \mathbf{w} = K \tag{4}$$

which can be solved using Lagrange multipliers.