

Pattern Classification and Recognition:

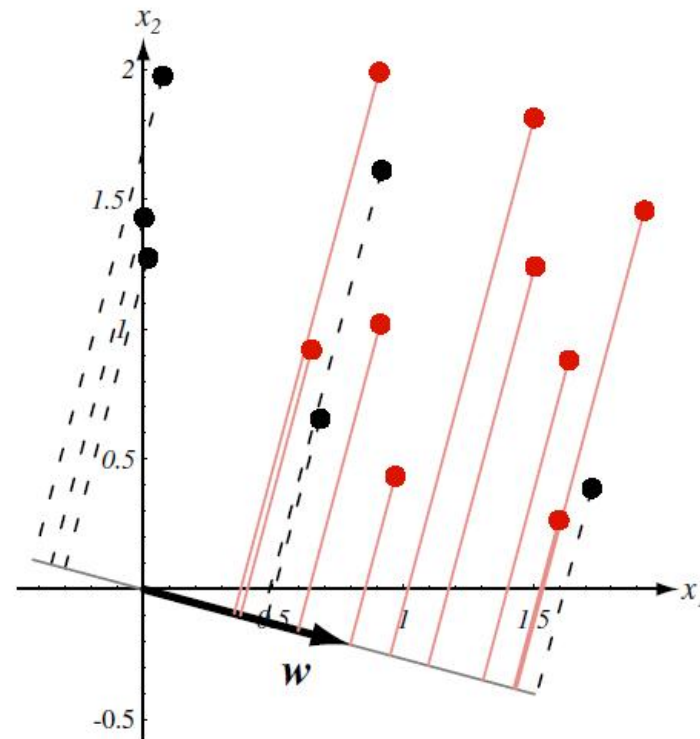
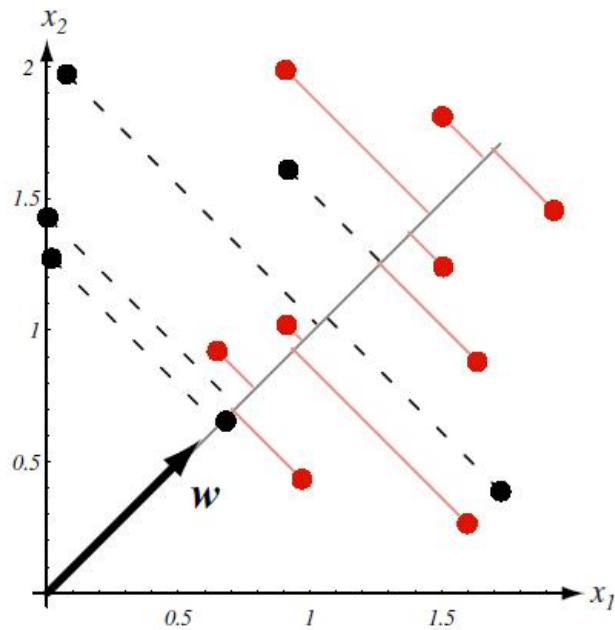
Linear Discriminant Analysis

ECE 681

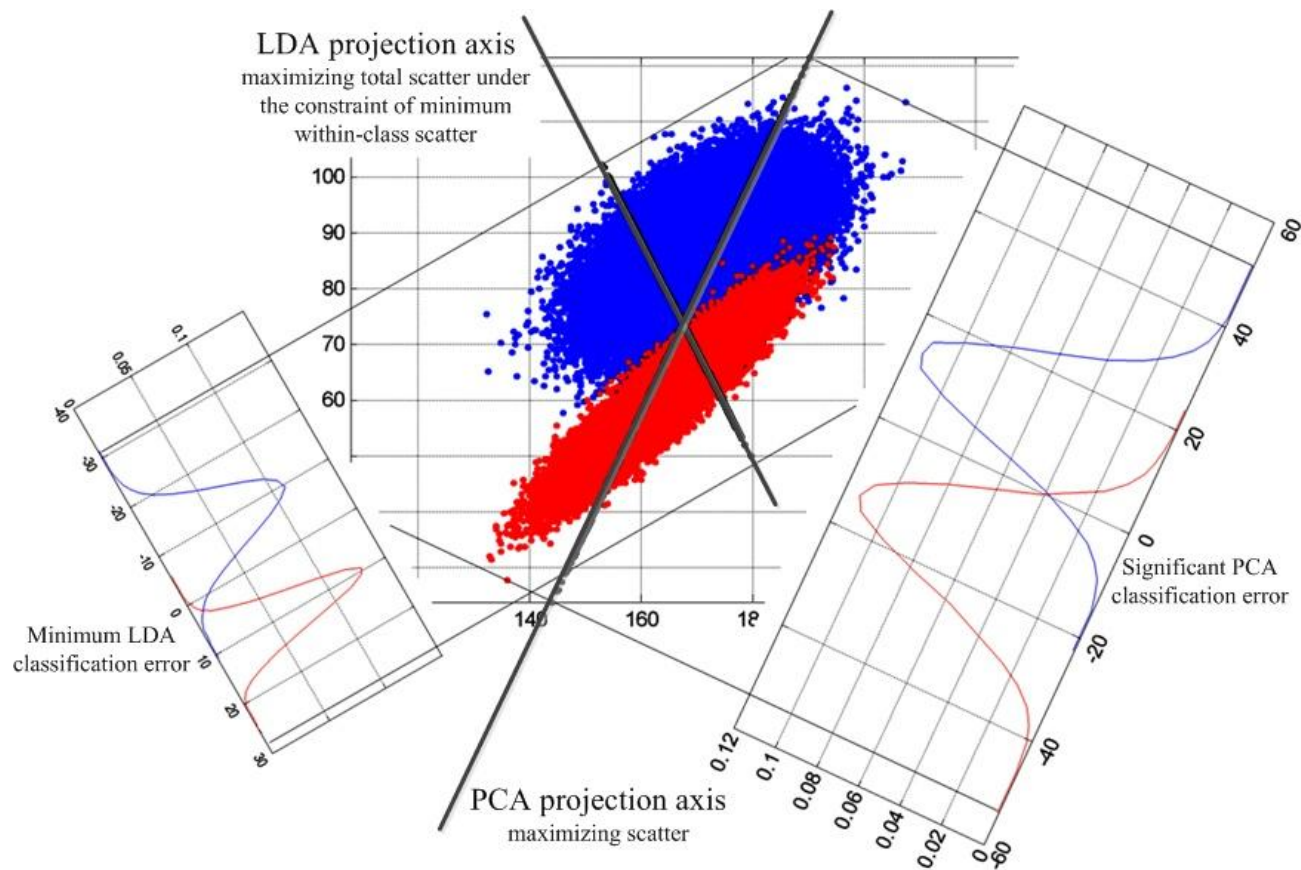
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Linear Projections

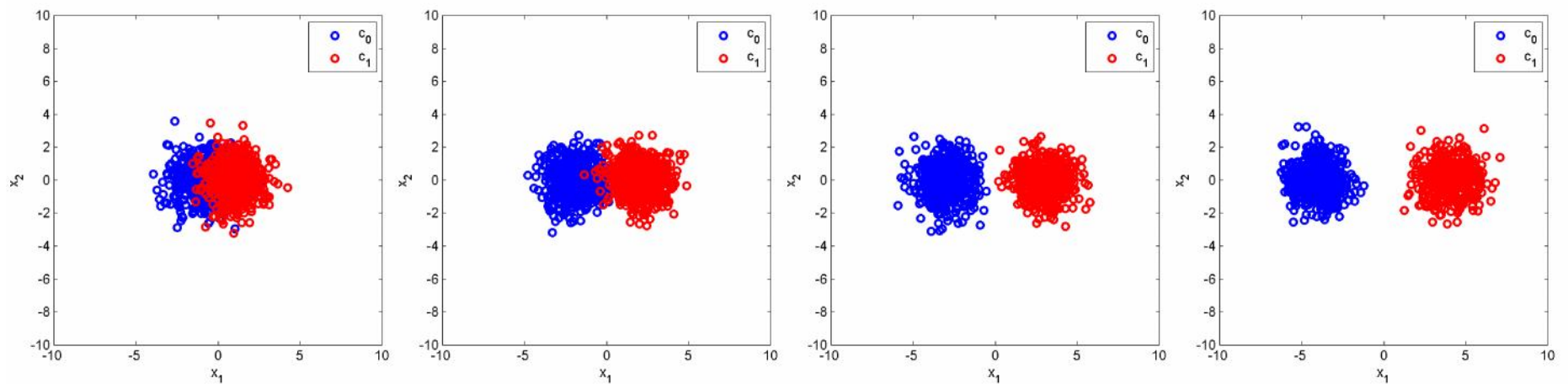


Choosing the “Best” Projection



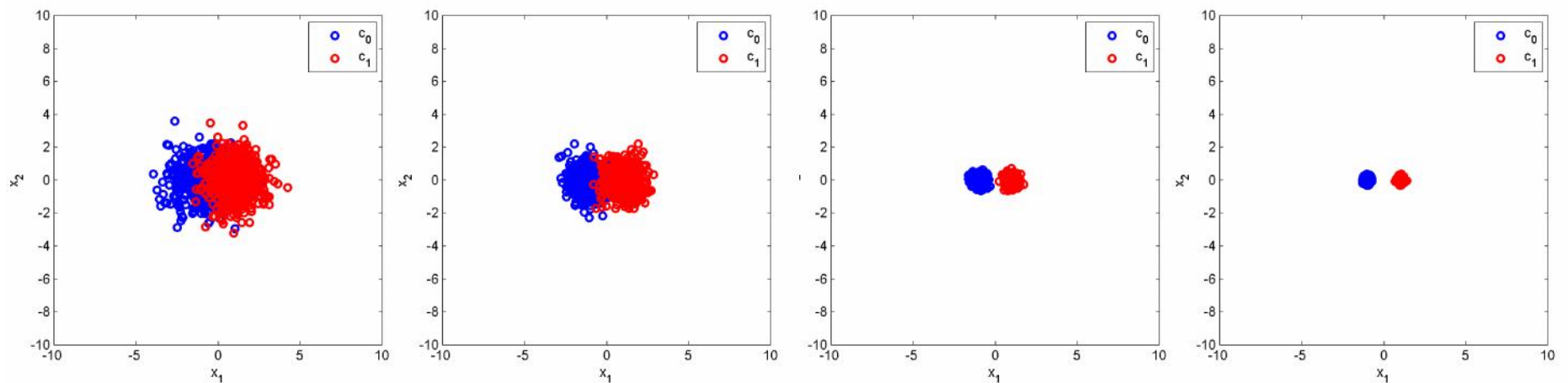
Projection for Classification

How to measure the separation between the projected class distributions?



Projection for Classification

Is the difference in the projected means enough?



Fisher Linear Discriminant

Optimize the projection vector so the difference in the means is large relative to the spread of each class

Fisher Linear Discriminant

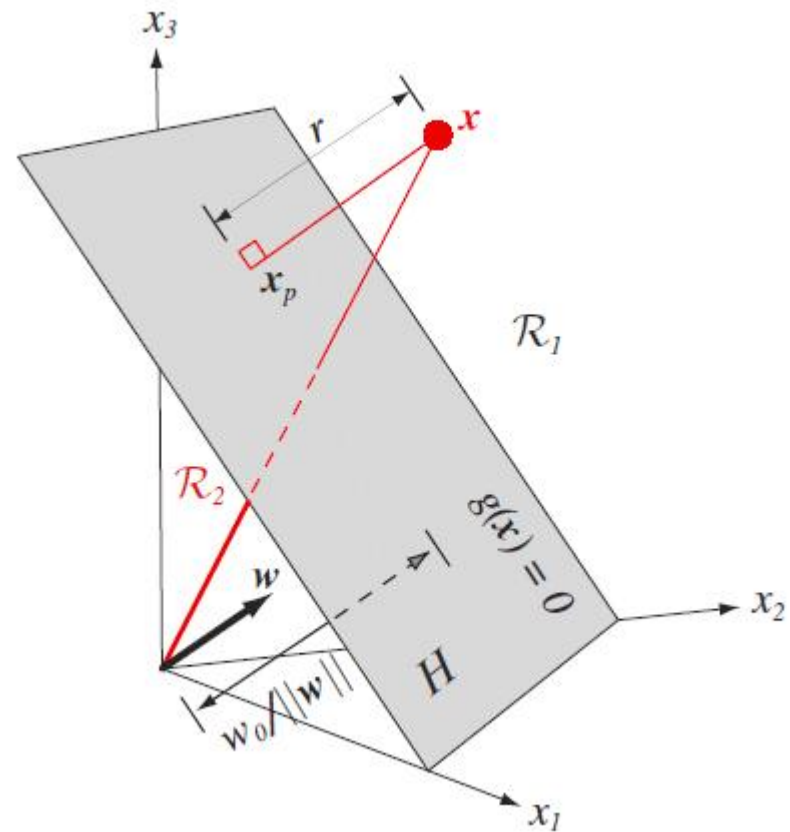
$$J(\mathbf{w}) = \frac{|\tilde{\mathbf{m}}_1 - \tilde{\mathbf{m}}_0|^2}{s_1^2 + s_0^2}$$

Fisher Linear Discriminant

$$J(\mathbf{w}) = \frac{\left| \tilde{m}_1 - \tilde{m}_0 \right|^2}{\tilde{s}_1^2 + \tilde{s}_0^2} = \frac{\mathbf{w}^T \mathbf{S}_B \mathbf{w}}{\mathbf{w}^T \mathbf{S}_W \mathbf{w}}$$

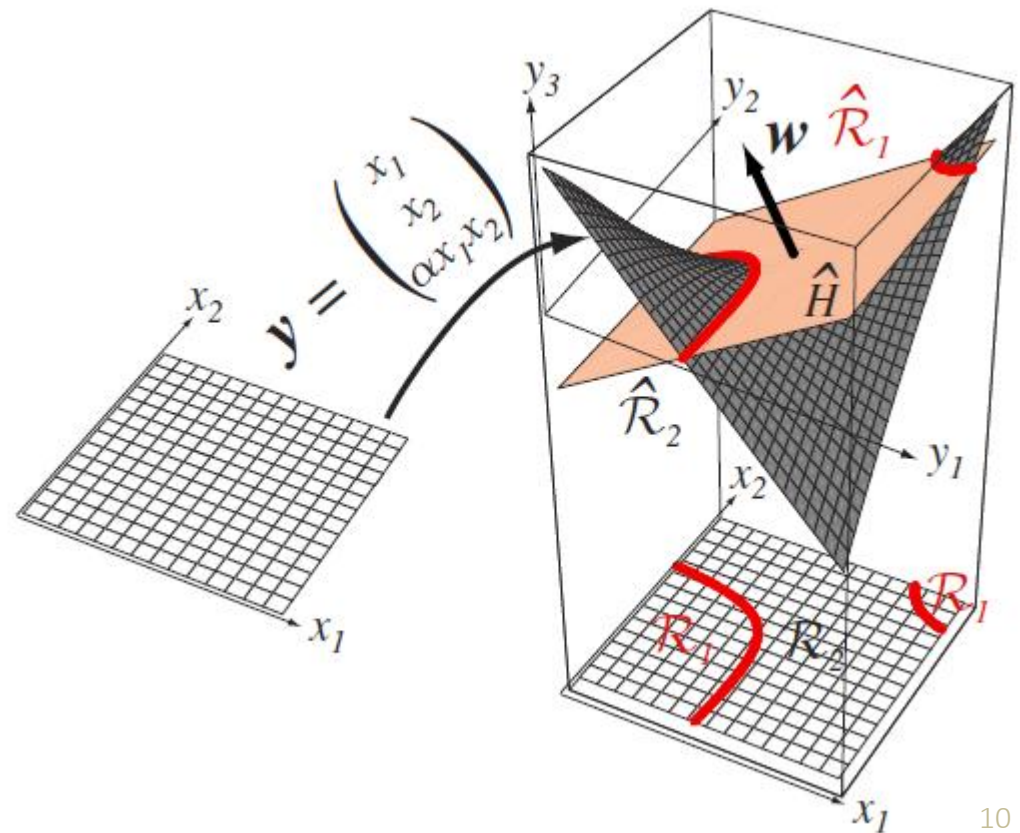
Linear Discriminant Functions

$$g(\mathbf{x}) = \mathbf{w}^T \mathbf{x} + w_0$$



Generalized Linear Discriminant Functions

$$g(\mathbf{x}) = \mathbf{w}^T \mathbf{x} + w_0 = w_0 + \sum_{i=1}^d w_i x_i$$

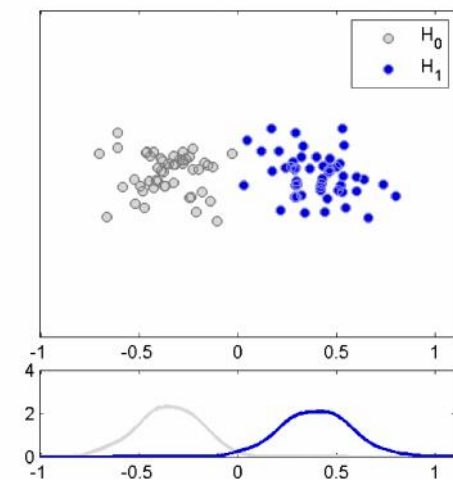
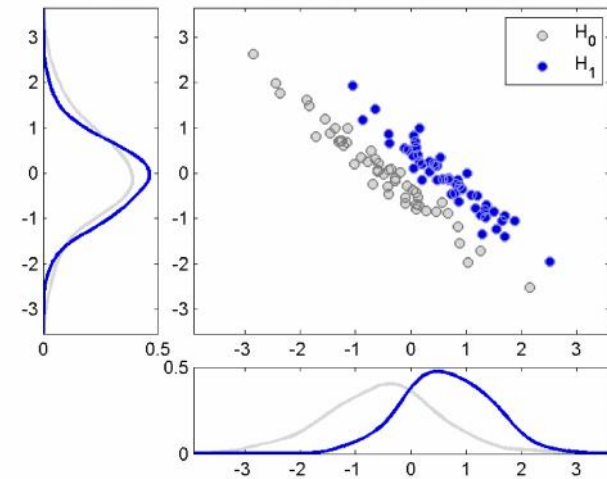
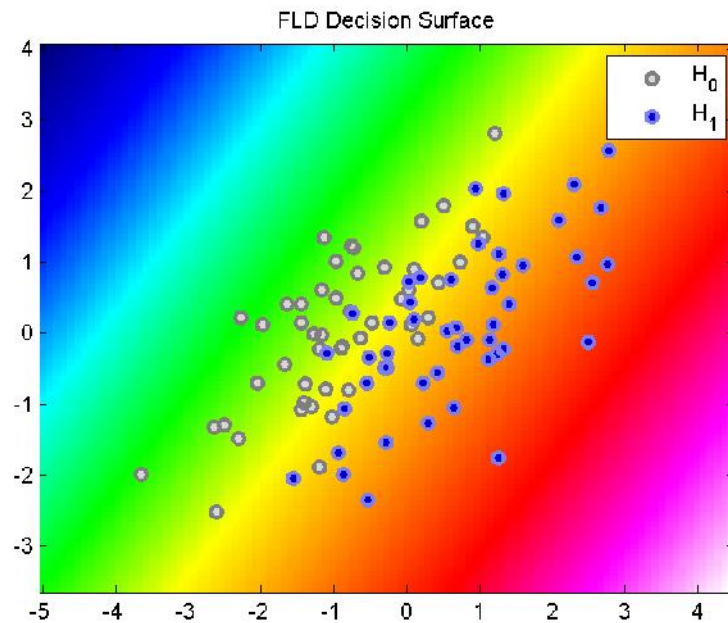


FLD

Decision Statistic: $w^T x$

$$(w = S_w^{-1}(m_1 - m_0))$$

Linear projection that preserves classification information



FLD

Decision Statistic: $w^T x$

$$(w = S_w^{-1}(m_1 - m_0))$$

Training a FLD:

- What do we need to run it?

Running a FLD:

- How do we get a decision statistic?

Classifier Comparison

