E9 205 Machine Learning for Signal Processing

Dimensionality Reduction - II

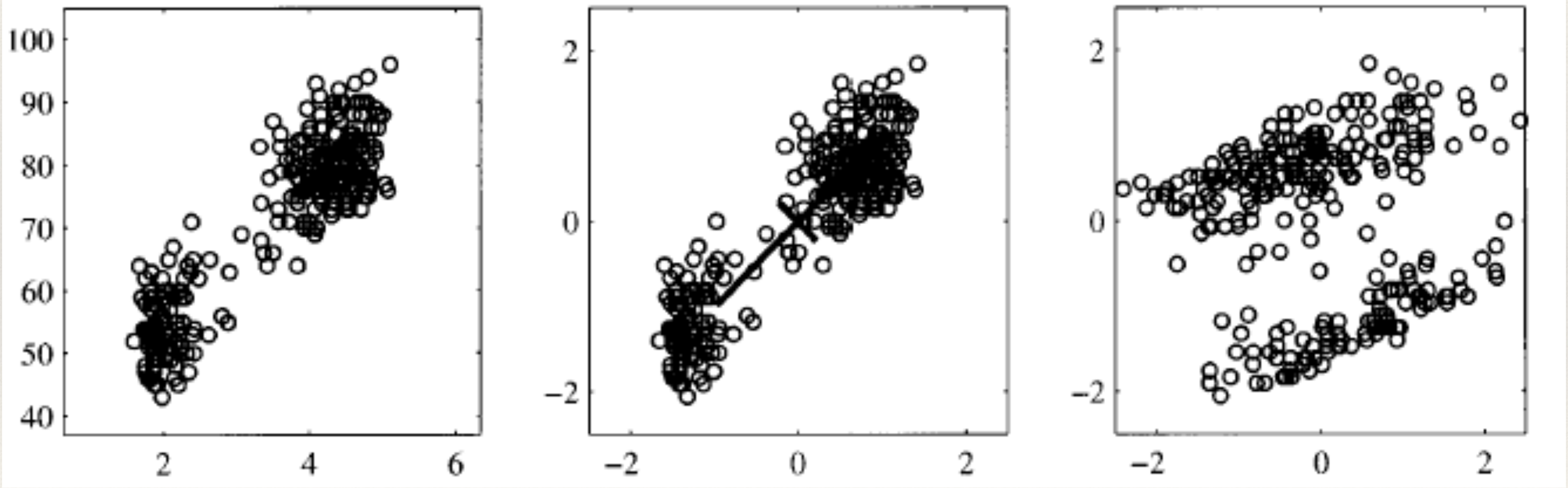
30-08-2017

Instructor - Sriram Ganapathy (sriram@ee.iisc.ernet.in)

Teaching Assistant - Aravind Illa (aravindece77@gmail.com).

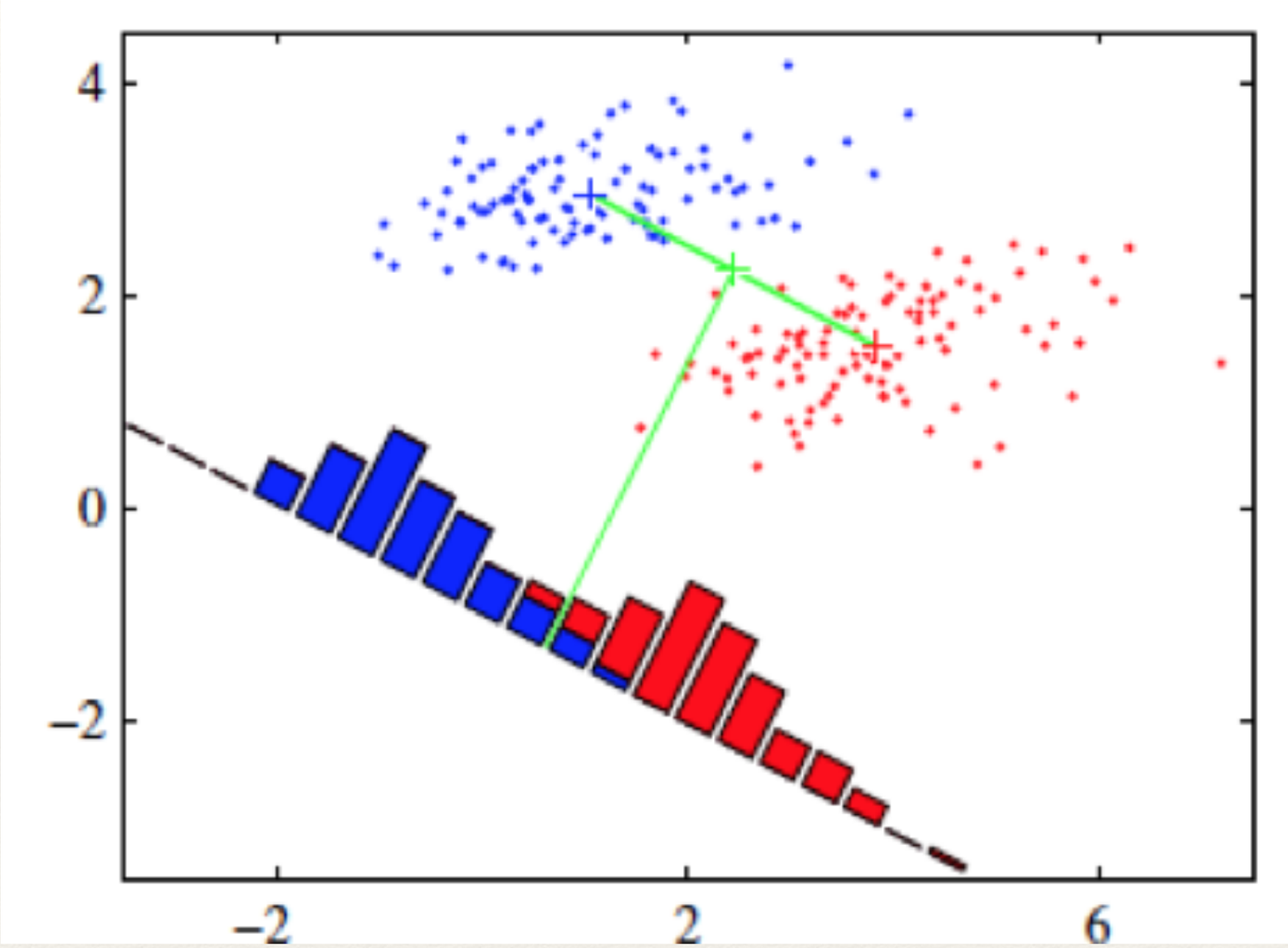
Whitening the Data

Original Data **Whitened data** **Whitened data**



PRML - C. Bishop (Sec. 12.1)

With Only the Within Class Factor



Linear Discriminant Analysis

Find a linear transform $f(\mathbf{x}) = \mathbf{w}^T\mathbf{x}$ with a criterion which maximizes the class separation

- Maximize the between class distance in the projected space while minimizing the within class covariance

$$J = \frac{\mathbf{w}^T \boldsymbol{S}_b \mathbf{w}}{\mathbf{w}^T \boldsymbol{S}_w \mathbf{w}}$$

$$\boldsymbol{S}_b = \sum_{k=1}^{K} N_k (\mathbf{m}_k - \boldsymbol{m})(\mathbf{m}_k - \boldsymbol{m})^T \quad \boldsymbol{S}_w = \sum_{k=1}^{K} \sum_{n \in C_k} (\mathbf{x}_n - \boldsymbol{m}_k)(\mathbf{x}_n - \boldsymbol{m}_k)^T$$

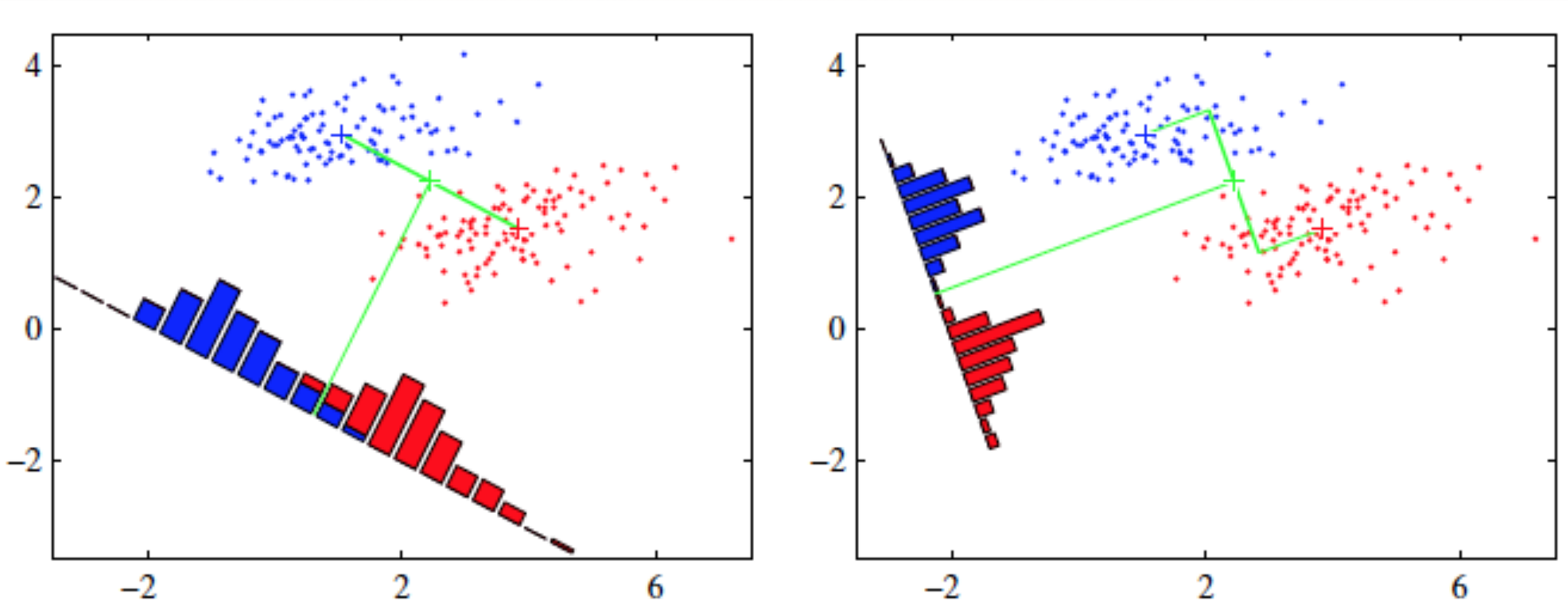
- Generalized Eigenvalue problem
- Eigenvectors of $\boldsymbol{S}_w^{-1}\boldsymbol{S}_b$

PRML - C. Bishop (Sec. 4.1.4, Sec. 4.1.6)

Linear Discriminant Analysis

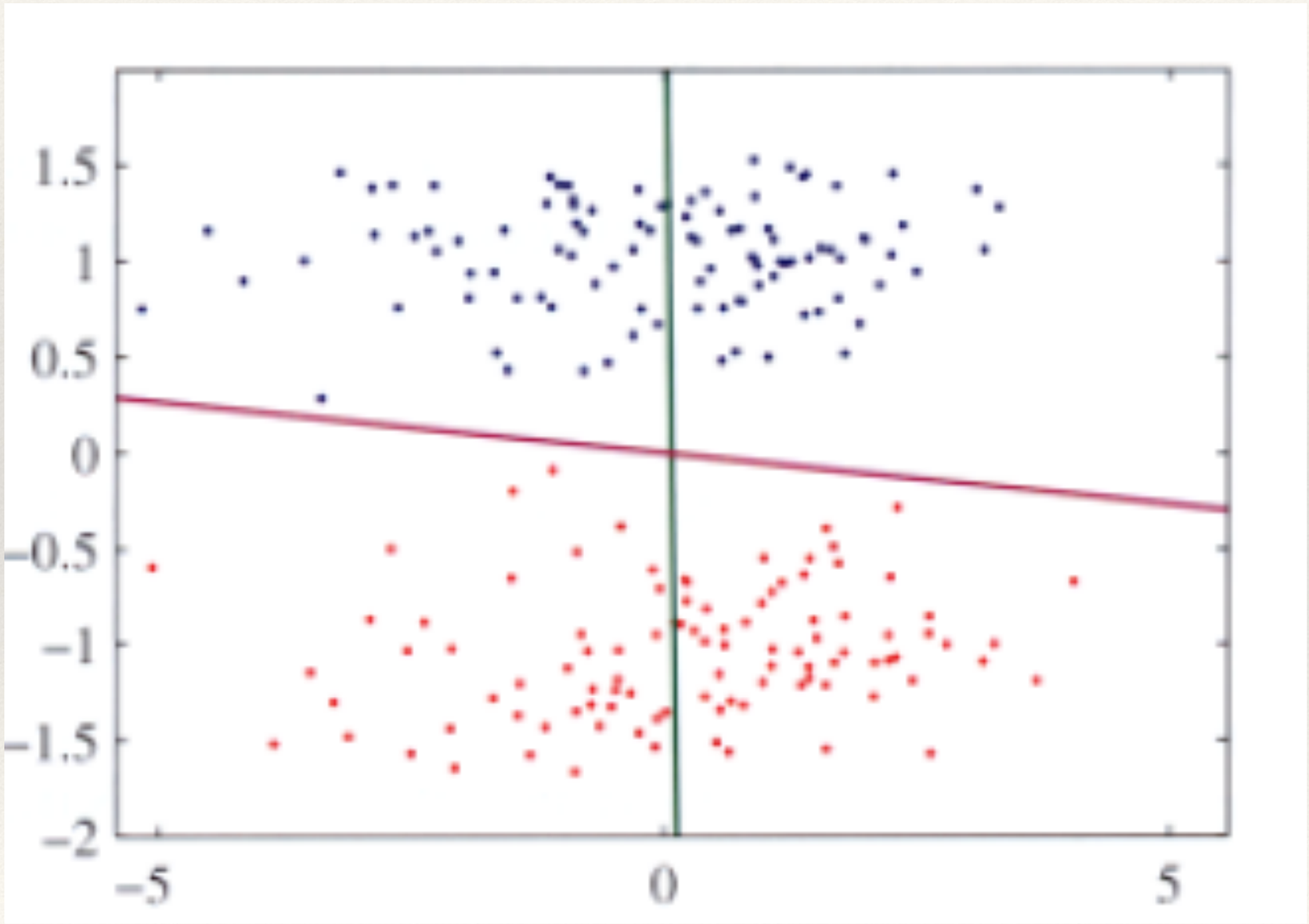
Projecting on line joining means

Fisher Discriminant



PRML - C. Bishop (Sec. 4.1.4, Sec. 4.1.6)

PCA versus LDA



PCA

LDA

PRML - C. Bishop (Sec. 4.1.4, Sec. 4.1.6)