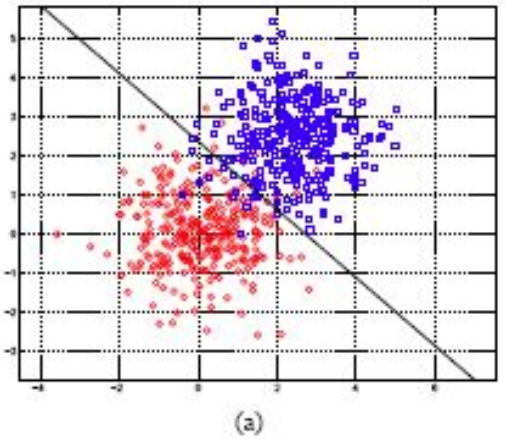
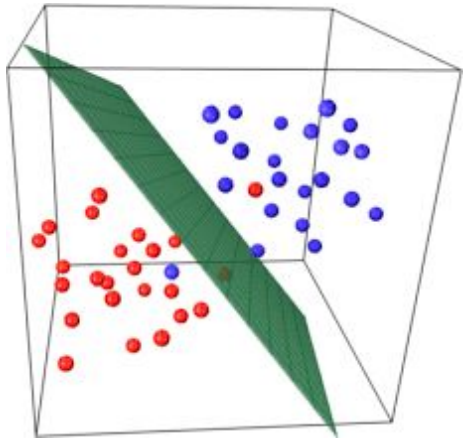
Fisher’s LDA & LDA

EC414 Discussion 5

Discriminant functions

- Discriminant functions attempt to assign an input vector to a class
- Linear discriminant functions perform classification where the decision surface is a **hyperplane**





Linear Classifiers

- Make classification decisions based on a linear predictor function, a combination of weights and the features of data

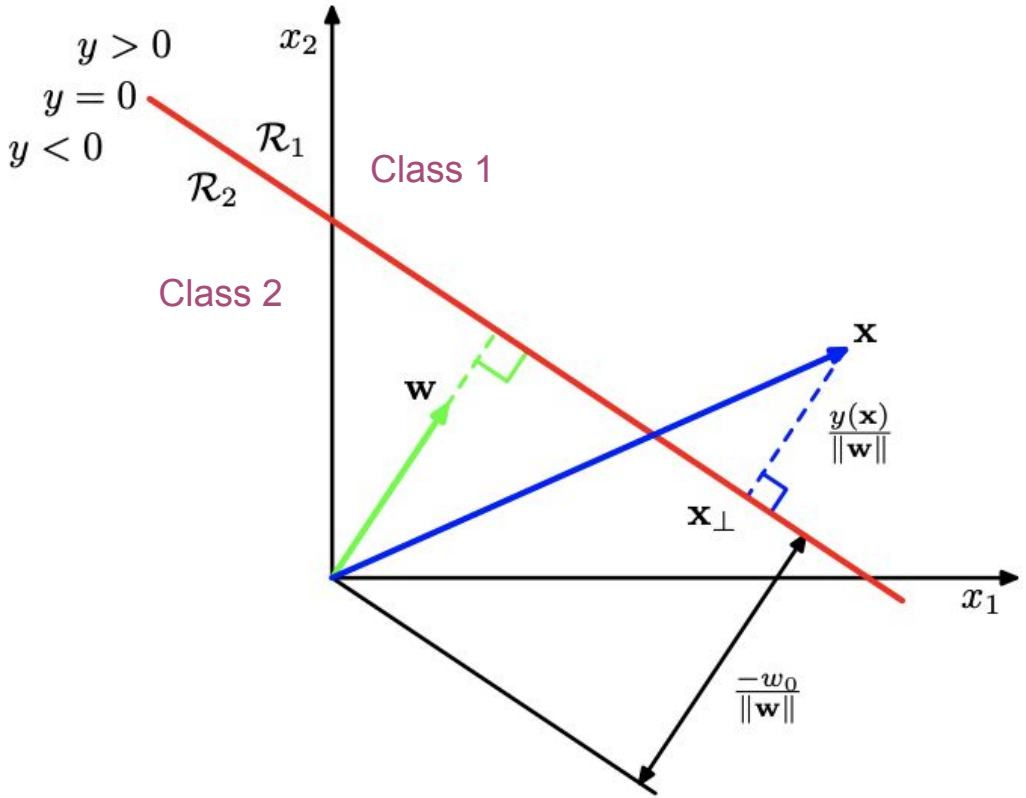
$$y(\mathbf{x}) = f\left(\mathbf{w}^{\mathrm{T}}\mathbf{x} + w_0\right)$$

where we can assume for 2 classes if y >= 0, x will be assigned to class 1 and class 2 if y < 0

- So, the decision boundary is defined by

$$y(\mathbf{x}) = 0$$

Linear Classifiers



Fisher's LDA

- No assumptions that data is Gaussian (unlike LDA), no assumption that data has same covariance matrix (unlike LDA)
- Main idea: project all data from d-dimensions to 1-dimension (along a direction w) - no bias. **Dimensionality reduction**
- Use

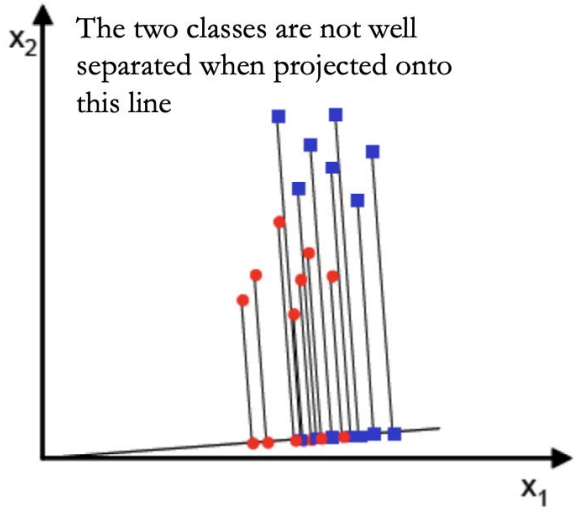
$$y = \mathbf{w}^{\mathrm{T}}\mathbf{x}.$$

  to make decision

- Used for 2-class problems

Fisher's LDA

- Attempts to **maximize class separation in one dimension (and minimize variance within each class)**, so this doesn't happen:



- And this does: