Reconhecimento de Padrões
Aprendizagem Computacional em Biologia
Inteligência Geoespacial

2022/2023

Practical Exercises:
Week #7

Topics

- Statistical Pattern Recognition

  - Sampling a Gaussian Distribution
    1. Univariate case
    2. Bivariate case

  - Maximum Likelihood Estimation

  - Bayes Classifier

Gaussian PDF estimation

1. Consider the Ripley data set contained in a data directory of your ST-PRTool Pattern Recognition tool software. The data is in the Matlab file 'riply_trn.mat' and contains labelled points corresponding to two classes. It can be loaded into your workspace by typing:

   `data = load('riply_trn'); % load labeled (complete) data`

   Estimate the Maximum Likelihood (ML) of a Mixture Gaussian Model. Use function `mlcgmm` to construct the model and functions `pgauss` and `pgmm` to visualize the model. With these functions the graphs in Figure 2 are obtained.
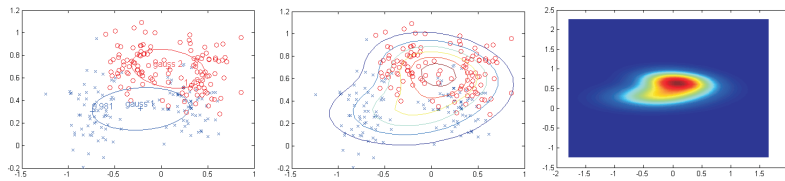
Figura 1: ML Estimation on Ripley Data

Bayes Classifier

1. With the Ripley data set from previous exercise construct a Bayesian classifier. Test the classifier with the Ripley data test set:
   `data = load('riply_tst'); % load labeled (complete) data`
   Compute decision boundary with `bayescls`.

2. Consider the first two classes of the `Cork Stoppers.xls` data set described by the features `ART` and PRT.

   (a) Compute the decision boundary

   (b) Compute the Bayes error

   (c) Consider the three most discriminative features. Compute the Bayes error for two and three classes. Compare results.

   (d) Consider the three least discriminative features. Compute the Bayes error for two and three classes. Compare results.

3. Consider the `Fruits` images data set. Consider the features extracted previously. Design a Bayesian Classifier for the 3-class fruit discrimination. Comment the results obtained.

Figura 2: Three Fruits in your dataset