Exercises for Pattern Analysis Marco Bögel, Sebastian Käppler Assignment 1, 21.04.2015



General Information:

Lecture (3 SWS): Mo 08.15 - 09.45 (H16) and Tue 08.15 - 09.45 (H16)

Exercises (1 SWS): Tue 12.15 - 13.15 (02.134-113) and Thu 8.30 - 9.30 (01.151-128)

Certificate: Oral exam at the end of the semester

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Pattern Recognition - Revisited

Exercise 1 Bayesian Classifier

- (a) What is the difference between discriminative and generative modeling?
- (b) What is the decision rule of the Bayesian classifier?
- (c) Simplify the decision rule if there is no prior knowledge about the occurrence of the classes available.
- (d) Show the optimality of the Bayesian classifier for the (0,1) loss function.

Exercise 2 Naive Bayes

- (a) Which independency assumption is used for naive Bayes?
- (b) What is the decision rule of naive Bayes?
- (c) What is the structure of the covariance matrix of normal-distributed classes in naive Bayes?

Exercise 3 Sigmoid Function

- (a) Write down the Sigmoid function g(x).
- (b) Show that the derivative g'(x) of the sigmoid function fulfills the property g'(x) = g(x) (1 g(x))
- (c) Write down the posteriors for a two class problem $(y = \pm 1)$ for a given decision boundary F(x) in terms of a logistic function.

Exercise 4 Gaussian mixture models and EM

- (a) Write down the general form of a Gaussian mixture model (GMM).
- (b) Which parameters of the GMM can be estimated using the EM algorithm?
- (c) How do you initialize the EM algorithm?
- (d) Describe the basic steps of the EM algorithm for GMMs.