Machine Learning

Introduction

Prerequisites: Math

One should be able at least to guess, what does it mean.

Examples:

$$\ln \prod_i f(x_i) = \sum_i \ln f(x_i)$$

$$\min_x f(x) = -\max_x \big(-f(x)\big)$$

$$\arg\min_x f(x) = \arg\min_x \ln f(x)$$

$$\min_x \sum_y f(x,y) \geq \sum_y \min_x f(x,y)$$

$$\sum_{i=1}^{n} a_i \ln x_i \to \max_x$$

$$\text{s.t. } x_i \geq 0, \sum_i x_i = 1$$

$$x_i \sim a_i$$

In particular: linear algebra (vectors, matrices, SVD, scalar products), a bit geometry, functions (derivative, gradients, integrals, series), optimization, probability theory …

Topics

1. Probability theory: probabilistic inference and learning (3 DS)

2. Discriminative learning (1 DS)

3. Neurons and neuronal networks: simple linear classifiers, complex classifiers by combination, basic algorithms, learning, clustering (2 DS)

4. Support Vector Machines: linear classifiers again, complex classifiers by generalization, kernels, a bit of statistical learning theory, optimization techniques (3 DS)

5. Decision trees, regression trees (1 DS)

6. Introduction to graphical models, MRF-s (1-2 DS)

Seminars

- 2 Groups, Thursday 4+5 DS. Please, partition you by yourself
- Practical assignments (no computers, on the board) – lectures supplement
- Assignments pair of days before on the page
- Homework !!!
- Credits: active participation is assessed – points during the semester, optional – written test

  Exam: oral (graded), with seminars – 4SWS, without – 2SWS

Miscellaneous

- Scripts, slides (quite chaotic at the moment), info etc.

  http://www1.inf.tu-dresden.de/~ds24/lehre/ml_ws_2013/ml_ws_2013.html

- Literature:
  - Christopher M. Bishop: „Pattern Recognition and Machine Learning“ (practically all the stuff)
  - Michail I. Schlesinger, Václav Hlavác: „Ten Lectures on Statistical and Structural Pattern Recognition“ (especially statistical PR)
  - During the semester – Papers (see www1.inf...) for SVM-s, Neuronal Networks etc.

- Comments, requests, questions, criticism are welcome

  (anonym via mail-form as well).