Theoretical Concepts of Machine Learning

Contact

Univ.-Doz. Dr. Ulrich Bodenhofer

Institute of Bioinformatics

Johannes Kepler University

Altenberger Str. 69

A-4040 Linz

Tel. +43 732 2468 9552

Fax +43 732 2468 9511

E-Mail `bodenhofer@bioinf.jku.at`

URL `http://www.bioinf.jku.at/`

Dates of Lectures

- October 7, 14, 21, and 28 and 29

- November 11, 12, 25, and 26

- December 2, 9 and 16

- January 13, 20 and 27

All lectures 1:45pm – 3:15pm/4:15pm, room KG712.

Dates of Exercises

- October 28

- November 11 and 25

- December 9

- January 13 and 27

All exercises Wednesday, 3:30pm – 4:15pm, room KG712

Course Material

- **No self-contained lecture notes!**

- Basic outline and most important facts are contained on slides that are available online:

  `http://www.bioinf.jku.at/teaching/ws2009/theorConcepts-vo/`

- Details to be written down by hand (keeps you thinking!)

- Supplementary material will be handed out where necessary and appropriate

- Large parts of the lecture can also be found in Sepp Hochreiter's lecture notes of the course *Bioinformatics II: Theoretical Bioinformatics and Machine Learning*

Books for Further Reading

[1] C. M. Bishop. *Neural Networks for Pattern Recognition*. Oxford University Press, 1995. ISBN 0-19-853864-2.

[2] R. O. Duda, P. E. Hart, and D. G. Stork. *Pattern Classification*. Second edition. John Wiley & Sons, 2001. ISBN 0-471-05669-3.

[3] T. Hastie, R. Tibshirani, and J. Friedman. *The Elements of Statistical Learning*. Springer, 2001. ISBN 0-387-95284-5.

[4] B. Schölkopf and A. J. Smola. *Learning With Kernels*. MIT Press, 2002. ISBN 0-262-19475-9.

[5] V. N. Vapnik. *Statistical Learning Theory*. John Wiley & Sons, 1998. ISBN 0-471-03003-1.

Exercises

- You will receive six assignment sheets with exercises that you will have to do as homework

- Programming examples are to be handed in electronically

- Other examples (calculations etc.) can be handed in electronically or on paper

- Every example has a certain value (points)

- Marks: 0–59.9% NGD5, 60–69.9% GEN4, 70–79.9% BEF3, 80-89.9% GUT2, 90-100% SGT1

JKU Moodle

- Electronic submissions of homework, markings, forums, etc. will be handled using JKU's Moodle platform

- Go to `https://moodle.jku.at/moodle/course/view.php?id=31` and register for the course (to be found in section "Informatik"); the access key for the course is available from the lecturer

- Every assignment consists of one or more examples; each assignment is a *topic* and each exercise is a *task/assignment* in Moodle

- Moodle only allows one file per task; if your submission consists of several files, put the files into a ZIP archive (`.rar` and `.tar.gz` are also acceptable)

How to Hand in Homework Electronically

- Allowed file types: plain text, Microsoft Office, OpenOffice, PDF, Mathematica, Matlab, R, programs (C, C++, Perl, or Python)

- File name conventions:
  - Start with $\mathrm{ex}n$ (n is the number of the exercise, not the number of the assignment)
  - Use common suffixes (in particular, `.pl` for Perl programs)

- Submit all relevant files: program(s) + data + results + documentation (if applicable)

- Include your name and the exercise number in each program (see below) and document

How to Hand in Homework on Paper

- Make cover page with name and ID number (Matrikelnummer)

- Clearly indicate to which example the solution belongs

- Be concise and structured

- Write legibly!

- Give the paper to the lecturer (room T734) or put it into his mailbox labeled in the secretary's office (room T731)

Miscellaneous

- Course material and assignment sheets are in English, but you may choose freely whether you hand in your homework in German or English

- Homework will be discussed in the exercise hours; therefore, participation is obligatory; if you cannot come, please notify the lecturer in advance

Outline

Unit 1: Overview of machine learning

Unit 2: Model Evaluation in Supervised Machine Learning

Unit 3: Statistical Learning Theory

Unit 4: Support Vector Machines

Unit 5: Artificial Neural Networks