

Theoretical Concepts of Machine Learning

Assoz.Univprof. Dr. Ulrich Bodenhofer
Institute of Bioinformatics
Johannes Kepler University
Altenberger Str. 69
A-4040 Linz

Tel. +43 732 2468 4526
Fax +43 732 2468 4539

E-Mail bodenhofer@bioinf.jku.at
URL <http://www.bioinf.jku.at/>

Dates of Lectures



- October 3, 10, 17, 24, and 31
- November 14, 21, and 28 (no lecture on November 7!)
- December 5 and 12
- January 9, 16, 23, and 31

All lectures 1:45pm – 3:15pm/4:15pm.

Dates of Exercises



- October 24
- November 14 and 28
- December 12
- January 16 and 31

All exercises Wednesday, 3:30pm – 4:15pm.

- **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/ws2012/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.

- 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

- Electronic submissions of homework, markings, forums, etc. will be handled using JKU's Moodle platform
- Go to
<https://moodle.jku.at/jku2012/course/view.php?id=172>
and register for the course (to be found in section “TNF | Institut für Bioinformatik”); the access key for the course is available from the lecturer
- An assignment consists of one or more exercises
- 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, WEKA, programs (C, C++, Perl, or Python)
- File name conventions:
 - Start with exn (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 S3 309) or put it into his mailbox labeled in the secretary's office (room S3 311)

- 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

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