T-61.5030

Advanced Course in Neural Computing (5 cp)

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General information on the course

Some basic matters:

- Code T-61.5030, 5 credit points.
- Replaces our former course T-61.263 (3 credit weeks) with the same name.
- No computer project.
- It is included in our basic course T-61.3030 Principles of Neural Computing, 5 cp (formerly T-61.261, 3 cr).
- That basic course is recommendable, but not a necessary prerequisite.
- This advanced course can be included into graduate studies.
Registration:

- You should tap in your personal information for being a valid participant.
- Use the TOPI system: http://wwwtopi.hut.fi
- Write your information also to the announcement list circulating on the lectures.

Lectures:

- Mondays 14-16 in the lecture hall T3.
- The first lecture is exceptionally on Thursday 14th September 10-12 in T3!
- No changes to the course this year.
- Lectures proceed faster than in the basic course, dealing with important points.
- More emphasis is laid on self-study (reading the book and slides yourself).
• You can find the details in the book.
• It suffices to read some matters from the slides only.
• There will probably be a ’demo’ lecture showing a few practical applications at the end of the course.
• Tentatively on Monday, December 11
• On the examination week (October 26 - November 1) there will be no lecture and exercises.

**Exercises:**

• Thursdays 10-12 in the lecture hall T3.
• The same as during the last year.
• There will be a total of 11 exercises.
• Assistant: Dr. Jaakko Peltonen.
• Email: Jaakko.Peltonen@hut.fi
• Room A326, Tel. 451 4429.
• The first exercises will be held on 21st September.

• Problem sheets and solutions will be available on the home page of the course.

• Problems will be available before each exercise, solutions after it.

Examinations:

• First examination is on Monday 18th December 16-19 o’clock in the lecture room T1.

• Second exam will be on Sat. 17th February 2007, and the third one in fall 2007.

• Exact requirements for the examination will appear on the home pages of the course.

• They will be copied to the participants.

• They define which matters you should
read from the textbook and for which the slides alone are sufficient.

- Problem sheets in examination are in Finnish.
- You must ask an English problem sheet a week before the examination!

Materials and language:

- The lectures and exercises are presented orally in Finnish.
- However, all the written course materials are available in English.
- Including the textbook, lecture slides, exercise problems, and their solutions.
- Examination requirements and home page are both in Finnish and English.
- Lecture slides, problems, and their solutions as well as some extra material will be copied via Edita Prima Oy.
Course textbook and coverage:

- Ordered to the bookshop in the main building, arrives in mid-September.
- Price: 74 euros, soft-covered.
- Or you can buy the book via internet etc.
- The same book is used also in our basic course Tik-61.3030 Principles of Neural Computing.
- The book is graduate level; but more difficult parts are skipped or discussed loosely.
- Most chapters (9 out of 15) of the textbook are discussed in this course.
- Chapters 3-6, 9, and 14 are skipped completely, and from Chapters 1 and 2
only the main points are briefly repetited.

• If necessary, you can also copy the chapters discussed in this course from master copies.

• They are located in our secretary Tarja Pihamaa’s room B326.

**Opintoyhdysmies** (Contact person taking the materials to Edita Prima Oy):

Sami Virpioja
Email: Sami.Virpioja@tkk.fi
Contents of Haykin’s book and matters discussed in this course

1. Introduction
   • Repetition of basic matters
2. Learning Processes
   • Statistical nature of learning
3. Single Layer Perceptrons
4. Multilayer Perceptrons
5. Radial-Basis Function Networks
6. Support Vector Machines
7. Committee Machines
8. Principal Components Analysis
9. Self-Organizing Maps
10. Information-theoretic Models
    • In particular Independent
Component Analysis (ICA), from a separate tutorial paper

11. Stochastic Machines and Their Approximates Rooted in Statistical Mechanics

12. Neurodynamic Programming

13. Temporal Processing Using Feedforward Networks

14. Neurodynamics

15. Dynamically Driven Recurrent Networks

The boldfaced chapters will be discussed in this course.

Some “real-world” applications will be presented in a separate demo lecture.

More information will be provided later on.