Information Theory and Machine Learning

T-61.182 Special Course in Computer and Information Science II, Spring 2004 (4 cr)

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General information

• The course is based on selected parts of the book


• Publisher: Cambridge Univ. Press, 2003.

• About 640 pages ⇒ We shall skip parts of the book in this course.

• Price: Officially 30 UK pounds (about 45 euros).

• Prices in internet booksellers vary, in some cases lower than 30 UK pounds.

• Comments and reviews on the book have been quite positive.

• Understanding the book requires some mathematical maturity.
We shall skip advanced special topics and non-essential theoretical proofs in our course.

Home page of the book:
http://www.inference.phy.cam.ac.uk/mackay/itila/

The book is freely viewable on the web site of the book in different formats (pdf, ps, djvu).

There is also some other material like found errors, software, etc.

The book deals with information theory, inference, and machine learning.

These topics are usually discussed separately, but actually they are closely related.

They are important in many areas of science and engineering:

Communications, signal processing, data mining, pattern
• In this course, we deal with basic information theory and coding (parts I and II).

• As well as Bayesian inference methods (part IV).

• Part V, neural networks, is largely overlapping with our two neural network courses.

• We deal briefly with things which open up fresh views or are not discussed in our neural network courses (if time allows).

• Advanced topics in information theory (Part III) and sparse graph coding (Part VI) are skipped in this special course.
Organization of the seminar

• Four (4) credit points as usual in our seminar courses.

• Weekly in the lecture room T4 on Thursdays 14:15 (up to 16 if necessary).

• A more detailed programme will be planned when the number of participants is known.

• Responsible teacher: Prof. Juha Karhunen

• Email: Juha.Karhunen@hut.fi, room TB327, tel. 451 3270.

• Course assistant: M.Sc. Antti Honkela

• His email: Antti.Honkela@hut.fi; room TB311.

• The language of the course is English due to foreign participants.

• The course is intended mainly for graduate students.
- Can be taken by undergraduate students who are mature enough.
- Sufficient mathematical background, most of M.Sc. studies done.
- You should know the fundamentals of probability theory and linear algebra.
- There will be no examination; would be difficult for graduate students working full-time in corporations etc.
- You should write your name, study book number, email address, and department to the enrollment list circulating.
- The price of the book is low, 30 GBP pounds officially.
- So it is recommended that you purchase the book.
- It takes some time until you will get the book.
- Please reserve your own talk from the list circulating in the seminar meetings as soon as possible.
Requirements for passing the course

- Sufficient participation (about 70%) in the seminar meetings.
  - Put a cross to the attendance list whenever you attend.

- You must prepare and present your own talk.
  - Usually one talk per meeting, about 45 min - 1 hour long.
  - If there are two talks, they could be about 35-45 min each.
  - Skip proofs, excessive theory and details, and try to explain clearly the most important matters of the scope of your talk.
  - You can give your slides (for example in .pdf format) to the course assistant.
  - He can copy them to the participants and/or put your slides onto the home page of the course.
• Solving sufficient amount of the given problems.
  – Solving 50% of the total number of problems suffices for the mark "accepted" (hyväksytty).
  – Solving 90-95% of problems is required for the mark "accepted with distinction (kiitän hyväksytty)
  – Typically there will be 2 – 3 problems per each talk.
  – You should select yourself 2 – 3 problems on the portion of the book covered in your talk.
  – Some problems have been solved in the book; of course, you should not select them.
  – You must be able to solve these problems yourself!
  – This guarantees that the problems are not too difficult.
  – Give the correct solutions of the your problems to the course organizer Prof. Juha Karhunen (or to assistant Antti Honkela).
– Problems have been classified in the book: 1= simple, 2=medium, 3=moderately hard, 4=hard, 5=research project.
– You should select only problems having degrees 1, 2, or 3.
– Problems are useful because they force people to read the corresponding parts of the book.
– It is preferable but not necessary to return your solutions to the problems given within 2 weeks.
– Somewhat open issue: replacing some problems by computer assignment(s) giving hands-on experience!