



DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

DIT470 Advanced topics in Machine Learning, 7.5 credits

Avancerade maskininlärningsmetoder, 7,5 högskolepoäng

Second Cycle

Confirmation

This course syllabus was confirmed by Department of Computer Science and Engineering on 2019-12-04 to be valid from 2021-01-18, spring semester of 2021.

Field of education: Science 100%

Department: Department of Computer Science and Engineering

Position in the educational system

The course can be part of the following programmes: 1) Computer Science, Master's Programme (N2COS), 2) Mathematical Sciences, Master's Programme (N2MAT) and 3) Applied Data Science Master's Programme (N2ADS)

Main field of studies

Computer Science

Data Science

Specialization

A1F, Second cycle, has second-cycle course/s as entry requirements

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Entry requirements

To be eligible for the course the student must have successfully completed courses in:

- 7.5 credits of programming (Python experience desirable but not absolutely required)
- 7.5 credits of a data structures or basic algorithm course
- 7.5 credits of basic probability and statistics
- 7.5 credits of calculus
- 7.5 credits of linear algebra
- 7.5 credits of a standard basic course in machine learning (for example DIT381, MSA220 or DIT866)

Learning outcomes

On successful completion of the course the student will be able to:

- to learn about modern and advanced machine learning methods and analyze them in different situations
- to read and understand state-of-the-art scientific articles in the field
- to propose and employ suitable models for the complex machine learning tasks
- to be prepared for research and development of advanced machine learning methods

Knowledge and understanding

- to understand in depth the advanced machine learning methods, and learn their practical implications
- to understand some of the main research areas and topics within machine learning
- to learn the way the complex real problems are turned into research questions in machine learning

Competence and skills

- to analyze advanced machine learning and understand why a method may work or may fail
- to deal with the cases where the standard machine learning is not very helpful and needs to be improved
- to be better prepared for research in AI/machine learning
- to read and follow the relevant state-of-the-art research articles

Judgement and approach

- to employ a suitable model w.r.t. the assumptions and analyze the different aspects such as performance and effectiveness
- to learn how machine learning models can be further developed to satisfy the requirements
- to distinguish some of the main research areas in machine learning, the corresponding challenges and the current approaches to solve them

Course content

- Theoretical machine learning and the computational aspects
- Advanced deep learning (Deep Neural Network) models
- Active learning/Online learning
- Advanced unsupervised learning, for example, GANs, clustering and dimension reduction

Sub-courses

1. **Written hall examination** (*Skriftlig salstentamen*), 4 credits
Grading scale: Pass with Distinction (VG), Pass (G) and Fail (U)
2. **Assignments** (*Inlämningsuppgifter*), 3.5 credits
Grading scale: Pass with Distinction (VG), Pass (G) and Fail (U)

Form of teaching

Lectures and assignments

Language of instruction: English

Assessment

The course will be examined by an written hall examination and the assignments.

If a student, who has failed the same examined element on two occasions, wishes to change examiner before the next examination session, such a request is to be submitted to the department in writing and granted unless there are special reasons to the contrary (Chapter 6, Section 22 of Higher Education Ordinance).

In the event that a course has ceased or undergone major changes, students are to be guaranteed at least three examination sessions (including the ordinary examination session) over a period of at least one year, though at most two years after the course has ceased/been changed. The same applies to work experience and VFU, although this is restricted to just one additional examination session.

Grades

The grading scale comprises: Pass with Distinction (VG), Pass (G) and Fail (U).

A passing grade for the entire course requires at least a passing grade for all sub-courses. To be awarded a higher passing grade for a full course, the student must, in addition, have a higher average on the weighted grades on the sub-courses grades.

Course evaluation

The course is evaluated through meeting after the course between teachers and student representatives. Further, an anonymous questionnaire is used to ensure written information. The outcome of the evaluations serves to improve the course by indicating which parts could be added, improved, changed or removed.

The results of and possible changes to the course will be shared with students who participated in the evaluation and students who are starting the course.

Additional information

The course is a joint course together with Chalmers.

Course literature will be announced at the latest 8 weeks prior to the start of the course.