UNIVERSITY OF GOTHENBURG

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

DIT866 Applied Machine Learning, 7.5 credits

Tillämpad maskininlärning, 7,5 högskolepoäng

Second Cycle

Confirmation

This course syllabus was confirmed by Department of Computer Science and Engineering on 2017-12-19 and was last revised on 2019-12-02 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 is compulsory within the Applied Data Science Master's Programme. It is also a single subject course at the University of Gothenburg.

The course can be part of the following programmes: 1) Computer Science, Master's Programme (N2COS), 2) Mathematical Sciences, Master's Programme (N2MAT), 3) Applied Data Science Master's Programme (N2ADS), 4) Computer Science, Bachelor's Programme (N1COS) and 5) Software Engineering and Management Master's Programme (N2SOF)

Main field of studies	*Specialization*
Data Science	A1F, Second cycle, has second-cycle course/s as entry requirements
Computer Science	A1F, Second cycle, has second-cycle course/s as entry requirements
Software Engineering	A1F, Second cycle, has second-cycle course/s as entry requirements

Entry requirements

To be eligible to the course, the student should have a Bachelor's degree in any subject, or have successfully completed 90 credits of studies in computer science, software engineering, or equivalent. Specifically, the course requires

- 7.5 credits programming,
- 7.5 credits introduction to data science or AI, such as DIT852 or DIT405,
- 7.5 credits calculus or mathematical modeling (such as DIT856),
- 7.5 credits probability theory, statistics, or mathematical statistics, such as DIT862. Alternatively have taken both of the following two courses: DIT847 and DIT278 (or equivalent)

Applicants must prove knowledge of English: English 6/English B or the equivalent level of an internationally recognized test, for example TOEFL, IELTS.

Learning outcomes

After completion of the course the student should be able to:

Knowledge and understanding

- describe the most common types of machine learning problems,
- explain what types of problems can be addressed by machine learning, and the limitations of machine learning
- account for why it is important to have informative data and features for the success of machine learning systems,
- explain on a high level how different machine learning models generalize from training examples.

Competence and skills

- apply a machine learning toolkit in an application relevant to the data science area,
- write the code to implement some machine learning algorithms,
- apply evaluation methods to assess the quality of a machine learning system, and compare different machine learning systems.

Judgement and approach

- discuss the advantages and limitations of different machine learning models with respect to a given task,
- reason about what type of information or features could be useful in a machine learning task,
- select the appropriate evaluation methodology for a machine learning system and motivate this choice,
- reason about ethical questions pertaining to machine learning systems.

Course content

The course gives an introduction to machine learning techniques and theory, with a focus on its use in practical applications.

During the course, a selection of topics will be covered in supervised learning, such as linear models for regression and classification, or nonlinear models such as neural networks, and in unsupervised learning such as clustering.

The use cases and limitations of these algorithms will be discussed, and their implementation will be investigated in programming assignments. Methodological questions pertaining to the evaluation of machine learning systems will also be discussed, as well as some of the ethical questions that can arise when applying machine learning technologies.

There will be a strong emphasis on the real-world context in which machine learning systems are used. The use of machine learning components in practical applications will be exemplified, and realistic scenarios will be studied in application areas such as e-commerce, business intelligence, natural language processing, image processing, and bioinformatics. The importance of the design and selection of features, and their reliability, will be discussed.

Sub-courses

1. **Take-home examination** *(Hemtentamen),* 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, exercise sessions, computer lab sessions.

Language of instruction: English

Assessment

The course is examined by an individual written take-home examination, as well as mandatory written assignments submitted as written reports, some of which will be carried out individually and others in groups of normally 2-4 students.

Late submission of the take-home examination results in the grade Fail (U), unless special reasons exist. A failed take-home examination is reexamined by a new take-home exam.

If a student, who has failed the same examined component twice, wishes to change examiner before the next examination, a written application shall be sent to the department responsible for the course and shall be granted unless there are special reasons to the contrary (Chapter 6, Section 22 of Higher Education Ordinance).

In cases where a course has been discontinued or has undergone major changes, the student shall normally be guaranteed at least three examination occasions (including the ordinary examination) during a period of at least one year from the last time the course was given.

Grades

The grading scale comprises: Pass with Distinction (VG), Pass (G) and Fail (U).
A Pass grade (G) for the entire course requires at least a Pass grade for all sub-courses.

To be awarded Pass with Distinction (VG) for the full course, the grade VG must be obtained on both the sub-courses.

Course evaluation

The course is evaluated through meetings both during and 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.

Additional information

The course is a joint course together with Chalmers.

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

The course replaces the course DIT865, 7.5 credits. The course cannot be included in a degree which contains DIT865. Neither can the course be included in a degree which is based on another degree in which the course DIT865 is included.

The course cannot be included in a degree which contains the course DIT381.