Linnæus University

Dnr: 2022/4548-3.1.2.2

Course syllabus

Faculty of Technology

Department of Computer Science and Media Technology

4DT905 Maskininlärning, 5 högskolepoäng
4DT905 Machine Learning, 5 credits

Main field of study
Computer Engineering

Subject Group
Informatics/Computer and Systems Sciences

Level of classification
Second Level

Progression
A1N

Date of Ratification
Approved by Faculty of Technology 2022-12-19
The course syllabus is valid from spring semester 2024

Prerequisites
90 credits in Computer Engineering, Linear algebra (1MA901), 7,5 credits, Applied probability and statistics (1MA915), 7.5 credits, and Multivariable Calculus (1MA916), 5 credits, or equivalent.

Objectives

After completing the course the student shall be able to:

Knowledge and understanding

- A.1 Provide an overview of the different areas within artificial intelligence,
- A.2 explain fundamental principles and applications of machine learning,
- A.3 explain the benefits and drawbacks of different machine learning techniques/algorithms, and
- A.4 explain different learning paradigms in machine learning.

Competence and skills

- B.1 Implement algorithms to solve typical machine learning tasks,
- B.2 represent data to facilitate machine learning,
- B.3 select an appropriate model for a task and evaluate its performance,

- B.4 recognize the effects of bad initialization and parameter selection and suggest ways to improve results, and
- B.5 recognize cases of over- and under-fitting of models and suggest ways to deal with this.

Judgement and approach

- C.1 reason about the effects that, e.g., bias in the training data can have on actual applications.

Content

The course gives an overview of fundamental concepts and techniques within machine learning.

The following topics are covered:

- An overview of artificial intelligence and machine learning.
- Fundamental principles for machine learning.
- Data preprocessing, feature extraction, and dimensionality reduction.
- Model selection, generalization, and overfitting.
- Optimization of training models.
- Regression.
- Nearest neighbor classifiers.
- Logistic regression.
- Naive Bayes.
- Decision trees.
- Artificial neural networks.
- Ensemble methods.
- Kernel methods and Support vector machines.
- k-means and hierarchical clustering.

Type of Instruction

The instruction consists of lectures, seminars, and teacher-supervised laboratory sessions.

Examination

The examination of the course is divided as follows:

Code	Designation	Grade	Credits
2401	Programming assignments	AF	2,50
2402	Written exam	AF	2,50

The course is assessed with the grades A, B, C, D, E, Fx or F.

The grade A constitutes the highest grade on the scale and the remaining grades follow in descending order where the grade E is the lowest grade on the scale that will result in a pass. The grade F means that the student’s performance is assessed as a fail (i.e. received the grade F). Assessment of student performance is made through theoretical assignments, programming assignments, and a written exam. Students who do not pass the regular examination will be offered retrials close to the regular examination.

To pass the course, grade E or higher is required for all parts. The final grade is decided from: programming assignments (50%) and written exam (50%).

Repeat examination is offered in accordance with Local regulations for courses and examination at the first and second-cycle level at Linnaeus University.

If the university has decided that a student is entitled to special pedagogical support due to a disability, the examiner has the right to give a customised exam or to have the student conduct the exam in an alternative way.

Objectives achievement

The examination elements are linked to the course objectives in the following ways:

Goal	2401	2402
A.1		☑
A.2		☑
A.3	☑	☑
A.4		☑
B.1	☑	
B.2	☑	☑
B.3	☑	☑
B.4	☑	☑
B.5	☑	☑
C.1		☑

Course Evaluation

During the implementation of the course or in close conjunction with the course, a course evaluation is to be carried out. Results and analysis of the course evaluation are to be promptly presented as feedback to the students who have completed the course. Students who participate during the next course instance receive feedback at the start of the course. The course evaluation is to be carried out anonymously.

Credit Overlap

The course cannot be included in a degree along with the following course/courses of which the content fully, or partly, corresponds to the content of this course: 4DV660, 5 credits

Other

Grade criteria for the A-F scale are communicated to the student through a special document. The student is to be informed about the grade criteria for the course by the start of the course at the latest.

The course is conducted in such a way that the course participants' experiences and knowledge are made visible and developed. This means, for example, that we have an inclusive approach and strive for no one to feel excluded. This can be expressed in

different ways in a course, for example by using the gender-neutral example.

Required Reading and Additional Study Material

Required reading:

- Bishop, Christopher, *Pattern recognition and machine learning*. Springer, 2006, ISBN: 0387310738. Pages: 400 of 700.
- James, Gareth, Witten, Daniela, Hastie, Trevor, and Tibshirani, Robert, *An introduction to statistical learning: with applications in R*, Springer, 2013. Pages: 350 of 410.
- Compendium of scientific articles. Approximately 100 pages.