Course syllabus

Applied Machine Learning
Tillämpad maskininlärning

EDAN96, 7.5 credits, A (Second Cycle)

Valid for: 2025/26
Faculty: Faculty of Engineering LTH
Decided by: PLED C/D
Date of Decision: 2025-04-14
Effective: 2025-05-05

General Information

Depth of study relative to the degree requirements: Second cycle, in-depth level of the course cannot be classified
Elective for: C4-pvs, C4-pvt, D4-bg, D4-mai, D4-se, D4-pv, E4-bg, E4-mi, F4, F4-pv, F4-fm, MSOC2, N4, Pi4-fm, Pi4-pv
Language of instruction: The course will be given in English

Aim

To give an introduction to fundamental methods and algorithms within Machine Learning and to give an introduction into a selection of specific subdomains and applications. To convey knowledge about breadth and depth of the domain.

Learning outcomes

Knowledge and understanding
For a passing grade the student must

- display basic knowledge concerning theories and methods related to the discussed material. Specific topics can include: unsupervised and supervised learning, classification and regression
- display basic knowledge concerning theories and methods related to the discussed material. Specific topics can include: information theory,
- display basic knowledge concerning theories and methods related to the discussed material. Specific topics can include: kernel methods,

- display basic knowledge concerning theories and methods related to the discussed material. Specific topics can include: principle component analysis
- display basic knowledge concerning theories and methods related to the discussed material. Specific topics can include: support vector machines,
- display basic knowledge concerning theories and methods related to the discussed material. Specific topics can include: decision trees, random forests, ensemble methods

Competences and skills
For a passing grade the student must

- complete a number of assignments based on problems related to the discussed topics and for some of them demonstrate the ability to: evaluate and prepare necessary data
- complete a number of assignments based on problems related to the discussed topics and for some of them demonstrate the ability to: select, implement, and train a model
- complete a number of assignments based on problems related to the discussed topics and for some of them demonstrate the ability to: evaluate the outcome and fine-tune the model

Judgement and approach
For a passing grade the student must

- be able to judge suitability of a given machine learning method to a given problem,
- understand limitations of applicability of machine learning methods

Contents

Fundamentals of machine learning, i.e., concepts and methods for unsupervised and supervised learning, classification and regression:

- probabiilty distributions, likelihood, maximum likelihood and maximum a posteriori estimation,
- gradient descent,
- model selection and cross validation
- overfitting
- generalised linear models
- regression
- kernel methods
- information theory

Specific topics:

- principle component analysis
- support vector machines,
- decision trees, random forests, ensemble methods

Application related topics (to be discussed on overview level) can include:

- specific neural networks, e.g., convolutional neural networks, recurrent neural networks
- autoencoders
- Bayesian classifiers

Examination details

Grading scale: TH - (U, 3, 4, 5) - (Fail, Three, Four, Five)
Assessment:

(Laboratory) Assignments and written exam. To qualify for the exam students must have completed the assignments. The final grade of the course is based on the result of the written examination.

The examiner, in consultation with Disability Support Services, may deviate from the regular form of examination in order to provide a permanently disabled student with a form of examination equivalent to that of a student without a disability.

Modules
Code: 0124. **Name:** Compulsory Course Items.
Credits: 5.0. **Grading scale:** UG - (U, G). **Assessment:** To qualify for a passing grade (3) the laboratory work and assignments must be completed. To take the exam it is necessary to pass all assignments. **The module includes:** Laboratory work and assignments (passing all assignments is required for passing the course).
Code: 0224. **Name:** Exam.
Credits: 2.5. **Grading scale:** TH - (U, 3, 4, 5). **Assessment:** To qualify for the exam the assignments must be completed. The final grade of the course is based on the result of the written examination. **The module includes:** Written exam.

Admission

Admission requirements:

- At least 120 credits(hp) in the engineering programme or equivalent previous education.
- **(**EDA011 Programming, First Course **or** EDA016 Programming, First Course **or** EDA017 Programming, First Course **or** EDA501 Programming, First Course **or** EDAA20 Programming and Databases **or** EDAA45 Introduction to Programming **or** EDAA50 Programming, First Course **or** EDAA55 Programming, First Course **or** EDAA65 Programming, First Course**)**
  and
  (EDAA01 Programming - Second Course **or** EDAA30 Programming in Java - Second Course **or** FMNN25 Advanced Course in Numerical Algorithms with Python/SciPy **or** FRTF25 Introduction to Machine Learning, Systems and Control**)**

The number of participants is limited to: 100
Selection: Completed university credits within the program incl credited such. Cut-off date for inclusion of credits in the ranking is the day after the enrollment period ends, if nothing else is published on the course website. Priority is given to students enrolled in programmes that include the course in their curriculum.
Kursen överlappar följande kurser: EDAN95 FMAN45 BMEN35

Reading list

- Kevin P. Murphy: Machine Learning - A Probabilistic Perspective. MIT Press, 2012, ISBN: 9780262018029. Reference text about machine learning.

- C. M. Bishop: Pattern Recognition and Machine Learning - Information Science and Statistics. Springer, New York, 2006, ISBN: 9780387310732. Reference text about machine learning.
- A. Lindholm, N. Wahlström, F. Lindsten, T.B. Schön: Machine Learning - A First Course for Engineers and Scientists. Cambridge University Press, 2022, ISBN: 978-1-108-84360-7. Introductory textbook.

Contact

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Examinator: Maj Stenmark, maj.stenmark@cs.lth.se
Course homepage: https://cs.lth.se/edan96/

Further information

Detailed rules concerning the assignments will be found in the course web site. Additional course literature will be announced and made available at course start.