Course syllabus

Advanced Applied Machine Learning
Avancerad tillämpad maskininlärning

EDAP30, 7.5 credits, A (Second Cycle)

Valid for: 2026/27
Faculty: Faculty of Engineering LTH
Decided by: PLED C/D
Date of Decision: 2026-04-16
Effective: 2026-05-18

General Information

Depth of study relative to the degree requirements: Second cycle, in-depth level of the course cannot be classified
Elective for: BME4, C4-pvs, C4-pvt, D4-bg, D4-mai, E4-mi, F4, MSOC2, Pi4
Language of instruction: The course will be given in English

Aim

To give a deep understanding of modern area machine learning topics, in particular related to generative models, language models, reinforcement learning, and Bayesian optimization. The focus is on learning to implement and use the methods first-hand in addition to understanding the theory.

Learning outcomes

Knowledge and understanding
For a passing grade the student must

- display advanced knowledge concerning theories, methods and applications related to the following subdomains: neural networks, including convolutional neural networks, recurrent neural networks and deep learning

- display advanced knowledge concerning theories, methods and applications related to the following subdomains: Generative models
- display advanced knowledge concerning theories, methods and applications related to the following subdomains: reinforcement learning
- display advanced knowledge concerning theories, methods and applications related to the following subdomains: Gaussian processes
- display advanced knowledge concerning theories, methods and applications related to the following subdomains: Bayesian optimization

Competences and skills
For a passing grade the student must

- complete a number of assignments based on problems related to at least some of the previously mentioned subdomains and demonstrate the ability to: evaluate and prepare the necessary data
- complete a number of assignments based on problems related to at least some of the previously mentioned subdomains and demonstrate the ability to: select / implement and train a model
- complete a number of assignments based on problems related to at least some of the previously mentioned subdomains and demonstrate the ability to: evaluate the outcome and fine-tune the model
- complete a number of assignments based on problems related to at least some of the previously mentioned subdomains and demonstrate the ability to: model a problem as a Markov Decision Process and optimise a policy using Reinforcement Learning

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

Main topics, to be introduced and discussed on advanced level

- neural networks, including convolutional neural networks, recurrent neural networks and Transformers
- Generative models
- Bayesian learning
- Gaussian processes
- Bayesian optimization
- Reinforcement learning

Examination details

Grading scale: TH - (U, 3, 4, 5) - (Fail, Three, Four, Five)
Assessment: (Laboratory / project) Assignments / hand-ins and optional written exam. Completed assignments result in a pass (mark 3), better grades can be achieved through participation in the optional written exam. There is the possibility of a bonus point system, which means that answering specific parts of the

assignments in addition to the general part can generate bonus points when participating in the written exam.

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: 0122. **Name:** Advanced Applied Machine Learning .
Credits: 7.5. **Grading scale:** TH - (U, 3, 4, 5). **Assessment:** To qualify for a passing grade (3) all assignments must be completed. With passing all assignments a student qualifies for participation in an optional exam, which gives opportunity to improve the course mark, i.e. if a 4 or 5 is achieved in the written exam, this will be the overall mark for the course. **The module includes:** Project/laboratory tasks and assignments (passing all assignments is required for passing the course). Optional written exam.

Admission

Admission requirements:

- At least 150 credits(hp) in the engineering programme or equivalent previous education. EDAA01 Programming - Second Course and (BMEN35 Data-driven Health or EDAN96 Applied Machine Learning module: Code: 0124. Name: Compulsory Course Items or FMAN45 Machine Learning).

Assumed prior knowledge: Fundamentals of machine learning including respective areas of mathematics (linear algebra, statistics, probability theory)
The number of participants is limited to: 50
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 enrolment 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

Reading list

- Kevin P. Murphy: Machine Learning - A Probabilistic Perspective. MIT Press, 2012, ISBN: 9780262018029. Reference text about machine learning.
- Richard S. Sutton and Andrew G. Barto: Reinforcement Learning: An Introduction. MIT Press Ltd, 2018, ISBN: 9780262039246. Reference text about Reinforcement Learning / Action Learning.
- Ian Goodfellow, Yoshua Bengio, Aaron Courville: Deep Learning. MIT Press, 2016, ISBN: 9780262035613. Reference text on deep 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. Reference text about machine learning.
- C. E. Rasmussen and C. K. I. Williams: Gaussian Processes for Machine Learning. MIT Press, 2006, ISBN: 026218253X. Reference text on Gaussian Processes.

Contact

Course coordinator: Davide Tateo, davide.tateo@cs.lth.se
Course coordinator: Elin A. Topp, elin_a.topp@cs.lth.se
Teacher: Erik Hellsten, erik.hellsten@cs.lth.se
Teacher: Marcus Klang, marcus.klang@cs.lth.se
Teacher: Xuan-Son Vu, xuan-son.vu@cs.lth.se
Examinator: Davide Tateo, davide.tateo@cs.lth.se
Examinator: Elin A. Topp, elin_a.topp@cs.lth.se
Course homepage: https://cs.lth.se/edap30/

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.