LUNDS UNIVERSITET
Lunds Tekniska Högskola

Course syllabus

Avancerad tillämpad maskininlärning
Advanced Applied Machine Learning

EDAP30, 7,5 credits, A (Second Cycle)

Valid for: 2023/24
Faculty: Faculty of Engineering, LTH
Decided by: PLED C/D
Date of Decision: 2023-04-18

General Information

Elective for: BME4, C4-pv, D4-bg, D4-mai, E4-bg, F4, MSOC2, Pi4
Language of instruction: The course will be given in English

Aim

To give deepened understanding in previously introduced subdomains of machine learning, to introduce advanced topics and to give insights into their application domains.

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
- autoencoders
- reinforcement learning
- Bayesian learning
- Gaussian processes
- 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
- select / implement and train a model
- 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

Main topics, to be introduced and discussed on advanced level

- neural networks, including convolutional neural networks, recurrent neural networks and deep learning
- autoencoders
- Bayesian learning
- Gaussian processes
- Bayesian optimization
- reinforcement learning

Topics to give an introductory overview and insight to from an application perspective

- graphical models / Bayesian networks and classifiers

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.

Admission

Admission requirements:

- At least 150 credits(hp) in the engineering programme or equivalent previous education
- EDAA01 Programming - Second Course
- BMEN35 Data-driven Health or EDAN96 Applied Machine Learning 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.
The course overlaps following course/s: 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.
- François Chollet: Deep Learning with Python. Manning Publications, 2018, ISBN: 9781617294433. Reference text about the applied part of the course.
- 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 and other information

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Course homepage: http://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.