LUNDS UNIVERSITET
Lunds Tekniska Högskola

Course syllabus

Tillämpad maskininlärning
Applied Machine Learning

EDAN96, 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: C4-pv, D4-bg, D4-mai, E4-bg, 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
- information theory,
- kernel methods,
- principle component analysis
- support vector machines,
- 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
- 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

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 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 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
- 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.
The course overlaps following course/s: EDAN95, FMAN45

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 and other information

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Course coordinator: Maj Stenmark, maj.stenmark@cs.lth.se
Course homepage: http://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.