



LUNDS UNIVERSITET
Lunds Tekniska Högskola

Course syllabus

Maskininlärning Machine Learning

FMAN45, 7,5 credits, A (Second Cycle)

Valid for: 2021/22

Faculty: Faculty of Engineering, LTH

Decided by: PLED F/Pi

Date of Decision: 2021-04-23

General Information

Main field: Machine Learning, Systems and Control.

Elective Compulsory for: MMSR1

Elective for: BME4, D4-bg, D4-mai, E5-bg, F4, F4-bs, F4-bg, F4-fm, F4-r, F4-mai, I4, MSOC2, Pi4-bam

Language of instruction: The course will be given in English on demand

Aim

To give knowledge about the basic theory for Machine Learning -- construction of automatised systems that can learn/gather information from data, for example learn to recognize characters in a hand-written text.

Learning outcomes

Knowledge and understanding

For a passing grade the student must

- be able to account for the statistical principles used in machine learning
- be able to describe the scientific basis for the design and analysis of learning algorithms and systems
- demonstrate in-depth knowledge of methods and theories in the field of machine learning.

Competences and skills

For a passing grade the student must

- have demonstrated the ability to develop learning techniques and learning systems for relevant technological problems

- have demonstrated the ability to identify, formulate, design, and implement learning components and applications.

Judgement and approach

For a passing grade the student must

have demonstrated the ability to critically evaluate and compare different learning models and learning algorithms for different problem setups and quality characteristics.

Contents

- Training, testing, generalization, hypothesis spaces
- Linear regression and classification
- Optimization techniques and statistical tools for learning
- Neural networks, convolutional neural networks and deep learning
- Clustering, autoencoders and generative models

Examination details

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

Assessment: Compulsory assignments including computer work and written reports. Approved results on these are enough to pass the course. To get a higher grade, the student also has to pass an oral examination. For those who do not get all the assignments approved during the course there will be a chance to hand in improved versions during the following semester.

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:

- FMAF05 Mathematics - Systems and Transforms or FMAF10 Applied Mathematics - Linear systems

Assumed prior knowledge: FMAF05 Mathematics - Systems and Transforms or FMAF10 Applied Mathematics - Linear Systems, and one of the basic courses in Mathematical Statistics, e.g. FMSF45.

The number of participants is limited to: 100

Selection: Completed university credits within the program. (Note that only credits which according to Ladok have been included in the program before the selection process count.) Priority is given to students enrolled on programmes that include the course in their curriculum. Among these students priority is given to those in the master's programme in Machine Learning, Systems and Control, for whom the course is compulsory.

Reading list

- Bishop, C. M.: Pattern Recognition and Machine Learning. Springer, 2006, ISBN: 9780387310732. Reference text.
- I. Goodfellow, Y. Bengio & A. Courville: Deep Learning. MIT press, 2016, ISBN:

978-0-262-03561-3. Reference text. HTML version available at <http://www.deeplearningbook.org/>.

- T. Hastie, R. Tibshirani & J. Friedman: The Elements of Statistical Learning: Data Mining, Inference, and Prediction, 2nd edition. Springer, 2009, ISBN: 9780387848570. Reference text. E-book available via university library.
- Mikael Nilsson: Lecture slides. Mostly self-contained. Will be available via the course home page during the course.

Contact and other information

Course coordinator: Anders Holst, studierektor@math.lth.se

Course administrator: Studerandeexpeditionen, expedition@math.lth.se

Teacher: Mikael Nilsson, mikael.nilsson@math.lth.se

Course homepage: <http://www.ctr.maths.lu.se/course/machinlearn/>