



**LUNDS UNIVERSITET**  
Lunds Tekniska Högskola

*Course syllabus*

# Maskininlärning Machine Learning

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

**Valid for:** 2023/24

**Faculty:** Faculty of Engineering, LTH

**Decided by:** PLED F/Pi

**Date of Decision:** 2023-04-18

## General Information

**Main field:** Machine Learning, Systems and Control.

**Elective Compulsory for:** MMSR1

**Elective for:** BME4, D4-bg, D4-mai, E5, F4, F4-bs, F4-bg, F4-r, F4-mai, I4, 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:** 110

**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. For students taking master's programmes 180 credits corresponding to a bachelor's degree are added.) Priority is given to students enrolled on programmes that include the course in their curriculum. Among these students place is guaranteed to those in the master's programme in Machine Learning, Systems and Control, for whom the course is compulsory.

**The course overlaps following course/s:** EDAN96

## 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](mailto:studierektor@math.lth.se)

**Course administrator:** Studerandeexpeditionen, [expedition@math.lth.se](mailto:expedition@math.lth.se)

**Teacher:** Mikael Nilsson, [mikael.nilsson@math.lth.se](mailto:mikael.nilsson@math.lth.se)

**Course homepage:** <https://canvas.education.lu.se/courses/20372>