Department of Mathematics
(incl. Math. Statistics)

Stockholm University

Syllabus

for course at advanced level

Machine Learning
Maskininlärning

7.5 Higher Education Credits
7.5 ECTS credits

Course code:	DA7063
Valid from:	Spring 2019
Date of approval:	2018-08-20
Department	Department of Mathematics (incl. Math. Statistics)
Main field:	Computer Science
Specialisation:	A1N - Second cycle, has only first-cycle course/s as entry requirements

Decision

This syllabus has been approved by the Board of the Faculty of Science at Stockholm University, August 20, 2018.

Prerequisites and special admittance requirements

For course admission knowledge equivalent to the following is required: Mathematics I, 30 ECTS credits (MM2001), Mathematics II - Linear Algebra 7.5 ECTS credits (MM5012) , Mathematics II - Analysis, part A 7.5 ECTS credits (MM5010) , Probability Theory I 7.5 ECTS credits (MT3001), Statistical Analysis 7.5 ECTS credits (MT4001), and either Programming Techniques for Mathematicians 7.5 ECTS credits (DA2004) and Computer Science for Mathematicians 7.5 ECTS credits (DA3018), or Computer Science I, 15 ECTS credits (DA2001) and Object Oriented Programming 7.5 ECTS credits (DA3002). English B/English 6 from Upper Secondary School level.

Course structure

Examination code	Name	Higher Education Credits
LABO	Practical Exercises	3.5
THEO	Theory	4

Course content

a. The course addresses the question how to enable computers to learn from past experiences. It introduces the field of machine learning describing a variety of learning paradigms, algorithms, theoretical results and applications. It introduces basic concepts from statistics, artificial intelligence, information theory and probability theory insofar they are relevant to machine learning. The following topics in machine learning and computational intelligence are covered in detail: nearest neighbour classifier, decision trees, bias and the trade-off of variance, regression, probabilistic methods, Bayesian learning, support vector machines, artificial neural networks, ensemble methods, dimensionality reduction, and subspace methods.

b. The course consists of one of the following items:
• Practical Exercises, 3.5 HECs
• Theory, 4 HECs

Learning outcomes

It is expected that the student after taking the course will:
• show basic knowledge of the most important algorithms and theory that form the foundation of machine

learning and computational intelligence,
• show a practical knowledge of machine learning algorithms and methods,
• be able to explain the principles, advantages, limitations -such as overfitting and possible applications - of machine learning,
• be able to identify and apply the appropriate machine learning technique to classification, pattern recognition, optimization and decision problems.
Intended learning outcomes belong to both course items.

Education

The education consists of lectures.
The course is given in English.

Forms of examination

a. Examination for the course is in the following manner: measurement of knowledge takes place through written examination, and written and oral presentation of the practical exercises.
If the instruction is in English, the examination may also be conducted in English.

b. Grading is carried out according to a 7-point scale related to learning objectives:
A = Excellent
B = Very Good
C = Good
D = Satisfactory
E = Sufficient
Fx = Fail
F = Fail

Grading of the element Practical Exercises is carried out according to a 2-point scale:
G = Pass
U = Fail

c. Grading criteria for the course will be distributed at the start of the course.

d. A minimum grade of E is required to pass the course.

e. Students who receive a failing grade on a regular examination are allowed to retake the examination as long as the course is still provided. The number of examination opportunities is not limited. Other mandatory course elements are equated with examinations. A student who has received a passing grade on an examination may not retake the examination to attain a higher grade. A student who has failed the same examination twice is entitled to have another examiner appointed, unless there are special reasons to the contrary. Such requests should be made to the departmental board. The course has at least two examinations for each academic year in the years in which instruction is provided. Intervening years include at least one examination.

f. Students awarded the grade Fx are given the opportunity to improve their grade to E. The examiner decides the supplementary assignments to be performed and the pass mark criteria. The supplementary assignments will take place before the next examination session.

Interim

Students may request that the examination be conducted in accordance with this course plan even after it has ceased to be valid. However, this may not take place more than three times over a two year period after course instruction has ended. Requests must be made to the departmental board. The provision also applies in the case of revisions to the course plan.

Limitations

The course may not be included in a degree together with the course item Machine Learning from any of the courses Computer Science, Advanced Course, 7.5 HECs (DA7055), Computer Science, Advanced Course, 15 HECs (DA7058), Computer Science, Advanced Course, 30 HECs (DA7061), or the equivalent.

Misc

The teaching is supplied by KTH EECS (School of Electrical Engineering and Computer Science). The course is a component of the Master’s Programme in Mathematical Statistics, the Master's Programme in Actuarial Mathematics, and in the Bachelor's Programme in Computer Science.

Required reading

Course literature is decided by KTH EECS (School of Electrical Engineering and Computer Science), and is published on the department of Mathematics' web site 2 months prior to course start, by the latest.