Department of Mathematics
(incl. Math. Statistics)

Stockholm University

Syllabus

for course at advanced level

Deep Learning in Data Science
Djupinlärning i Data Science

7.5 Higher Education Credits
7.5 ECTS credits

Course code:	DA7064
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	4.5
THEO	Theory	3

Course content

a. The course addresses:
• Learning of representations from raw data: images and text.
• Principles of supervised learning.
• Elements for different methods for deep learning: convolutional networks and recurrent networks.
• Theoretical knowledge of and practical experience of training networks for deep learning including optimization using stochastic gradient descent.
• New progress in methods for deep learning,
• Analysis of models and representations.
• Transferred learning with representations for deep learning.
• Application examples of deep learning for learning of representations and recognition.

b. The course consists of the following units:
• Practical Exercises, 4.5 HECs
• Theory, 3 HECs

Learning outcomes

It is expected that the student after taking the course will be able to:
• explain the basic the ideas behind learning, representation and recognition of raw data,
• account for the theoretical background for the methods for deep learning that are most common in practical contexts,
• identify the practical applications in different fields of data science where methods for deep learning can be efficient (with special focus on computer vision and language technology),
• solve problems connected to data representation and recognition,
• implement, analyse and evaluate simple systems for deep learning for automatic analysis of image and text data.
Intended learning outcomes belong to both course units.

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 of the Theory unit takes place through a written take-home exam, and of the Practical Exercises unit through a written presentation. The take-home exam will not be graded in case of late submission; however, the examiner should take special circumstances into account.
The examination is 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

c. Grading criteria for the course will be distributed at the start of the course.
Late submission of the take-home exam will have consequences for the final course grade, which are described in more detail in the course's grading criteria.

d. In order to pass the course, students must receive a passing grade on all course units.
The final grade on the course is determined by weighting the grades from all course units, where each grade is weighted in relation to the scope of the course unit.

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. 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.

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.