# LINKÖPINGS UNIVERSITET

# Deep Learning

Deep Learning
3 credits

Programme course

732A78

Valid from: 2020 Spring semester

| Determined by | Main field of study | |
|---|---|---|
| Course and Programme Syllabus Board at the Faculty of Arts and Sciences | Computer Science | |
| **Date determined** | **Course level** | **Progressive specialisation** |
| 2019-11-07 | Second cycle | A1F |
| **Revised by** | **Disciplinary domain** | |
| | Technology | |
| **Revision date** | **Subject group** | |
| | Computer Technology | |
| **Offered first time** | **Offered for the last time** | |
| Spring semester 2019 | Spring semester 2024 | |
| **Department** | **Replaced by** | |
| Institutionen för datavetenskap | 732A82 | |

# Course offered for

- Master's Programme in Statistics and Machine Learning

# Entry requirements

- 180 ECTS credits passed including 90 ECTS credits in one of the following subjects:
    - statistics
    - mathematics
    - applied mathematics
    - computer science
    - engineering
- Passed courses in:
    - calculus
    - linear algebra
    - statistics
    - programming
- English corresponding to the level of English in Swedish upper secondary education (Engelska 6)
  Exemption from Swedish
- At least 6 ECTS credits passed from semester 1 Master's Programme in Statistics and Machine Learning, or the equivalent

# Intended learning outcomes

After completion of the course the student should at an advanced level be able to:

- use relevant concepts and methods from Deep Learning in order to formulate, structure and solve practical problems that involve large and complex data

- choose a deep learning architecture that is appropriate for a  given data structure, problem formulation and application area

- choose appropriate activation functions and hyperparameter settings in Deep Learning models

- estimate the performance of Deep Learning models

- use existing Deep Learning software in order to analyze large and complex datasets, tune the network architecture and make predictions.

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## Course content

The course introduces main concepts in Deep Learning and widely used Deep Learning models. The course includes the following topics:

- Deep and shallow networks

- Regularization, droupout and early stopping. Optimization of deep neural networks

- Convolutional neural networks and image analysis

- Deep recurrent neural networks and sequence analysis

- Autoencoders and feature extraction

- Generative Adversarial neural networks

## Teaching and working methods

The teaching comprises lectures, practical sessions and computer exercises complemented by self-studies. lectures are devoted to presentations of theories, concepts and methods. Practical sessions are devoted to presentations of practical tools needed for computer exercises. Computer exercises provide practical experience of data analysis with Deep Learning software.

## Examination

Written reports on the computer assignments.

If special circumstances prevail, and if it is possible with consideration of the nature of the compulsory component, the examiner may decide to replace the compulsory component with another equivalent component.

If the LiU coordinator for students with disabilities has granted a student the right to an adapted examination for a written examination in an examination hall, the student has the right to it.

If the coordinator has recommended for the student an adapted examination or alternative form of examination, the examiner may grant this if the examiner assesses that it is possible, based on consideration of the course objectives.

An examiner may also decide that an adapted examination or alternative form of examination if the examiner assessed that special circumstances prevail, and the examiner assesses that it is possible while maintaining the objectives of the course.

Students failing an exam covering either the entire course or part of the course twice are entitled to have a new examiner appointed for the reexamination.

Students who have passed an examination may not retake it in order to improve their grades.

## Grades

ECTS, EC

## Other information

Planning and implementation of a course must take its starting point in the wording of the syllabus. The course evaluation included in each course must therefore take up the question how well the course agrees with the syllabus.

The course is conducted in such a way that there are equal opportunities with regard to sex, transgender identity or expression, ethnicity, religion or other belief, disability, sexual orientation and age.

If special circumstances prevail, the vice-chancellor may in a special decision specify the preconditions for temporary deviations from this course syllabus, and delegate the right to take such decisions.