

# Introduction to Machine Learning

Single subject and programme course

9 credits

Introduction to Machine Learning

732A68

Valid from: 2017 Autumn semester

**Determined by**

The Quality Board at the Faculty of Arts  
and Sciences

**Date determined**

2017-10-27

## Main field of study

Statistics

## Course level

Second cycle

## Advancement level

A1N

## Entry requirements

- 180 ECTS credits including 90 ECTS credits within one of the following subjects:
  - statistics
  - mathematics
  - applied mathematics
  - computer science
  - engineering
- Passed courses in
  - calculus
  - linear algebra
- Passed basic course in statistics of at least 6 ECTS credits
- Passed course in programming of at least 6 ECTS credits
- English corresponding to the level of English in Swedish upper secondary education (Engelska 6)  
Exemption from Swedish

## Intended learning outcomes

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

- use relevant concepts and methods from machine learning in order to formulate, structure and solve practical problems that involve large or complex data,
- make an inference for the parameter values for commonly used machine learning models,
- use machine learning models for prediction and decision making,
- estimate the quality of the machine learning models,
- select a suitable model in situations with a limited or no information about the underlying dependencies in the data,
- implement machine learning models in a programming language and use existing machine learning software in order to analyze large and/or complex datasets, make predictions and estimate the uncertainty of these predictions.

## Course content

The course introduces main concepts and tools in probabilistic machine learning which are necessary for professional work and research in data analytics.

- introduction to and overview of machine learning (including regression, classification, supervised and unsupervised learning) and its application areas,
- Nearest Neighbors and Naïve Bayes,
- discriminant analysis, logistic regression and decision trees,
- model selection and uncertainty estimation: holdout method, cross-validation, AIC, bootstrap confidence intervals,
- linear regression and regularization methods (Ridge, LASSO),
- splines, generalized linear and additive models,
- Principal component analysis (PCA) and Principal component regression (PCR),
- kernel smoothers, kernel trick and support vector machines,
- neural networks,
- bagging, boosting and random forests,
- Online learning and mixture models.

## Teaching and working methods

The teaching comprises lectures, seminars, and computer exercises, complemented by self-studies. Lectures are devoted to presentations of theories, concepts and methods. Computer exercises provide practical experience of data analysis in some machine learning software. The seminars comprise student presentations and discussions of computer assignments.

Language of instruction: English.

## Examination

Written reports on the computer assignments. Active participation in the seminars. One final written examination. Detailed information about the examination can be found in the course's study guide.

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 instead 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.

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 carried out in such a way that both men's and women's experience and knowledge is made visible and developed.

## Department

Institutionen för datavetenskap