



## Course syllabus

School of Business and Economics  
Department of Economics and Statistics

4NA910 Avancerad statistisk maskininlärning, 7,5 högskolepoäng  
Advanced statistical machine learning, 7.5 credits

### **Main field of study**

Economics

### **Subject**

Economics

### **Level**

Second cycle

### **Progression**

A1N

### **Date of Ratification**

Approved 2024-02-12.

The course syllabus is valid from autumn semester 2024.

### **Prerequisites**

General entry requirements for studies at the second-cycle level and specific entry requirements: Statistics 15 credits (descriptive statistics, statistical inference, and regression analysis), or the equivalent. English 6, or the equivalent.

### **Objectives**

After completing this course the student should be able to:

- interpret and describe a subset of the concepts and methods central to machine learning
- carry out inference for the parameters in the machine learning models covered in the course
- implement machine learning methods for prediction and decision making
- critically assess the quality of machine learning models/algorithms based on their

strengths

- identify various applications of machine learning models covered in the course
- construct a complete analytical model with different methods

## Content

The course contains:

- introduction and overview of machine learning and its application areas
- linear regression and regularization methods (Ridge, LASSO) principal component analysis (PCA) and principal component regression (PCR)
- support vector machines
- neural networks, random forests
- bagging and boosting related methods

## Type of Instruction

Teaching is carried out as distance learning via a learning platform and consists of self-studies based on instructions from the course coordinator. The teaching consists of lectures and computer exercises. The lectures are devoted to a review of theory, concepts and methodology. The computer exercises are devoted to practical data analysis in one using machine learning software. The course requires access to a computer with internet connection and a webcam.

## Examination

The course is assessed with the grades A, B, C, D, E or F.

The course is examined through an individual written digital query 1.5 credits and two individual submission written tasks carried out using computer programs included in the course 2 credits and 4 credits.

The grade A constitutes the highest grade on the scale and the remaining grades follow in descending order where the grade E is the lowest grade on the scale that will result in a pass. The grade F means that the student's performance is assessed as fail.

Resit examination is offered in accordance with Linnaeus University's Local regulations for courses and examination at the first- and second-cycle levels.

In the event that a student with a disability is entitled to special study support, the examiner will decide on adapted or alternative examination arrangements.

## Course Evaluation

A course evaluation should be conducted during the course or in connection with its conclusion. The results and analysis of the completed course evaluation should be promptly communicated to students who have completed the course. Students participating in the next course instance should be informed of the results of the previous course evaluation and any improvements that have been made, no later than at the start of the course.

## Overlap

The course cannot be included in a degree along with the following course/courses of which the content fully, or partly, corresponds to the content of this course:

1ST810 and 1ST910 with 1.5 credits each.

## Required Reading and Additional Study Material

### **Required reading**

Gareth, J., Witten, D., Hastie, T., Tibshirani, R., *An Introduction to Statistical Learning with Applications in R*. Springer. Latest edition. About 430 pages.

### **Additional study material**

R Online Manuals (electronic material that will be distributed during the lectures).

### **Reference literature**

Goodfellow, I., Bengio, Y., Courville, A., *Deep Learning*. MIT Press. Latest edition. About 800 pages.