Time Series and Sequence Learning

Single subject and programme course

6 credits

Tidsserier och sekvensinlärning

732A80

Valid from: 2020 Autumn semester

Determined by
Course and Programme Syllabus Board
at the Faculty of Arts and Sciences

Date determined
2020-05-11

Main field of study
Statistics

Course level
Second cycle

Advancement level
A1N

Course offered for
- Masters Programme in Statistics and Machine Learning

Entry requirements
- Bachelor's degree equivalent to a Swedish Kandidatexamen of 180 ECTS credits including an in-depth academic paper 15 ECTS credits in
    - statistics
    - mathematics
    - applied mathematics
    - computer science
    - engineering
- Completed courses in
    - calculus
    - linear algebra
    - statistics
    - machine learning
    - programming
- English corresponding to the level of English in Swedish upper secondary education (Engelska 6/B)
  (Exemption from Swedish)

Intended learning outcomes
After completion of the course, the student should on an advanced level be able to:
- apply state-of-the-art methods for the analysis of sequential (e.g., time series) data,
- account for major principles for the selection, estimation and validation of sequential models,
- use statistical and numerical software to fit appropriate time series models to given data sets, make inference about time series components, and compute forecasts and their statistical uncertainty,
- demonstrate insightful assessment of the generalization capacity of the statistical relationships on which forecasts can be based.

Course content

The course provides basic skills and knowledge about state-of-the-art methods needed for professional work in which sequential data are explored, modified, modelled and assessed. The course focus is on:

- Linear autoregressive models (AR and ARMA)
- Nonlinear autoregressive model, including temporal convolutional networks
- State space models, Kalman filtering and smoothing
- Nonlinear state space models and Sequential Monte Carlo filtering
- Recurrent neural networks
- Model estimation, validation, and forecasting

Teaching and working methods

The teaching comprises lectures, exercise sessions, and computer laboratory work. The lectures are devoted to presentations of concepts, theories and methods. The computer laboratory work provides practical experience of sequential data analysis. The exercise sessions comprise problem solving, student presentations and discussions of the assignments.
Homework and independent study are a necessary complement to the course.
Language of instruction: English.

Examination

Assignments encompassing computer-based data analysis. 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