Time Series and Sequence Learning

Tidsserier och sekvensinlärning
6 credits

Single subject and programme course

732A80

Valid from: 2020 Autumn semester

Determined by	**Main field of study**	
Course and Programme Syllabus Board at the Faculty of Arts and Sciences	Statistics	
Date determined	**Course level**	**Progressive specialisation**
2020-05-11	Second cycle	A1N
Revised by	**Disciplinary domain**	
	Technology	
Revision date	**Subject group**	
	Statistics	
Offered first time	**Offered for the last time**	
2020		
Department	**Replaced by**	
Institutionen för datavetenskap		

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
- Completed courses in
    - calculus
    - linear algebra
    - statistics
    - machine learning
    - programming
- 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 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 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 carried out in such a way that both men´s and women´s experience and knowledge is made visible and developed.

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.