Time Series and Sequence Learning

Tidsserier och sekvensinlärning
6 credits

Single subject and programme course

732A80

Valid from: 2025 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	A1F
Revised by	**Disciplinary domain**	
Chairman of the Course and Programme Syllabus Board at the Faculty of Arts and Sciences	Technology	
Revision date	**Subject group**	
2024-04-23; 2024-09-30	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

- Bachelor's degree equivalent to a Swedish Kandidatexamen of 180 ECTS credits in one of the following subjects:
    - statistics
    - mathematics
    - applied mathematics
    - computer science
    - engineering
- Completed 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 24 ECTS credits passed in the main field of Statistics at second cycle and at least 5 ECTS credits passed in the main field of Computer Science at second cycle

Intended learning outcomes

After completion of the course, the student shall on an advanced level be able to:

-
  apply methods for the analysis of sequential data
- account for principles for sample selection, estimation and validation of sequential models
- use statistical and numerical software to fit time series models
  analyze inference about time series components, and compute forecasts and their statistical uncertainty
- evaluate the generalization capacity of the statistical relationships to make forecasts

Course content

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

- Linear autoregressive models
- 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. In addition, the student shall practice self-study.

Language of instruction: English.

Examination

The course is examined by:

- written reports in groups of laboratory tasks, grade scale: EC, P/F
- individual written computer examination, grade scale: EC

For Pass (E) as the final grade, at least E is required on the individual written computer examination and Pass on other parts. Higher grades are based on the individual written computer examination.

Detailed information can be found in the study instructions.

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.

About teaching and examination language

The teaching language is presented in the Overview tab for each course. The examination language relates to the teaching language as follows:

- If teaching language is “Swedish”, the course as a whole could be given in Swedish, or partly, or as a whole, in English. Examination language is Swedish, but parts of the examination can be in English.
- If teaching language is “English”, the course as a whole is taught in English. Examination language is English.
- If teaching language is “Swedish/English”, the course as a whole will be taught in English if students without prior knowledge of the Swedish language participate. Examination language is Swedish or English depending on teaching language.