School of Economics and Management

STAN47, Statistics: Deep Learning and Artificial Intelligence Methods, 7.5 credits

Statistik: Deep learning och metoder för artificiell intelligens, 7,5 högskolepoäng

Second Cycle / Avancerad nivå

Details of approval

The syllabus was approved by The Board of the Department of Statistics on 2018-12-03 and was last revised on 2020-12-10. The revised syllabus applies from 2021-07-01, autumn semester 2021.

General Information

Second cycle level course in Statistics. The course may be included in a Master's degress in Statistics. The course can also be taken as a single subject course or within other Master's programmes at Lund University.

Language of instruction: English

Main field of studies	*Depth of study relative to the degree requirements*
Statistics	A1F, Second cycle, has second-cycle course/s as entry requirements

Learning outcomes

Knowledge and understanding

For a passing grade the student shall

- demonstrate knowledge of computational models that are composed of multiple processing layers to learn representations of data with multiple levels of abstraction,
- demonstrate understanding of differences in architecture of basic neural network models,
- demonstrate knowledge of feedforward neural networks and understanding of their abilities of modeling non-linear effects,

- demonstrate familiarity of some basic architectures that use backpropagation and recurrence, and
- demonstrate understanding of the unique abilities of deep convolutional nets to solving general pattern recognition problems.

Competence and skills

For a passing grade the student shall

- demonstrate the ability to apply concrete algorithms and applications in the areas of agents, logic, search, reasoning under uncertainty, machine learning, neural networks and reinforcement learning, and
- demonstrate the ability to master a number of most popular algorithms and architectures and apply them to solve particular machine learning problems.

Judgement and approach

For a passing grade the student shall

- demonstrate a skill of selecting a particular deep learning architecture suitable for solving a practical problem at hand and presenting the solution to a general audience.

Course content

The course presents an application-focused and hands-on approach to learning neural networks and reinforcement learning. It can be viewed as first introduction to deep learning methods, presenting a wide range of connectionist models which represent the current state-of-the-art. Topics and features: the fundamentals of machine learning, and the mathematical and computational prerequisites for deep learning; feed-forward neural networks, convolutional neural networks, and the recurrent connections to a feed-forward neural network; a brief history of artificial intelligence and neural networks, and reviews interesting open research problems in deep learning and connectionism. The course can be of interest for students of statistics, computer science, cognitive science and mathematics, as well as fields such as linguistics, logic, philosophy, and psychology.

Course design

The course is designed as a series of lectures, student presentations, and lab sessions with reports. Students are required to work on projects to apply the techniques on real world problems. The preferred software for this course will be ‘R’ and/or Python, however, the students are permitted to use any mathematical software of their liking that have facilities to perform all task in the course (Matlab being one example). Project discussions will enable students to share and compare ideas with each other and to receive specific guidance from the instructors. Efforts will be made to help students to embed real-world problems into mathematical models so that suitable algorithms can be applied with consideration of computational constraints.

Assessment

Grading is based on individual performance, via written assignments, oral presentations as well as group activities.

The University views plagiarism very seriously, and will take disciplinary actions against students for any kind of attempted malpractice in examinations and assessments. Plagiarism is considered to be a very serious academic offence. The penalty that may be imposed for this, and other unfair practice in examinations or assessments, includes suspension from the University.

The examiner, in consultation with Disability Support Services, may deviate from the regular form of examination in order to provide a permanently disabled student with a form of examination equivalent to that of a student without a disability.

Subcourses that are part of this course can be found in an appendix at the end of this document.

Grades

Marking scale: Fail, E, D, C, B, A.

A (Excellent) 85-100 points/percent. A distinguished result that is excellent with regard to theoretical depth, practical relevance, analytical ability and independent thought.

B (Very good) 75-84 points/percent. A very good result with regard to theoretical depth, practical relevance, analytical ability and independent thought.

C (Good) 65-74 points/percent. The result is of a good standard with regard to theoretical depth, practical relevance, analytical ability and independent thought and lives up to expectations.

D (Satisfactory) 55-64 points/percent. The result is of a satisfactory standard with regard to theoretical depth, practical relevance, analytical ability and independent thought.

E (Sufficient) 50-54 points/percent. The result satisfies the minimum requirements with regard to theoretical depth, practical relevance, analytical ability and independent thought, but not more.

F (Fail) 0-49 points/percent. The result does not meet the minimum requirements with regard to theoretical depth, practical relevance, analytical ability and independent thought.

To pass the course, the students must have been awarded the grade of E or higher.

The final grade is determined as a weighted sum of the results of the written assignments (2hp), the lab work (2hp), and the oral presentations (3.5hp).

Entry requirements

STAN45 or STAN52 or DABN14, or 90 credits in Statistics and a course in linear algebra that covers matrix calculus, or the equivalent.

Subcourses in STAN47, Statistics: Deep Learning and Artificial Intelligence Methods

Applies from H19

1901 Assignments, 2,0 hp
Grading scale: Fail, Pass
1902 Laboratory Work, 2,0 hp
Grading scale: Fail, Pass
1903 Oral Presentations, 3,5 hp
Grading scale: Fail, Pass