Stockholms universitet

STOCKHOLMS UNIVERSITET
Statistiska institutionen
Autumn term 2025

Dan Hedlin
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Course description
Machine Learning, 7.5 credits (hp), ST5401

CONTENTS OF THE COURSE

The course covers a number of machine learning methods with a focus on prediction. The course focuses on supervised and unsupervised machine learning. Contents include flexible regression and classification, regularization, methods for predictive model performance evaluation, deep learning, generative learning and mixture models.

The course consists of two modules:
1. Machine learning exam, 4.5 credits
2. Machine learning assignments in the R programming language, 3 credits

LEARNING GOALS

After completing the course, the student should be able to:

- Formulate and structure solutions to practical machine learning problems
- Identify and estimate suitable machine learning models for prediction and clustering
- Evaluate and select among machine learning models and learning algorithms
- Implement machine learning models and algorithms in a programming language

COURSE LITERATURE

- Lindholm, A., Wahlström, L., Lindsten, F. and Schön, T. B. (2021). Machine Learning – A First Course for Engineers and Scientists. Cambridge University Press.
  The whole book except for "Strictly proper loss" in section 5.2, chapters 8 and 9 and section 10.4 is part of the course. A draft version is freely available in PDF at: http://smlbook.org/.
- Ruppert, D., Wand, M.P. and Carrol, R.J. (2003). Semiparametric regression. Cambridge University Press.
  Pages 57-69 in Chapter 3 is part of the course.
- Bishop, C.M. and Bishop, H. (2024). Deep learning: foundations and concepts. Springer.
  Most of chapter 12 is part of the course.
  An online version available at https://www.bishopbook.com/
- Additional material distributed during the course, e.g. lecture notes, exercises, etc., will be posted on the learning platform Athena.

EXAMINER AND TEACHERS

The Department of Statistics is located in House 4, level 6, Albano Campus. General information about the department (office hours, phone numbers, schedules etc.) is posted on the department website, www.statistics.su.se.

Teachers	*Reception hours*	*E-mail*
Dan Hedlin	On agreement	dan.hedlin@stat.su.se
– lecturer, examiner, course coordinator		
Ulf Högnäs	On agreement	ulf.hognas@stat.su.se
Edgar Bueno	On agreement	edgar.bueno@stat.su.se

SCHEDULE
The schedule with exact times and places can be found at the course website or TimeEdit Stockholms universitet.

Although attendance is not mandatory, it is strongly recommended that students attend all teaching sessions in order to better achieve the learning goals.

EXAMINATION
Students are assessed by examination of the learning outcomes with respect to the learning goals through two written examinations:

- Module 1 - Individual exam. Graded according to a criterion-referenced seven-grade scale.
- Module 2 – Hand-in assignment working in pairs. Graded according to a two-grade scale with the grades Pass (G) and Fail (U)

Grades
Grading of the course is on a criterion-referenced seven-grade scale:

A	Excellent
B	Very good
C	Good
D	Satisfactory
E	Pass
Fx	Inadequate
F	Totally inadequate

To pass the course at least grade E on Module 1 and grade pass on Module 2 are required. The grading of the course will be based solely on the grading of Module 1, provided that Module 2 has been graded as a pass. If you pass Module 1 but fail Module 2, the grade of the course will be Fx.

- Students who have obtained at least grade E on the course cannot retake the exam to achieve a higher grade.
- Both Fx and F on Module 1 are fails. To pass the course, the student must retake the exam.
- Students with either Fx or F on the course can redo the examination at least four times, provided that the course is still offered, to achieve at least grade E.
- A student who has obtained either grade Fx or F twice on the same exam has the right to demand another examiner the next time the student takes the same exam. This must be done in writing to the head of department.

MODULE 1 - EXAM

- Module 1 is examined through a written computer-based exam.
- The writing time is 5 hours. The written exam is an individual exam.

- Special support, if required, may be allowed after request at the department's student counsellor and upon permission of the examiner. Contact the student counsellor well in advance before the exam, preferably no later than three weeks.

Deadline to sign up for the exam is usually 10 days before the exam. However sometimes the last day to sign up is earlier than 10 days before. Please check the sign-up period for each single exam in Ladok. You register for the exam via Ladok. If you have problems with the registration, contact expedition@stat.su.se.
If you have not registered correctly, you cannot take the exam.

Dates for Module 1
See under 'schedule' above.

MODULE 2 - HAND-IN ASSIGNMENT, 3 CREDITS

- Module 2 is examined through three hand-in assignments and should be completed in groups of two students. The three hand-in assignments must be presented in the form of three written reports. Instructions for the hand-in assignments will be posted at Athena.
- Module 2 is graded as Pass (all three hand-in assignments are approved) or Fail (at least one assignment is not approved). If one or more hand-in assignments is graded as Fail, the students will have a chance to re-submit the incorrect hand-in assignment(s).
- Collaboration within the group is, of course, allowed. However, individual testing and grading within the group may occur. Please note that all group members are responsible for and should be able to answer to all parts of the report. Cooperation between groups is allowed, but each group must submit their unique report. Any type of plagiarism is prohibited and text-matching tools will be used.
- A student may fail if she or he is unable to give satisfactory answers to written or oral questions about any of the hand-in assignments in Module 2. Should the examiner wish to ask questions about any assignment orally, a time will be agreed on with the student.
- It is forbidden to post solutions to any of the assignments publicly in any form, for example by uploading the solution in a public repository such as GitHub.
- If you miss the first submission occasion and submit for the first time at the resubmission occasion and then fail, you have no more chances to resubmit during the current term.

Dates for Module 2

- See the deadline for the submission of each hand-in assignment in Athena.
- Re-submission for one or more failed hand-in assignments: November 10, no later than 15.00 hrs, via Athena.

USE OF AI

The use of AI tools is permitted as an aid during the learning process but not to produce material for any kind of examination.

- Any type of plagiarism is prohibited, which includes AI-generated text.
- The use of AI tools for the improvement of an originally self-written text is not permitted.
- Text matching software and AI-generated text detectors are used by the department.

Read "Guidelines for disciplinary matters at Stockholm University"

- https://www.su.se/medabarteta/organisation-styrning/styrdokument-regelboken/utbildning/regler-och-handläggningsordning-för-disciplinärenden-1.605869

GRADING CRITERIA

Module 1 is an individual written computer-based exam. The written exam covers the course content material. The following grading criteria apply for Module 1.

A: (Excellent): Excellent ability to formulate and solve machine learning problems at a level beyond that explicitly taught. The student provides exhaustive and clear explanations of machine learning concepts, models and methods. Corresponds to at least 90% of the total written test score.
B: (Very good): Very good ability to formulate and solve machine learning problems, including some problems that have not necessarily been directly addressed in the course. The student provides clear explanations of machine learning concepts, models and methods. Corresponds to 80-89% of the total written test score.
C: (Good): Good ability to formulate and solve most types of machine learning problems that have been considered in the course. The student provides correct explanations of machine learning concepts, models and methods. Corresponds to 70-79% of the total written test score.
D: (Satisfactory): Satisfactory ability to formulate and solve most types of machine learning problems that have been considered in the course. The student provides satisfactory explanations of machine learning concepts, models and methods. Corresponds to 60-69% of the total written test score.
E: (Adequate): The student is able to adequately formulate and solve most types of machine learning problems that have been considered in the course. The student can in an adequate way explain machine learning concepts, models and methods. Corresponds to 50-59% of the total written test score.
Fx: (Inadequate): The student's achievements are inadequate with respect to at least one of the criteria for the grade E. Corresponds to 40-49% of the total written test score.
F: (Totally Inadequate): The student shows significant inadequacies in relation to the assessment criteria. Corresponds to 0-39% of the total written test score.

Module 2 comprises three hand-in assignments carried out in groups of two. The following grading criteria apply for Module 2.

Pass: The student is able to analyse machine learning problems in the R language in accordance with the assignment instructions. The student can summarize their work in well-written reports.
Fail: The student's achievements are inadequate with respect to at least one of the criteria for the grade Pass.