HALMSTAD UNIVERSITY
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School of Information Technology

Machine Learning 5 credits

Maskininlärning 5 hp

Second cycle
Main field: Computer Science and Engineering, Second cycle, has only first-cycle course/s as entry requirements (A1N)
Syllabus is adopted by the Research and Education Board (2021-09-09) and is valid for students admitted for the spring semester 2023.

Placement in the Academic System

The course is given as a single subject course.

Prerequisites and Conditions of Admission

Degree of Bachelor in Computer science or Degree of Bachelor of Science in Engineering or the equivalent of 180 Swedish credit points or 180 ECTS credits at an accredited university. Programming 7.5 credits and Mathemathics 7.5 credits including Linear Algebra. Applicants must have written and verbal command of the English language equivalent to English course 6 in Swedish Upper-Secondary School.

Course Objectives

The aim of this is for students to learn about standard supervised ML techniques for regression and classification as well as best practices in ML, and gain practice implementing ML in Python to work on real data.

Following successful completion of the course the student should be able to:

Knowledge and understanding

- describe common supervised machine learning algorithms, e.g. for classification and regression
- describe common unsupervised machine learning algorithms, e.g. for data clustering
- describe main application areas of machine learning

Skills and ability

- identify problems where machine learning is useful and choose appropriate methods
- apply data preprocessing and design appropriate data representations for specific problems
- apply machine learning methods on real world problems

Judgement and approach

- evaluate the performance of machine learning methods on specific problems
- assess when and which machine learning methods are applicable
- analyze and explain scientific results from the machine learning area

Primary Contents

The course covers the following topics:

- Introduction to machine learning, including basics and prerequisites.
- Basic aspects of supervised machine learning, including basic regression and classification algorithms.
- Overfitting and generalization, the bias/variance tradeoff, and methods for avoiding overfitting, including regularization. Explanation of how these problems are addressed in various methods, including Support Vector Machines (SVMs), and ensemble methods.
- Introduction to Neural Networks for supervised learning, as well as an overview of deep neural networks and unsupervised feature extraction with autoencoders.
- Overview of unsupervised data clustering methods and their applications.

Teaching Formats

Each lecture is delivered through a video conference tool, and followed by a practical lab assignment in Python, provided as a Jupyter notebook, which allows the participants to dig into the concepts presented in the lecture and put them to practice.

Teaching is in English and fully online.

Examination

The overall grades of Fail or Pass will be awarded for the course.
Exams will consist of a test that will be conducted online on the university's learning platform at the end of the course. The practical tasks are carried out in Python and presented in the form of Jupyter Notebooks.

Name of the test		Grading
Written Examination	2,5 credits	U/G
Practical Assignments	2,5 credits	U/G

If there are special reasons, the examiner may make exceptions from the specified examination format and allow a student to be examined in another way. Special reasons can e.g. be a decision on learning support.

For elite sports students according to Riktlinjer för kombinationen studier och elitidrott vid Högskolan i Halmstad, DNR: L 2018/177, the examiner has the right to decide on an adapted examination component or let the student complete the examination in an alternative way.

Course Evaluation

Course evaluation is part of the course. This evaluation should offer guidance in the future development and planning of the course. Course evaluations should be documented and made available to the students.

Course Literature and Other Study Resources

Burkov, Andriy. The hundred-page machine learning book. 2019. E-book: `http://themlbook.com/wiki/doku.php`

Scikit-learn online resources: `https://scikit-learn.org/stable/tutorial/index.html`