COURSE SYLLABUS
Machine Learning, 7.5 credits

Machine Learning, 7,5 högskolepoäng

Course Code:	TMLS22	**Education Cycle:**	Second-cycle level
Confirmed by:	Dean Mar 1, 2021	**Disciplinary domain:**	Technology
Valid From:	Jan 1, 2022	**Subject group:**	DT1
Version:	1	**Specialised in:**	A1F
		Main field of study:	Computer Science

Intended Learning Outcomes (ILO)

After completion of the course, the student shall

Knowledge and understanding
- Display knowledge of the machine learning area of research
- Demonstrate comprehension of the basic building blocks of machine learning systems

Skills and abilities
- Demonstrate the ability to implement and test basic learning algorithms based on pseudocode or formal specifications
- Demonstrate the ability to combine tools and techniques from standard open source platforms to construct machine learning prototypes
- Demonstrate the ability to plan and conduct machine learning experiments and to describe algorithmic performance and behavior through analysis of experimental results

Judgement and approach
- Demonstrate the ability to suggest a suitable machine learning approach for a problem or real-world challenge
- Demonstrate the ability to evaluate algorithms and algorithm parameter configurations for a concrete task
- Demonstrate the ability to motivate the potential costs and benefits of machine learning application for a given context

Contents

Machine learning is a core subject within computer science and a branch of artificial intelligence. It focuses on how to design, implement, and evaluate algorithms that learn to improve their performance through experience. Research on machine learning is conducted in mathematics (computational learning theory), statistics (statistical learning), and computer science (empirical machine learning, data mining and knowledge discovery, pattern recognition, natural language processing, and computer vision). In addition, machine learning is an engineering discipline with practical applications to a multitude of challenges in the digital

society.

This course introduces machine learning as a scientific research and engineering discipline. It provides students with the opportunity to gain a broad understanding of the discipline and its applications, as well as a basic understanding of its history, origins, and fundamental motivations.
More concretely, the course aims to teach students how to define tasks in a way which makes it possible to solve them wholly or partly with machine learning methodology. This entails the mapping of the task to a generic machine learning task and the identification of a suitable mechanism for learning from experience (data) to improve the performance at solving the task in question.

The course includes a series of lectures that highlight relevant topics from the course literature. Each lecture will focus on a specific learning paradigm or a general theme, such as: evaluation procedures and measures, experimentation, and software development and testing. Lab-based exercises will provide opportunities for students to solve basic machine learning problems under the supervision of a lab instructor. Students are then expected to complete individual assignments and participate in seminars to discuss their solutions. The last assignment is to conduct a project to be presented at the final seminar.

Type of instruction

The course comprises of several modes of instruction, including: lectures, lab-based exercises, and seminar sessions. Students will be provided with a detailed course memo, which describes the course contents and organization as well as the mapping to learning outcomes. The attendance at lectures, seminars, and exercises is optional but recommended. The lectures provide additional views and special topics grounded in the course literature. The lab-based exercises provide a relaxed setting that helps students gain experience and improve their ability to apply machine learning theory and method in practice. This experience is needed to complete the assignments and the project.

During the project, students are expected to leverage standard open source tools, frameworks, and environments typical for machine learning research and application. This approach ensures that students can focus on essentials concerning the course subject and also provides useful experience in using industry-relevant software and workflows.

The teaching is conducted in English.

Prerequisites

Passed courses at least 90 credits within the major subject Computer Engineering, Electrical Engineering (with relevant courses in Computer Engineering), or equivalent, or passed courses at least 150 credits from the programme Computer Science and Engineering, and completed courses in Artificial Intelligence, 7,5 credits and Mathematics for Intelligent Systems, 7,5 credits or equivalent. Proof of English proficiency is required.

Examination and grades

The course is graded 5,4,3 or Fail.

The final grade will only be issued after satisfactory completion of all assessments.

Registration of examination:

Name of the Test	Value	Grading
Machine Learning Project[I]	3 credits	5/4/3/U
Assignment 1	1.5 credits	U/G
Assignment 2	1.5 credits	U/G
Assignment 3	1.5 credits	U/G

[I] Determines the final grade of the course, which is issued only when all course units have been passed.

Course literature

Literature

The literature list for the course will be provided 8 weeks before the course starts.

Principal texts:
Author: Russell, Stuart; Norvig, Peter
Title: Artificial Intelligence: A Modern Approach
Publisher: Pearson (2016)
ISBN: 978-1-2921-5396-4 (paperback)

Author: Flach, Peter
Title: Machine Learning: The Art and Science of Algorithms that Make Sense of Data
Publisher: Cambridge (2012)
ISBN: 978-1-1074-2222-3 (paperback)