COURSE SYLLABUS

Deep Learning, 7.5 credits

Djupinlärning, 7,5 högskolepoäng

Course Code:	TDIS22	**Education Cycle:**	Second-cycle level
Confirmed by:	Dean Mar 1, 2021	**Disciplinary domain:**	Technology
Revised by:	Director of Education Oct 25, 2023	**Subject group:**	DT1
Valid From:	Jan 1, 2025	**Specialised in:**	A1F
Version:	3	**Main field of study:**	Computer Science

Intended Learning Outcomes (ILO)

After a successful course, the student shall

Knowledge and understanding
- display knowledge of state-of-the-art deep learning algorithms
- display knowledge of the purpose of the different components of a deep learning system
- display knowledge of how the discussed deep learning techniques work and how they relate to one another

Skills and abilities
- demonstrate the ability to design and implement deep learning based applications to address real-world problems
- demonstrate the ability to analyse and evaluate the performance of deep learning based solutions experimentally
- demonstrate the ability to present and discuss chosen solutions orally as well as in writing

Judgement and approach
- demonstrate the ability to select an appropriate deep learning technique and configuration for a given real-world problem
- demonstrate the ability to reflect on the impact of deep learning solutions on society with respect to ethics and fairness

Contents

This is an introductory course in Deep Learning. The course covers basic and state-of-the-art algorithms for training various deep neural network architectures, alternating theory with practice. The course includes assignments where the students implement various deep learning algorithms. After completing the course, the student shall have acquired a thorough theoretical understanding of, and practical experience with, modern algorithms for deep learning, applied on common deep learning tasks. Specifically, the student should understand and be able to apply all theoretical concepts covered.

The course includes the following elements:
- Methodology for training Neural Networks
- Neural Network Architectures: Convolutional Neural Networks, Recurrent Neural Networks, Transformers, Graph Convolutional Neural Networks
- Learning from no or little data: Unsupervised, Weakly-supervised, Self-supervised learning, as well as Few and Zero-shot learning
- Deep Generative Models: Generative Adversarial Networks and Variational Autoencoders
- Deep Reinforcement Learning
- Explainable Deep Learning Models
- Computer Vision Applications: Object Detection, Semantic Segmentation, Image Captioning, Visual Question Answering
- Evaluation of Deep Learning Models

Type of instruction

This course consists of lectures, assignments, one project, project tutoring and two project seminars.

The teaching is conducted in English.

Prerequisites

Passed courses at least 90 credits within the major subject Computer Engineering, Computer Science, 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 Artificial Intelligence, 7,5 credits, Mathematics for Intelligent Systems, 7,5 credits, and Machine Learning, 7.5 credits or equivalent. Proof of English proficiency is required.

Examination and grades

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

The credits for the project are awarded for the project report, as well as for two presentations and active participation in the two presentation seminars – one for presenting the project design and one for presenting the final project. The final grade for the course will be determined by the presentations and the project report. The grade for this report is given based on the collaborative part of the report, as well as on the individual part.

Registration of examination:

Name of the Test	Value	Grading
Project[I]	5.5 credits	5/4/3/U
Assignment 1	1 credit	U/G
Assignment 2	1 credit	U/G

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

Course literature

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

Principal texts:
Title: Deep Learning (Adaptive Computation and Machine Learning Series), 1st ed., 2016.
Authors: Goodfellow, I., Bengio, Y. and Courville, A.
Publisher: MIT Press
ISBN: 978-0262035613
WEB: http://www.deeplearningbook.org

A compendium of scientific and popular science papers and articles.

Reference literature:
Title: Deep Learning with Python, 2nd Edition, 2021
Author: Chollet, F.
Publisher: Manning Publications
ISBN: 9781617296864