Deep learning for media technology

Deep Learning för medieteknik
6 credits

Programme course

TNM112

Valid from:

Determined by	**Main field of study**	
Board of Studies for Computer Science and Media Technology	Computer Science and Engineering, Media Technology and Engineering	
Date determined	**Course level**	**Progressive specialisation**
2023-08-31	Second cycle	A1X
Revised by	**Disciplinary domain**	
	Technology	
Revision date	**Subject group**	
	Computer Technology	
Offered first time	**Offered for the last time**	
Autumn semester 2023		
Department	**Replaced by**	
Institutionen för teknik och naturvetenskap		

Specific information

The course can not be included in degree together with TBMI26.

Course offered for

- Master of Science in Media Technology and Engineering

Entry requirements

Probability theory and statistics, calculus, linear algebra, and basic programming. Foundations in machine learning is beneficial but not required.

Prerequisites

Probability theory and statistics, calculus, linear algebra, and basic programming. Foundations in machine learning is beneficial but not required.

Intended learning outcomes

The course teaches fundamental techniques in deep learning, theoretical as well as practical, and gives an overview of modern techniques and applications related to deep learning for images, graphics and sound.

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

- describe fundamental techniques for how to construct and optimize artificial neural networks, and show understanding of how theoretical concepts relate to practical situations,
- demonstrate knowledge on modern methods for how neural networks can be designed, optimized and used in different contexts within computer vision, image processing, computer graphics, natural language processing and visualization,
- use existing deep learning tools for solving classification and and regression problems for digital media,
- use techniques for testing and improving the performance of neural networks, including concepts such as detection of overfitting and techniques for increasing generalization capability,
- formulate and solve simpler problems from start, including data collection, selection of techniques, and analysis of the results,
- reason around the consequences of an increasing use of deep learning in the society, both in terms of opportunities as well as problematic questions.

Course content

Overview of machine learning. Artificial neural networks (ANN) and the term deep learning. Learning paradigms (supervised/unsupervised/semi-supervised/self-supervised/reinforcement learning). Optimization of ANNs (back-propagation, stochastic gradient descent, momentum, batch normalization). Regularization (augmentation, drop-out, early-stopping). Data (images/video/sound/3D, representation, training/testing, bias, adversarial examples). Architectures (convolutional networks, auto-encoders, recurrent networks, recursive networks). Generative deep learning. Applications (computer vision, image processing, computer graphics, natural language processing, visualization) and implications (societal impacts, ethics, bias).

Teaching and working methods

The course consists of lectures, lessons and laboratory work. The lectures teaches theory and explains around the intensive research that has been conducted within deep learning over the last decade. The lessons treat the practical aspects of using tools for solving problems with deep learning; knowledge which is then applied in the laboratory work for constructing and optimizing neural networks.

Examination

TEN1	Written Examination	3 credits	U, 3, 4, 5
LAB1	Laboratory Work	3 credits	U, G

Grades

Four-grade scale, LiU, U, 3, 4, 5

Other information

About teaching and examination language

The teaching language is presented in the Overview tab for each course. The examination language relates to the teaching language as follows:

- If teaching language is “Swedish”, the course as a whole could be given in Swedish, or partly in English. Examination language is Swedish, but parts of the examination can be in English.
- If teaching language is “English”, the course as a whole is taught in English. Examination language is English.
- If teaching language is “Swedish/English”, the course as a whole will be taught in English if students without prior knowledge of the Swedish language participate. Examination language is Swedish or English depending on teaching language.

Other

The course is conducted in such a way that there are equal opportunities with regard to sex, transgender identity or expression, ethnicity, religion or other belief, disability, sexual orientation and age.

The planning and implementation of a course should correspond to the course syllabus. The course evaluation should therefore be conducted with the course syllabus as a starting point.

The course is campus-based at the location specified for the course, unless otherwise stated under “Teaching and working methods”. Please note, in a campus-based course occasional remote sessions could be included.