Submodule MIN-336-01 Deep Learning

Subheading	(MIN-DL)
Person in Charge	Pigors, Adrian, Prof. Dr.
Language of Instruction	by agreement
Curriculum Allocation	MIN
Course Type, Contact Hours per Week	Lecture with exercise, 4 SWS
ECTS Credits	6
Contact Hours / Independent Study Hours	68 h / 112 h
Suggestions for Independent Study	See bibliography
Recommended Prerequisites	MIN-335
Examination	Written or oral examination, experimental work
Group Size	30

Learning Outcomes

Algorithmic and mathematical skills: Students are able to explain the various models and algorithms of deep learning (DL) and describe their mathematical foundations.
Analysis, design, and realization skills: Students can select and combine suitable DL methods for a given problem. They can build and train neural networks and they can evaluate the quality of DL solutions.
Technological skills: Students are familiar with current DL frameworks and libraries.

Content

Selected topics from the following areas:
- Basics of deep learning
- Convolutional neural networks (CNNs) for image data
- Recurrent neural networks (RNNs) and LSTM networks for sequential data
- Implementation of various network architectures in current software environments (e.g. Python, Keras, TensorFlow)
- Training of neural networks (hyperparameter optimization, regularization, etc.), transfer learning
- Deep learning for computer vision (CV): classic and modern CNN architectures for CV tasks such as image classification and object detection, autoencoders
- Deep learning for natural language processing (NLP): statistical language models, word embeddings, RNN and CNN architectures for NLP tasks such as text classification and generation, attention mechanism
- Current developments and applications of deep learning

Requirements for Contact Hours

Active participation, solving exercise problems

Requirements for Independent Study Hours

Preparation and review of the lectures

Bibliography

Goodfellow, Bengio, Courville: Deep Learning. MIT Press, 2016
Chollet: Deep Learning with Python. Manning, 2020
Géron: Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow. O'Reilly, 2019
Further current literature on the lecture contents