MI116 - Neural Networks and Deep Learning
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General information	
Module Code	MI116
Unique Identifier	
Module Leader(s)	Prof. Dr. Meyer, Carsten (carsten.meyer@haw-kiel.de)
Lecturer(s)	Prof. Dr. Meyer, Carsten (carsten.meyer@haw-kiel.de)
Offered in Semester	Sommersemester 2020
Module duration	1 Semester
Occurrence frequency	Regular
Module occurrence	In der Regel im Sommersemester
Language	Englisch
Recommended for international students	Yes
Can be attended with different study programme	Yes

Curricular relevance (according to examination regulations)
Study Subject: M.Sc. - MIE - Information Engineering (PO 2022, V3) Study Specialization: Information Technology and Systems Module type: Wahlmodul Semester: 1, 2, 3
Study Subject: M.Sc. - MIE - Information Engineering (PO 2022, V3) Study Specialization: IT Security Module type: Wahlmodul Semester: 1, 2, 3
Study Subject: M.Sc. - MIE - Information Engineering (PO 2022, V3) Study Specialization: Intelligent Systems Module type: Wahlmodul Semester: 1, 2, 3

Qualification outcome
Areas of Competence: Knowledge and Understanding; Use, application and generation of knowledge; Communication and cooperation; Scientific self-understanding / professionalism.

Neural Networks and Deep Learning recently have gained strong interest (Deep Learning has been considered one of 10 breakthrough technologies by the MIT Technology Review 2013). The aim of the course is to provide a fundamental understanding of important concepts, algorithms, techniques and architectures of neural networks and deep learning.

After completing the course, students should
have a basic overview over neural network and deep learning concepts, algorithms and architectures, suitable applications capabilities and limitations,
be able to apply suitable neural network and deep learning techniques to new problems, analyze the outcome of neural network and deep learning experiments and explore potential methods to improve performance.

Since the lab work is being done in teams, the students learn to communicate in teams about scientific contents and to express and justify their opinion about suitable problem solutions and conclusions drawn from experiments.

The students learn to apply selected algorithms of neural networks and deep learning to given (toy and real)
problems, to analyze the results, draw conclusions and report the results in a scientific way.

Content information

Content	- Biological neurons - Artificial neuron models - Artificial neural networks: Architectures and the learning problem - Feedforward neural networks and backpropagation - Deep learning: Motivation and concepts - Convolutional neural networks - Unsupervised learning: Example autoencoders - Recurrent neural networks: Long Short-Term Memory (LSTM) and (if time permits) Hopfield networks - (If time permits) Advanced topics - (If time permits) Self-organizing (Kohonen) maps
Literature	- Ian Goodfellowet al., "DeepLearning", MIT Press, 2016 - Michael Nielsen: „NeuralNetworks andDeepLearning", 2017 (More literature in the course)

Teaching formats of the courses

Teaching format	SWS
Lehrvortrag	2
Labor	2

Workload

Number of SWS	4 SWS
Credits	5,00 Credits
Contact hours	48 Hours
Self study	102 Hours

Module Examination

Examination prerequisites according to exam regulations	None

MI116 - Übung	Method of Examination: Übung
	Weighting: 0%
	wird angerechnet gem. § 11 Absatz 2 PVO: Yes
	Graded: No
MI116 - Klausur	Method of Examination: Klausur
	Duration: 120 Minutes
	Weighting: 100%
	wird angerechnet gem. § 11 Absatz 2 PVO: Yes
	Graded: Yes

Miscellaneous	
Recommended Prerequisites	- strong interest in neural networks and deep learning - conceptual and analytical skills - mathematical skills desired (linear algebra, analysis, calculus), although not absolutely necessary - programming skills desired (Python language), although not absolutely necessary - ability to work with software libraries (in Python)
Miscellaneous	Especially suited for focus areas "A: Intelligent Systems" and "C: Information Technology and Systems Development" Lecture will be offered at CAU Kiel (14 lectures during the regular semester at CAU Kiel, which is shifted with respect to the semester at Fachhochschule Kiel). NOTE THAT THE EXAM WILL BE OFFERED DURING THE REGULAR EXAMINATION PERIOD OF CAU KIEL, WHICH IS SHIFTED WITH RESPECT TO THE EXAMINATION PERIOD OF FACHHOCHSCHULE KIEL! Students are asked to bring their own laptops to the laboratory classes. Laboratory assignments are encouraged to be solved in teams of two or three students.