HAW Kiel
Hochschule für Angewandte Wissenschaften Kiel
Kiel University of Applied Sciences

# ADL - Applied Deep Learning

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| General information | |
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| **Module Code** | ADL |
| **Unique Identifier** | ApplDeepLear-01-BA-M |
| **Module Leader(s)** | Prof. Dr. Schramm, Hauke (hauke.schramm@haw-kiel.de) |
| **Lecturer(s)** | Ignatov, Marina (marina.ignatov@haw-kiel.de) |
| **Offered in Semester** | Sommersemester 2026 |
| **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) |
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| Study Subject: B.Eng. - E - Elektrotechnik (PO 2017, V3)<br>Study Specialization: Technische Informatik<br>Module type: Wahlmodul<br>Semester: 6 |
| Study Subject: B.Eng. - E - Elektrotechnik (PO 2023, V4)<br>Module type: Wahlmodul<br>Semester: 6 |
| Study Subject: B.Eng. - Wing - Wirtschaftsingenieurwesen - Elektrotechnik (PO 2025, V2)<br>Module type: Wahlmodul<br>Semester: 6 |
| Study Subject: B.Eng. - Wing - Wirtschaftsingenieurwesen - Elektrotechnik (PO 2017, V1)<br>Study Specialization: Digitale Wirtschaft<br>Module type: Wahlmodul<br>Semester: 6 |
| Study Subject: B.Sc. - INF - Informatik (PO 2021,V1)<br>Module type: Wahlmodul<br>Semester: 6 |
| Study Subject: B.Sc. - INF - Informatik (PO 2021,V1)<br>Study Focus: Künstliche Intelligenz<br>Module type: Verpfl. Wahlmodul, PVO §3<br>Semester: 4 |

| Qualification outcome |
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| *Areas of Competence: Knowledge and Understanding; Use, application and generation of knowledge; Communication and cooperation; Scientific self-understanding / professionalism.* |
| The aim of the course is to provide both fundamental understanding and practical knowledge of deep learning techniques for independently applying research and development in this important and growing branch of artificial intelligence. On successful completion of this course students will have knowledge on basic neural network and deep learning concepts and their main applications, e.g. in the field of image processing. |

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| The given theoretical foundations in deep learning will be encouraged by a strong practical focus with various appropriate examples in the lecture and laboratory. After completing the course, successful students will be able to understand and apply basic deep learning techniques to a range of practical problems, like image classification or semantic segmentation. They can (1) identify and utilize an efficient approach for a given task, (2) design and implement a practical realization, (3) test the proposed implemented system for validity and (4) they are able to provide algorithmic refinement and maintenance. |
| On completing the course, students should have improved presentation and team working skills due to the cooperation in small project teams on given problems. They learn to follow design requirements by understanding of written questions and describe and interpret findings in a written report using scientific language. |
| On completing the course, students should be able to improve their working ethics through evaluating individual efforts and strictly avoiding plagiarism. |

## Content information

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| **Content** | This course explains the theoretical and practical aspects of fundamental deep learning techniques and enables the independent development and enhancement of such systems. We will study basic neural network setup and training technology as well as some foundations in important application areas, like image processing. More specifically, this includes:<br>• Learning algorithms, over- and underfitting, hyperparameters, validation, supervised / unsupervised learning, gradient-based learning<br>• Deep feedforward networks: weight initialization, batch normalization, regularization, loss functions, backpropagation, mini-batching<br>• Convolutional neural networks: convolution operation, layers, hyperparameters, receptive field<br>• Practical applications |
| **Literature** | Rafael C. Gonzales, Richard E. Woods: Digital Image Processing. Prentice-Hall Inc., 2001, ISBN 0-130-94650-8.<br>Ian Goodfellow et al., "DeepLearning", MIT Press, 2016<br>Michael Nielsen: „NeuralNetworks and DeepLearning", 2017 |

## Teaching formats of the courses

| Teaching format | SWS |
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| Lehrvortrag | 2 |
| Labor | 2 |

## Workload

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

## Module Examination

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| **Examination prerequisites according to exam regulations** | None |
| **ADL - Laborprüfung** | Method of Examination: Laborprüfung<br>Weighting: 0%<br>wird angerechnet gem. § 11 Absatz 2 PVO: Yes<br>Graded: No<br>Remark: verpflichtende Teilnahme.<br>Die in SoSe 2024 bestehende Teilprüfung "Übung" wird bei nicht abgeschlossener Modulprüfung auf die neue Teilprüfung "Laborprüfung" angerechnet. |

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| **ADL - Klausur** | Method of Examination: Klausur<br>Duration: 120 Minutes<br>Weighting: 100%<br>wird angerechnet gem. § 11 Absatz 2 PVO: No<br>Graded: Yes |

| **Miscellaneous** | |
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| **Recommended Prerequisites** | - interest in neural networks and deep learning<br>- conceptual and analytical skills<br>- mathematical skills desired (linear algebra, analysis, calculus)<br>- programming skills desired (e.g. Python language)<br>- interest to work with software libraries (e.g. Python) |