

## AMLEA - Advanced Machine Learning in Energy Applications

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<b>Allgemeine Informationen</b>	
<b>Modulkürzel oder Nummer</b>	AMLEA
<b>Eindeutige Bezeichnung</b>	AdvMachLearn-01-MA-M
<b>Modulverantwortlich(e)</b>	Prof. Dr. Hennig, Patrick (patrick.hennig@haw-kiel.de)
<b>Lehrperson(en)</b>	Prof. Dr. Hennig, Patrick (patrick.hennig@haw-kiel.de)
<b>Wird angeboten zum</b>	Sommersemester 2024
<b>Moduldauer</b>	1 Fachsemester
<b>Angebotsfrequenz</b>	Regelmäßig
<b>Angebotsturnus</b>	In der Regel im Sommersemester
<b>Lehrsprache</b>	Englisch
<b>Empfohlen für internationale Studierende</b>	Ja
<b>Ist als Wahlmodul auch für andere Studiengänge freigegeben (ggf. Interdisziplinäres Modulangebot - IDL)</b>	Ja

<b>Studiengänge und Art des Moduls (gemäß Prüfungsordnung)</b>
Studiengang: M.Eng. - MET - Elektrische Technologien (PO 2017, V3) Modulart: Wahlmodul Fachsemester: 1, 2
Studiengang: M.Sc. - DS - Data Science Modulart: Wahlmodul Fachsemester: 2
Studiengang: M.Sc. - MCS - Computer Science (PO 2023, V1) Modulart: Wahlmodul Fachsemester: 1, 2
Studiengang: M.Sc. - MIE - Information Engineering (PO 2022, V3) Modulart: Wahlmodul Fachsemester: 1, 2, 3

<b>Kompetenzen / Lernergebnisse</b>
<i>Kompetenzbereiche: Wissen und Verstehen; Einsatz, Anwendung und Erzeugung von Wissen; Kommunikation und Kooperation; Wissenschaftliches Selbstverständnis/Professionalität.</i>

Students can specifically (in terms of content)...

- explain the concept of machine learning (ML) and classify it in the context of artificial intelligence (AI),
- name, differentiate, describe and explain the concepts, methods and models of supervised and unsupervised learning,
- understand the mathematical and statistical foundations as well as in-depth methods and models of machine learning,
- name and explain basic and advanced methods of data analysis and data pre-processing, in particular procurement, transformation, cleansing, partitioning, scaling, visualization and static description,
- describe the complete process of carrying out an ML project from the analysis and pre-processing of data to the application of methods and development of models through to the post-processing of data (e.g. model-based forecasting).

Students have/are generally able to...

- significantly deepened and expanded their knowledge,
- define and interpret the special features and limitations of the methods and models,
- develop, on the basis of existing knowledge, both research- and application-oriented develop and apply independent generalized and specialized ideas on the methods and models in a research and application-oriented manner,
- weigh up the correctness of their extended and, if necessary, independently modified knowledge, taking into account scientific-disciplinary (e.g. mathematics and statistics) and methodological considerations, and solve scientific and practical problems on this basis.

Students can specifically (in terms of content) ...

- identify and assess the application potential of AI or ML in different and possibly unknown application contexts,
- solve specific problems largely independently using Python.

Students can generally ...

- integrate new information into the existing knowledge network and/or further process and develop existing knowledge and thus acquire new knowledge independently,
- apply their knowledge, understanding and problem-solving skills in new, unfamiliar and unpredictable situations that are related to their field of study in a broader or multidisciplinary context by integrating existing and new knowledge in complex contexts,
- deal with a high degree of complexity and intricacy with regard to scientific and practical tasks,
- making scientifically sound decisions,
- designing research questions from a purely scientific point of view, selecting well-founded research methods and interpreting research results critically.

Students can generally ...

- engage in discussions with representatives of different academic and non-academic fields of activity as well as on alternative, theoretically justifiable solutions to problems,
- integrate participants into tasks in a goal-oriented manner, taking into account the respective group situation,
- recognize potential for conflict in cooperation with others and reflect on this against the background of cross-situational conditions,
- ensure the implementation of solution processes appropriate to the situation through constructive, conceptual action

Students can generally ...

- develop a professional self-image that is oriented towards goals and standards of professional action both in academia and in professional fields outside academia.
- justify their own professional actions with theoretical and methodological knowledge and reflect on alternative approaches.
- judge their own abilities, make autonomous use of relevant freedom of organization and decision-making and develop these further under guidance.
- recognize situation-appropriate and cross-situational framework conditions for professional action and reflect on decisions in an ethical and responsible manner.
- critically reflect on their professional actions in relation to social expectations and consequences and further develop their professional actions.

### Angaben zum Inhalt

<b>Lehrinhalte</b>	<ul style="list-style-type: none"> <li>- Advanced topics in machine learning with a strong application focus</li> <li>- Application examples are mainly, but not exclusively, from the energy sector e.g. <ul style="list-style-type: none"> <li>- Determination of power degradation of PV systems based on operating data</li> <li>- Energy generation forecasts for wind power plants</li> <li>- Electricity price forecasts for the spot market</li> </ul> </li> <li>- Problem areas: <ul style="list-style-type: none"> <li>- Supervised learning: regression, classification</li> <li>- Unsupervised learning: clustering, dimension reduction</li> <li>- Reinforcement learning</li> </ul> </li> <li>- Exploratory data analysis and pre-processing</li> <li>- Course draws on previous knowledge at Bachelor level and deepens the content</li> <li>- Content is taught and applied using practical examples and small projects</li> </ul>
<b>Literatur</b>	Literature will be announced during the course.

### Lehrformen der Lehrveranstaltungen

Lehrform	SWS
Lehrvortrag	2
Übung	2

### Arbeitsaufwand

<b>Anzahl der SWS</b>	4 SWS
<b>Leistungspunkte</b>	5,00 Leistungspunkte
<b>Präsenzzeit</b>	48 Stunden
<b>Selbststudium</b>	102 Stunden

### Modulprüfungsleistung

<b>Voraussetzung für die Teilnahme an der Prüfung gemäß PO</b>	Keine
<b>AMLEA - Übung</b>	Prüfungsform: Übung Gewichtung: 0% wird angerechnet gem. § 11 Absatz 2 PVO: Ja Benotet: Nein Anmerkung: Regular participation and collaboration & short presentation

<b>AMLEA - Hausarbeit</b>	Prüfungsform: Hausarbeit Gewichtung: 100% wird angerechnet gem. § 11 Absatz 2 PVO: Nein Benotet: Ja
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<b>Sonstiges</b>	
<b>Empfohlene Voraussetzungen</b>	<ul style="list-style-type: none"><li>- interest in machine learning and neural networks</li><li>- basic knowledge in machine learning recommended</li><li>- conceptual and analytical skills</li><li>- mathematical skills (linear algebra, analysis, calculus)</li><li>- programming skills (e.g. Python)</li><li>- interest to work with software libraries (e.g. Python)</li></ul>