AMLEA - Advanced Machine Learning in Energy Applications

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

Studiengänge und Art des Moduls (gemäß Prüfungsordnung)
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

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

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	
Lehrinhalte	- Advanced topics in machine learning with a strong application focus - Application examples are mainly, but not exclusively, from the energy sector e.g. - Determination of power degradation of PV systems based on operating data - Energy generation forecasts for wind power plants - Electricity price forecasts for the spot market - Problem areas: - Supervised learning: regression, classification - Unsupervised learning: clustering, dimension reduction - Reinforcement learning - Exploratory data analysis and pre-processing - Course draws on previous knowledge at Bachelor level and deepens the content - Content is taught and applied using practical examples and small projects
Literatur	Literature will be announced during the course.

Lehrformen der Lehrveranstaltungen	
Lehrform	**SWS**
Lehrvortrag	2
Übung	2

Arbeitsaufwand	
Anzahl der SWS	4 SWS
Leistungspunkte	5,00 Leistungspunkte
Präsenzzeit	48 Stunden
Selbststudium	102 Stunden

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

AMLEA - Hausarbeit	Prüfungsform: Hausarbeit Gewichtung: 100% wird angerechnet gem. § 11 Absatz 2 PVO: Nein Benotet: Ja

Sonstiges	
Empfohlene Voraussetzungen	- interest in machine learning and neural networks - basic knowledge in machine learning recommended - conceptual and analytical skills - mathematical skills (linear algebra, analysis, calculus) - programming skills (e.g. Python) - interest to work with software libraries (e.g. Python)