Course syllabus

Machine Learning for Energy Engineers
Maskininlärning för energiingenjörer

MVKP30, 7.5 credits, A (Second Cycle)

Valid for: 2026/27
Faculty: Faculty of Engineering LTH
Decided by: PLED M
Date of Decision: 2026-03-26
Effective: 2026-05-18

General Information

Main field: Sustainable Energy Engineering **Depth of study relative to the degree requirements:** Second cycle, in-depth level of the course cannot be classified
Elective for: E4-em, I5-hem, M5, MHET2, W5-et
Language of instruction: The course will be given in English

Aim

The course introduces engineering students to machine learning (ML) and artificial intelligence (AI) methods relevant to energy engineering. It provides a broad overview of concepts and applications, complemented by practical exercises and project work. While advanced topics are presented, the emphasis is on conceptual understanding and practical implementation using modern tools. Students will learn to:

- Understand the role of ML/AI in engineering and energy systems.
- Apply basic ML workflows using Python, Google Colab, and libraries such as scikit-learn and PyTorch.
- Explore selected topics through guided exercises and a group project.

Learning outcomes

Knowledge and understanding
For a passing grade the student must

- Describe the fundamental principles of machine learning and its main categories: supervised, unsupervised, and reinforcement learning.
- Explain the purpose and general characteristics of commonly used methods such as regression, classification, clustering, and neural networks.
- Recognize advanced concepts (e.g., convolutional neural networks, autoencoders, physics-informed ML) and their relevance in engineering contexts.
- Identify basic considerations related to data integrity and ethical aspects in ML applications.

Competences and skills
For a passing grade the student must

- Implement machine learning workflows using provided examples in Python and adapt them for given tasks.
- Perform essential steps in data preparation, model training, and evaluation using standard libraries.
- Complete two structured homework assignments involving coding tasks based on course examples.
- Collaborate in a group to carry out a project, prepare a written report, and present results orally.
- Conduct a constructive peer review of another group’s project report.

Judgement and approach
For a passing grade the student must

- Assess the applicability of machine learning methods for engineering problems.
- Reflect on model performance and limitations using appropriate evaluation measures.
- Consider ethical and reproducibility aspects when applying data-driven methods.

Contents

The course consists of lectures, computer exercises, homework assignments, guest lectures, and a final group project. Topics include:

- Data representation and preprocessing.
- Supervised learning: regression, classification, evaluation metrics.
- Neural networks: basic architectures and concepts.
- Dimensionality reduction and autoencoders.
- Introduction to physics-informed ML methods.
- Unsupervised learning: clustering, anomaly detection.
- Reinforcement learning: basic principles and simple implementations.
- Ethical and integrity considerations in ML.

Advanced topics are introduced for awareness and context.

Examination details

Grading scale: UG - (U, G) - (Fail, Pass)
Assessment:

Grading scale: UG - (U, G) - (Fail, Pass). To pass the course (≥ 7 out of 10 points), students must fulfill the following requirements:

- Homework assignments (6 points):
- Two homework assignments are required. Each homework consists of several coding-based subtasks derived from the computer exercise sessions.
- Final group project (4 points):
- The final project includes a written report, an oral presentation, and one peer-review report.

Attendance requirement

- Attendance is recorded for 12 computer exercises, based on the total attendance score:
- 10–12: no additional requirements
- 7–9: completion of one additional homework task
- Below 7: completion of two additional homework tasks

The examiner, in consultation with Disability Support Services, may deviate from the regular form of examination in order to provide a permanently disabled student with a form of examination equivalent to that of a student without a disability.

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Modules
Code: 0122. **Name:** Machine Learning for Energy Engineers.
Credits: 7.5. **Grading scale:** UG - (U, G).

Admission

Assumed prior knowledge: EDAA65 Programming, first course, FMSF55 Mathematical statistics, basic course.
The number of participants is limited to: No

Reading list

- Lecture slides and Google Colab notebooks (via Canvas).
- Recommended videos lectures and online tutorials.
- Optional book: Introduction to Machine Learning with Python (Müller & Guido).
- Optional book: Data-Driven Science and Engineering: Machine learning, Dynamical Systems, and Control (Steven L. Bruton, & J Nathan Kutz).

Contact

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Further information

The course contains lectures, exercises, computer exercises, guest lectures and study visits.