MJ2507 AI applications in Sustainable Energy Engineering 6.0 credits

Tillämpad AI för hållbar energiteknik

This is a translation of the Swedish, legally binding, course syllabus.

If the course is discontinued, students may request to be examined during the following two academic years

Establishment

Course syllabus for MJ2507 valid from Autumn 2021

Grading scale

A, B, C, D, E, FX, F

Education cycle

Second cycle

Main field of study

Mechanical Engineering

Specific prerequisites

Knowledge in Thermodynamics, Heat transfer, Renewable Energy, energy conversion processes and system design found in the courses:
MJ2411 "Renewable Energy Technology",
MJ2405 "Sustainable Power Generation",

MJ2407 "Sustainable Energy Utilisation" and
MJ2413 "Energy and Environment"

The courses must be completed.

Knowledge in Matlab or Pyhton is required.

Language of instruction

The language of instruction is specified in the course offering information in the course catalogue.

Intended learning outcomes

The course aims to providing the students with fundamental background and tools for understanding the fundamentals in artificial intelligence and using machine learning in applications within sustainable energy engineering.

After completing the course, the student will be able to

1. Explain and describe the background and areas of use for artificial intelligence with focus on machine learning, including the main characteristics for common techniques.
2. Explain and describe the method for developing a ML model, including selection of technique, treatment of data, design, model evaluation and model improvement.
3. Design a working machine learning model aimed to optimize design or operation in a case related to energy, including assessment of model's performance according to common evaluation steps and critical comparison to a non-AI approach.
4. Identify existing AI trends in the energy sector including companies and implications in their business
5. Demonstrate an insight to advantages, limitations, and risks connected to AI's role in society, and specifically from the energy sector perspective.

Course contents

The course aims to bring the students knowledge about key concepts that form artificial intelligence (AI), and their applications within the field of sustainable energy engineering. With focus on machine learning (ML), the students will be given insight in the fundamental theory and algorithms that shape ML models, as well as how to select method and data based on various applications. The course also introduces potential implications for energy businesses, as well as ethical aspects of using artificial intelligence. The students will learn to manage data for the purpose of ML applications as well as to create, integrate and use ML for analysis and design in an energy context. Based on the course content, students are expected to describe advantages and limitations for AI applications in the energy sector, as well as discuss trends and potential risks connected to the subject.

The course is split into two parts: Part 1 focuses on background and theory of AI and narrows down to machine learning for energy applications. The block mainly consists of lectures and ends with a quiz about the theory, principles, and available tools for AI applications in the energy sector. The second block consists of hands-on applications of AI in energy technology,

where the students will carry out a project in groups. During the project work supervision and help sessions will be provided, and the block ends with a compulsory presentation of the project. At the end of the course, the final examination is an individual assignment in form of an essay about aspects of AI in the energy sector and society in general. The course grade is weighted according to the credits in the examination sectioning below.

Examination

- INLA - Home Assignment, 1.5 credits, grading scale: A, B, C, D, E, FX, F
- KONA - Quiz, 1.5 credits, grading scale: P, F
- PROA - Project, 3.0 credits, grading scale: A, B, C, D, E, FX, F

Based on recommendation from KTH's coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability.

The examiner may apply another examination format when re-examining individual students.

Ethical approach

- All members of a group are responsible for the group's work.
- In any assessment, every student shall honestly disclose any help received and sources used.
- In an oral assessment, every student shall be able to present and answer questions about the entire assignment and solution.