SYLLABUS

Artificial Intelligence and Pattern Recognition 7.5 credits D7062E

Artificell intelligens och mönsterigenkänning

Course syllabus admitted: Autumn 2023 Sp 1 - Present

DECISION DATE
2022-02-14

Luleå University of Technology 971 87 Luleå, Sweden
Phone: +46 (0)920 49 10 00 • Corporate Identity: 202100-2841

LULEÅ TEKNISKA UNIVERSITET

Artificial Intelligence and Pattern Recognition 7.5 credits D7062E

Artificell intelligens och mönsterigenkänning

Second cycle, D7062E

Education level	Grade scale	Subject	Subject group (SCB)
Second cycle	G U 3 4 5	Datateknik	Computer Technology

Main field of study

Computer Science and Engineering

Entry requirements

In order to meet the general entry requirements for second cycle studies, you should have successfully completed the first cycle and have a good understanding of mathematical analysis and linear algebra; ability to develop and apply computer programs to solve mathematically formulated problems, understanding of basic mathematical statistics including probability distributions, expectation and variance, understanding of basic signal processing including sampling, time-discrete processing of time-continuous signals, linear and time-invariant systems.

Selection

The selection is based on 30-285 credits

Course Aim

After completion of the course, the student should be able to:

- define the area of Artificial Intelligence (in particular, with relation to control theory and computer science), and shortly describe its major fields
- list a minimum of three existing tools implementing AI methods, and describe their basic characteristics
- given two existing tools implementing AI methods, compare them with respect to their basic characteristics.
- In-depth understanding of the basic methods and theories used in AI and pattern recognition
- Given a real-life applied AI problem that the student has encountered during the course, or that is analogue to those the student encountered during the course:
    - categorize the problem using standard concepts
    - list a minimum of three appropriate AI methods to tackle the problem
    - describe in their own words at minimum two appropriate AI methods to tackle the problem
    - apply one appropriate AI method to tackle the problem, given access to the necessary tool implementing AI methods, and data relevant to the problem.
- Understanding of appearance-based recognition approaches for robotic applications (e.g. navigation, detection)

Contents

- Artificial Intelligence as a subject area, its history and its precursors, a basic introduction into robotics, reasoning and retrieval systems, machine learning ,and ethical aspects of AI.
- Theory and mathematical methodology of sub-symbolic AI methods
- Probability theory as applied in pattern recognition contexts
- Machine Learning and pattern recognition methods like K-NN and variants, Support Vector Machines, Naïve Bayes and Bayesian Networks, Expectation Maximization, and others
- Methods for improving AI and pattern recognition methods, such as multiple classifier combination, ensemble methods, bagging, boosting, and extended methods.
- Unsupervised learning techniques, such as clustering (k-means, hierarchical, DBSCAN), PCA, LDA, and other pattern analysis techniques
- Bag of Visual Words technique for appearance based recognition

Realization

Each course occasion´s language and form is stated and appear on the course page on Luleå University of Technology's website.
Lectures will be given in the form of short videos 6-10 minutes covering a specific concept related to the module, a short reflection questions will be asked after the video to confirm the success of delivering the knowledge. Weekly live sessions will be conducted where students can ask the instructors and sort out their concerns if they are existed. Project related to the covered topics should be delivered at the end of the module as the major contribution from the students, project will be split into different tasks, and each task will be assigned to the students at the end of the relevant module.

Examination

If there is a decision on special educational support, in accordance with the Guideline Student's rights and obligations at Luleå University of Technology, an adapted or alternative form of examination can be provided.
Oral examination with differentiated numerical grades, as well as different quizzes and project divided into different tasks. Eligibility to attend the oral exam requires approval of all individual quizzes and project’s tasks.

Unauthorized aids during exams and assessments

If a student, by using unauthorized aids, tries to mislead during an exam or when a study performance is to be assessed, disciplinary measures may be taken. The term “unauthorized aids” refers to aids that the teacher has not previously specified as permissible aids and that may assist in solving the examination task. This means that all aids not specified as permissible are prohibited. The Swedish version has interpretative precedence in the event of a conflict.

Course offered by

Department of Computer Science, Electrical and Space Engineering

Modules

Code	Description	Grade scale	Cr	Status	From period	Title
0001	Oral exam	G U 3 4 5	4.5	Mandatory	A22	
0002	Reflective quizzes and project tasks	U G#	3	Mandatory	A22	

Study guidance

Study guidance for the course is to be found in our learning platform Canvas before the course starts. Students applying for single subject courses get more information in the Welcome letter. You will find the learning platform via My LTU.

Last revised

by Jonny Johansson, HUL SRT 2022-02-14

Syllabus established

by Jonny Johansson, HUL SRT 2022-02-14