

Tools of Artificial Intelligence

Introduction and course plan

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Know your instructors



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Expertise (Vinay C. Gogineni)

- ▶ Fundamentals of AI (i.e., Developing new algorithms and architectures)
- ▶ Responsible AI (Fairness- and Privacy-Conscious AI)
- ▶ Graph Machine Learning
- ▶ Federated Learning (Decentralized Machine Learning)
- ▶ Machine Unlearning
- ▶ Their application in Healthcare, Industrial Internet-of Things (IIoT), Fusion-Energy

Expertise (Smith K. Khare)

- ▶ Healthcare information
- ▶ Neuro-developmental disorder and Brain-computer interface
- ▶ Medical image analysis
- ▶ Biomedical and time-series signal analysis
- ▶ Explainable machine and deep learning techniques
- ▶ Uncertainty quantification

Expertise (Orkun Furat)

- ▶ Spatial statistics and stochastic geometry
- ▶ Machine learning and generative modeling
- ▶ Image and spatial data analysis
- ▶ Stochastic 3D modeling with applications in materials science
- ▶ Computational tools for characterizing engineering processes
- ▶ Physics-informed neural networks for surrogate modeling in nano optics

Tools of Artificial intelligence

ECTS Value: 5

Teaching language: English

Duration: 4 hours on Wednesday

Grading: 7-point grading scale

Courses taught previously

Calculus and linear algebra

*Bachelors (5
ECTS)*

*Total students
(86)*

*Students passed
in 1st attempt
(84)*

*Students passed
in 2nd attempt
(2)*

Ingeniørfagligt Grundlag 1, (E24)

*Bachelors (5
ECTS)*

*Total students
(48)*

*Students passed
in 1st attempt
(43), Re-attempt
(1), No show (4)*

Tools of Artificial Intelligence *5 ECTS*

*Total students
(56)*

*Students passed
in 1st attempt
(54), Re-attempt
(2)*

Learning objectives - Knowledge

Having completed this course, the student has knowledge of:

- ▶ Basic machine learning techniques: neural networks, genetic algorithms, machine learning, deep learning, and reinforcement learning.
- ▶ Representational techniques appropriate to the above learning methods
- ▶ The experimental challenges and demands of the machine learning approaches referred to above.

Learning objectives - Skills

Having completed this course, the student is able to:

- ▶ Implement, debug and deploy the AI techniques taught in new situations.
- ▶ Devise suitable representations of data for chosen machine learning techniques
- ▶ Test, evaluate and document the performance of chosen machine learning techniques using suitable correct methodologies
- ▶ Write a straightforward experimental scientific paper documenting a comparison experiment

Learning objectives - Competences

Having completed this course, the student is able to:

- ▶ identify robotic problems where machine learning techniques could be applied
- ▶ select appropriate techniques from the toolbox of possibilities
- ▶ characterise a new AI technique in terms of scope and type (unsupervised, semi-supervised or supervised)
- ▶ evaluate reported applications of machine learning techniques in terms of results and methodology

Course structures

- ▶ Module 1: Introduction
- ▶ Module 2: Machine Learning pipeline for classification task on a numeric data
- ▶ Module 3: Machine Learning pipeline for Regression task on a numeric data
- ▶ Module 4: Deep learning Pipelines for Classification, Segmentation and Physics-Informed Inference (Image data)
- ▶ Module 5: Self Supervised Learning and Decentralized Learning
- ▶ Module 6: Basics of Reinforcement Learning

Lecture plans

- ▶ Each module would be covered in about 8 hours.
- ▶ Each module would require two 4 hours session.
- ▶ First 1-2 hours would be dedicated to lectures (including breaks).
- ▶ Second 1-2 hours would be dedicated to practical implementation in Python (including breaks).
- ▶ Students are required to make a group of 3-4, whom they would be working on during the entire semester.

Exam and evaluation

- ▶ Each group work on any one task from module 2-module 6.
- ▶ Implement one of the pipeline with existing state-of-the-art technique on a dataset of their choice (or would be provided by faculty)
- ▶ Write a 6-7 page report including abstract, introduction, literature survey, methodology, results, discussion, conclusion, and references.
- ▶ Submit the report on itslearning portal (Deadline would be provided to you shortly).
- ▶ Make a presentation of 8-10 minutes and there would be questions on the presentation and report for 10-15 minutes.

Note: You submit the report as a group, but Oral Exam would be carried out individually.

Questions??

