

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??

