DD2601 Deep Generative Models and Synthesis 7.5 credits

Djupa generativa modeller

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

The official course syllabus is valid from the autumn semester 2025 according to the decision by the Faculty Board: J-2024-2237.
Date of decision: 2024-12-10

Grading scale

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

Education cycle

Second cycle

Main field of study

Computer Science and Engineering

Specific prerequisites

Knowledge in deep learning, 6 credits, equivalent to completed course DD2424/DD2437. Active participation in DD2424/DD2437 whose final examination has not yet been reported to Ladok is equated with course completion.

Knowledge and skills in programming, 6 credits, equivalent to completed course DD1337/DD1310-DD1319/DD1321/DD1331/DD100N/ID1018.

Knowledge in multivariable analysis, 7.5 credits, equivalent to completed course SF1626.

Knowledge in probability theory and statistics, 6 credits, equivalent to completed course SF1910-SF1925/SF1935.

Language of instruction

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

Intended learning outcomes

After passing the course, the students should be able to:

- characterise synthesis problems, deep generative methods, and their applications
- distinguish different objectives, performance measures, and common problems with generative modelling
- describe the relation between deep generative models and regression-based methods
- train and tune deep generative models on different datasets
- evaluate generative models objectively and subjectively
- discuss ethical aspects of particular relevance to generative AI

in order to

- be able to judiciously use deep generative modelling to solve problems in industry and/or academia.

Course contents

- Relevant concepts from probability theory and estimation
- Introduction to synthesis problems and generative models
- Principles of synthesis versus classification
- Regression versus probabilistic modelling
- Modelling goals and evaluation
- Mixture density networks (MDNs)
- Autoregression and large language models (LLMs)
- Normalising flows
- Variational autoencoders (VAEs)
- Diffusion models and flow matching
- Generative adversarial networks (GANs)

- Subjective evaluation
- Hybrid approaches
- Recent developments
- Ethical aspects of generative AI

Examination

- LAB1 - Digital Assignment with Oral Comprehension Questions, 7.5 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.