



DD2361 Advanced Topics in Deep Learning in Biomedical Image Analysis 7.5 credits

Avancerade ämnen inom djupinlärning i biomedicinsk bildanalys

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

Establishment

The official course syllabus is valid from the autumn semester 2026 as decided by the faculty board decision HS-2025-1945. Date of decision 2025-10-07

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, 5.5 credits, equivalent to completed course DD2424/DD2437 or completed parts KON1 and LAB2 in DD2437.

Knowledge and skills in programming, 6 credits, equivalent to completed course DD1337/DD1310-DD1319/DD1321/DD1331/DD1333/DD100N/ID1018/ID1022.

Knowledge in linear algebra, 7.5 credits, equivalent to completed course SF1624/SF1672/SF1684.

Knowledge in multivariable analysis, 7.5 credits, equivalent to completed course SF1626/SF1674/SF1686.

Knowledge of probability theory and statistics, 6 credits, equivalent to completed course SF1910-SF1925/SF1935 or completed exam module TEN1 within SF1910/SF1925/SF1935.

Intended learning outcomes

After passing the course, the student should be able to

- identify the basic concepts, terminology, theories, models and methods for biomedical image analysis using deep learning
- characterise the unique challenges associated with different types of biomedical image data modalities
- describe and implement commonly used architectures for deep neural networks for biomedical image analysis
- develop and systematically test a number of methods for biomedical image analysis using deep learning
- select appropriate evaluation methods to assess the performance of deep learning models for problems in biomedical image analysis
- identify limitations of the methods covered in the course

in order to

- curate biomedical image data for use in deep learning-based methods
- implement, analyse and evaluate systems for biomedical image analysis using deep neural networks
- apply the knowledge acquired in the course to critically read and benefit from the literature in the field.

Course contents

- Introduction and fundamentals.
- Image acquisition and biomedical data modalities.
- Supervised learning for medical imaging.
- Medical image segmentation.
- Self-supervised learning and foundation models.
- Multimodal learning and image-text models.
- Generative AI and diffusion models.
- Human–AI interaction and clinical decision-making.
- Uncertainty estimation and reliable AI.

- AI-generated medical reports and clinical natural language processing (NLP).
- Bias and fairness in medical AI.
- Federated learning and integrity.
- Model evaluation, statistical validity and external validity.

Examination

- ÖVN1 - Lesson Assignments and Tutorial Quizzes, 1.5 credits, grading scale: P, F
- INLM - Hand-in Assignments with Oral Assessment, 3.0 credits, grading scale: A, B, C, D, E, FX, F
- KON1 - Digital Quizzes, 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. If the course is discontinued, students may request to be examined during the following two academic years.

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.