DD2368 Quantum Neural Networks 7.5 credits

Kvantneurala nätverk

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

Establishment

The official course syllabus is valid from the autumn semester 2025 according to the decision by the Faculty Board: J-2024-2224. Date of decision: 2024-10-08

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 algebra and geometry, 7.5 higher education credits, equivalent to completed course SF1624.

Knowledge in neural networks, 5.5 higher education credits, corresponding to completed course DD2424/DD2437 or completed modules KON1 and LAB2 in DD2437.

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

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 student should be able to:

- explain and describe the basics of quantum computing and quantum machine learning
- implement and evaluate differentiable quantum programming techniques
- design and optimise variational quantum circuits for machine learning tasks
- create and evaluate advanced quantum-based neural network architectures

in order to develop and optimise quantum algorithms for advanced data processing tasks.

Course contents

Quantum computing principles and their application in machine learning.

Quantum bits, quantum gates and quantum circuits.

Many-quantum bit systems and quantum entanglement.

Differentiable quantum programming techniques, variational quantum circuits and hybrid quantum classical algorithms.

Advanced topics include the design and implementation of quantum neural networks, such as quantum convolutional and graph-based neural networks.

Examination

- LAB1 - Laboratory Assignments, 4.0 credits, grading scale: P, F
- PRO1 - Project Work, 3.5 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.

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.