Quantum Machine Learning

Kvantmaskininlärning
6 credits

Programme course

TSIT06

Valid from:

Determined by	**Main field of study**	
	Computer Science and Engineering, Applied Physics	
Date determined	**Course level**	**Progressive specialisation**
	Second cycle	A1F
Revised by	**Disciplinary domain**	
	Information missing	
Revision date	**Subject group**	
Offered first time	**Offered for the last time**	
2026		
Department	**Replaced by**	
Institutionen för systemteknik		

Course offered for

- Master of Science in Applied Physics and Electrical Engineering

Intended learning outcomes

After completing the course the student should be able to:

1. use relevant concepts and methods in quantum machine learning to formulate, structure and solve practical problems.
2. infer the parameters in a number of common quantum machine learning models.
3. evaluate and choose among models.
4. implement quantum machine learning models and algorithms in a programming language.

Course content

- Introduction to machine learning, and introduction to quantum computers, a brief introduction to quantum mechanics
- Representation of classical data in quantum systems, coding and embedding, quantum data representation and quantum feature map
- Quantum algorithms for machine learning, quantum classifiers, quantum mechanical kernel methods, quantum clustering
- Quantum variational circuits, quantum neural networks, quantum convolutional neural networks (QCNNs), quantum federated learning (QFL), quantum reinforcement learning (QRL), kvantmekanisk multimodal inlärning
- Research directions in the area
- Applications of QML in language models, computer vision, health care, medicin design, transport, and intrusion detection

Examination

TEN1	Written examination	4 credits	U, 3, 4, 5
LAB1	Labatory work	2 credits	U, G

Grades

Four-grade scale, LiU, U, 3, 4, 5