FDD3558 Solving Engineering Problems with Neural-inspired Computation 5.0 credits

Lösa tekniska problemer med neural inspirerad beräkning

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

Course syllabus for FDD3558 valid from Spring 2024

Grading scale

P, F

Education cycle

Third cycle

Specific prerequisites

Linear algebra (SF1604 or similar)
Machine learning (DD2421 or similar)
Artificial Neural Networks (DD2437 or similar, or self-study to compensate)

Language of instruction

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

Intended learning outcomes

After completing the course, the student should be able to
(1) Describe computational models for leaky integrators and leaky integrate-and-fire neurons, as well as ways to represent and encode information with biophysical models.
(2) Account for adaptation and learning in neuromorphic neural networks, including supervised optimization using surrogate gradients and unsupervised methods, including e-prop and EventProp.
(3) Understand address-event representations and account for the operating principles of event-based cameras and actuators.
(4) Write and execute neuromorphic algorithms on dedicated neuromorphic hardware.
(5) Quantitatively and qualitatively analyze neuromorphic algorithms and account for differences between neuromorphic and non-neuromorphic algorithms.
(6) Solve sensor processing and sensorimotor problems with neuromorphic neural networks.
(7) Implement neuronal computation and machine learning as energy efficient / energy saving processes.

Course contents

1. Computing with neurons
2. Learning in neural systems
3. Event-based sensing and computing
4. Neuromorphic hardware
5. Neuromorphic robotics

Examination

- PRO1 - Project, 4.0 credits, grading scale: P, F
- ÖVN1 - Exercise, 1.0 credits, grading scale: P, 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.

Students perform lab exercises for the 5 different lecture topics. At least four of the five lecture exercises need to be completed.

Other requirements for final grade

Students design and implement a project in neuromoprhic computing after the lectures. The project will be graded P/F.

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.