HALMSTAD UNIVERSITY
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School of Information Technology

Applied Deep Learning with PyTorch 5 credits

Tillämpad Deep Learning med PyTorch 5 hp

Second cycle
Main field: Computer Science and Engineering, Second cycle, has only first-cycle course/s as entry requirements (A1N)
Syllabus is adopted by the Research and Education Board (2022-04-11) and is valid for students admitted for the autumn semester 2022.

Placement in the Academic System

The course is given as a single subject course.

Prerequisites and Conditions of Admission

Degree of Bachelor of Science with a major in Computer Science and Engineering or Degree of Bachelor of Science in Engineering, Computer Science and Engineering or the equivalent of 180 Swedish credit points or 180 ECTS credits at an accredited university. Including 7.5 credits programming and 7.5 credits mathematics. Applicants must have written and verbal command of the English language equivalent to English course 6 in Swedish Upper-Secondary School.

Course Objectives

The overall goal of the course is for the student to develop basic knowledge of deep learning and integrate theoretical and practical competence relevant for research and development of basic deep learning methods.

Following successful completion of the course the student should be able to:

Knowledge and understanding

- discuss the theoretical and practical aspects of deep neural networks
- describe the construction of different types of deep neural networks
- describe different loss functions used for training and optimization as well as regularization techniques to avoid over- and under-fitting

Skills and ability

- implement a multi-layer perceptron to solve a typical classification or regression problem, including systematic choice of suitable model parameters to optimize the generalization performance
- use a convolutional neural network to classify images design a recurrent network for problems with sequence data

Judgement and approach

- identify difficulties and requirements, and then search for alternative solutions to overcome problems by referring to the theoretical and technical aspects
- analyze a typical problem within the subject area and deduce which method or methods that are most suitable to solve it

Primary Contents

The main content of the course concerns techniques for analysis, design, and programming of deep learning algorithms. The course is broken down into two modules of 2.5 credits: theory and practice. The theoretical content covers basic principles of multi-layer perceptrons, spatio-temporal feature extraction with convolutional neural networks (CNNs) and recurrent neural networks (RNNs), classification and regression of big data, and producing novel data samples using generative models. The practical sessions cover the basics of programming with PyTorch, image classification, and semantic segmentation using CNNs, future image frame prediction with RNNs and image generation with generative adversarial networks.

Teaching Formats

Teaching consists of lectures, computer exercises and project work. In the computer exercises the student solves small problems using deep learning models. After programming various exercises, the participants will develop an advanced deep learning project. Participants will be encouraged to bring their own data. High-end GPU machines will be provided for the exercises and project.

Teaching is in English and via the University's learning platform.

Examination

The overall grades of Fail or Pass will be awarded for the course.
The examination consists of a written examination, programming exercises, and a presentation of a project. Which are all done individually.

Name of the test		Grading
Written Examination	2,5 credits	U/G
Programming Exercises and Project Work	2,5 credits	U/G

If there are special reasons, the examiner may make exceptions from the specified examination format and allow a student to be examined in another way. Special reasons can e.g. be a decision on learning support.

For elite sports students according to Riktlinjer för kombinationen studier och elitidrott vid Högskolan i Halmstad, DNR: L 2018/177, the examiner has the right to decide on an adapted examination component or let the student complete the examination in an alternative way.

Course Evaluation

Course evaluation is part of the course. This evaluation should offer guidance in the future development and planning of the course. Course evaluations should be documented and made available to the students.

Course Literature and Other Study Resources

Ian Goodfellow, Yoshua Bengio, Aaron Courville. *Deep Learning*. MIT Press, 2016 `http://www.deeplearningbook.org`

Lecture notes

Laboratory manuals will be provided by the teacher and will also be made available for course participants via the University's learning platform.