

Topics in deep learning for perception, 3,0 hp

Teman inom djup inläring för perception, 3,0 hp

Course Code/Codes	50DT057
Subject Area	Computer Science (Datavetenskap)
School/equivalent	School of Science and Technology (Institutionen för naturvetenskap och teknik)
Valid from	2018-02-01
Approved	2018-02-01
Revised	,
Approved by	Head of School Peter Johansson
Translation to English, date and signature	

1 Course content

This course is intended as a guided study of deep neural network (NN) architectures applied to problems in perception research. We will overview the most common network designs and focus on applications relevant to perception with mobile robots. The course will cover:

- An overview / revision of basic machine learning concepts relevant to deep learning
- Deep feedforward networks
- Autoencoders
- Convolutional neural networks
- Regularization and optimization for NNs
- Practical tips for applying deep learning
- Selected example deep NN approaches for perception problems

2 Outcomes

2.1 The course in relation to the doctoral programme

The course shall primarily refer to the following intended learning outcomes for third-cycle courses and study programmes as described in the Higher Education Ordinance, i.e. the doctoral student shall demonstrate:

Knowledge and understanding

- advanced and up-to-date specialised knowledge in a limited area of this field (part of outcome 1)
- familiarity with the methods of the specific field of research in particular (part of outcome 2)

Competence and skills

- the capacity for scholarly analysis and synthesis (part of outcome 3)
- the capacity to review and assess new and complex phenomena, issues and situations autonomously and critically (part of outcome 3)
- the ability to identify and formulate issues with scholarly precision critically, autonomously and creatively (part of outcome 4)
- the ability to plan and use appropriate methods to undertake research and other qualified tasks within predetermined time frames (part of outcome 4)
- the ability to review and evaluate research and other qualified tasks (part of outcome 4)

Judgement and approach

intellectual autonomy and disciplinary rectitude (part of outcome 9)

The intended learning outcomes are listed in the same order as in the general syllabus for the programme.

2.2 Intended course learning outcomes

To obtain a passing grade, the doctoral student shall demonstrate:

- Knowledge and Understanding
 - knowledge of the most common deep neural network architectures applicable to problems in perception
 - understanding of the basic concepts behind feedforward networks, autoencoders and convolutional neural networks
 - knowledge of important practical issues in training deep neural networks, data pre-processing, regularization, and optimization approaches used.

Competence and Skills

- skills to design neural networks, train and evaluate them
- skills to use some of the available deep learning software frameworks

Judgment and Approach

- the ability to critically analyze current research articles that use deep learning for perception research
- the ability to reason about advantages and limitations of different deep learning architectures applied to perception systems

3 Reading list and other teaching material

The following course readings and teaching material will be used on the course:

- Deep Learning. Ian Goodfellow and Yoshua Bengio and Aaron Courvill. MIT Press, 2016 (<http://www.deeplearningbook.org/>)
- Selected scientific articles

4 Teaching formats

Teaching on the course takes the following format:

The course will consist of a number of seminars, as well as a small independent project.

5 Examination

The course will be examined by means of completing a small project and presenting it orally.

6 Grades

Examinations on third-cycle courses and study programmes are to be assessed according to a two-grade scale with either of the grades 'fail' or 'pass' (local regulations).

The grade shall be determined by a teacher specifically nominated by the higher education institution (the examiner) (Higher Education Ordinance).

To obtain a passing grade on examinations included in the course, the doctoral student is required to demonstrate that he/she attains the intended course learning outcomes as described in section 2.2. Alternatively, if the course consists of multiple examinations generating credit, the doctoral student is required to demonstrate that he/she attains the outcomes that the examination in question refers to in accordance with section 5.

A student who has failed an examination is entitled to a retake.

If an examination consists of several examination components, and a student fails an examination component, the examiner may, as an alternative to a retake, set a make-up assignment with regard to the examination component in question.

A doctoral student who has failed an examination twice for a specific course or course element is entitled, upon his/her request, to have another examiner appointed to determine the grade.

7 Admission to the course

7.1 Admission requirements

To gain access to the course and complete the examinations included in the course, the applicant must be admitted to a doctoral programme at Örebro University.

7.2 Selection

Selection between applicants who have been admitted to doctoral programmes at Örebro University and who otherwise meet the admission requirements as listed above is made according to the following order of precedence:

If no other selection criteria are specified in this section, priority shall be given to applicants with a lower number of course credits left before the award of their degree over applicants with a higher number of remaining course credits. Should two or more students have equal number of credits, selection will be done through the drawing of lots. This also applies within any selection groups listed unless otherwise stated.

7.3 Other applicants than doctoral students admitted at Örebro University

Other applicants than doctoral students admitted at Örebro University may be given access to the course on the grounds of provisions for and/or agreements regarding contracted courses, joint degrees, national graduate schools or cooperation in other respects with other universities.

Any decisions on what such other applicants may be given access to the course are made separately and on the basis of the provisions and/or agreements that occasion the student to apply for the course.

For participation in the course in other respects, the same provisions shall apply as for doctoral students admitted to Örebro University.

8 Transfer of credits for courses, study programmes and other experience

Provisions on the transfer of credits can be found in the Higher Education Ordinance and on the university's webpage.

9 Other information

Transitional provisions