COURSE SYLLABUS

Machine Learning

7,5 ECTS credit points (7,5 högskolepoäng)

1 Course title and credit points
The course is titled Machine Learning/Maskininlärning and awards 7,5 ECTS credits. One credit point (högskolepoäng) corresponds to one credit point in the European Credit Transfer System (ECTS).

2 Decision and approval
This course is established by School of Computing 2013-05-28. The course syllabus was revised by Head of Department of Computer Science and Engineering and applies from 2014-10-30.
Reg.no: BTH 4.1.1-0545-2014

3 Objectives
The main purpose of the course is to introduce theory and methods from machine learning and real-world applications from data mining. The technological development has increased our dependency on databases for storage and processing of information. The number and size of these databases grow rapidly. Due to this growth, it becomes more difficult to manually extract useful information. We therefore need semiautomatic and automatic methods to use, aggregate, analyze, and extract such information. Methods and techniques from machine learning, data mining, and artificial intelligence have been shown to be useful for these purposes.

4 Content
The course comprises the following themes:

- Current and future learning systems:
- motivation, goals, theories, and existing methods as well as basic research and application trends.
- Development of learning systems:
- planning, design, implementation, and testing of learning systems.
- Directions and areas within learning systems:
- supervised learning, unsupervised learning, classification, meta learning.

Evaluation of learning systems:
- approaches, methods, and measures for evaluation and validation of learning systems.

5 Aims and learning outcomes

Knowledge and comprehension
After completion of the course, the student will be able to:
- independently and exhaustively define and describe solvable and tractable learning problems
- independently and broadly explain and summarize results from the application and evaluation of learning systems

Skills and abilities
After completion of the course, the student will be able to:
- independently and exhaustively modify or create and apply learning systems to different learning problems
- independently and exhaustively plan and execute experiments to evaluate and compare learning systems

Approach and ability to evaluate
After completion of the course, the student will be able to:
- independently and exhaustively evaluate and compare learning systems for different learning problems given various evaluation criteria
- independently and exhaustively evaluate and compare methods and measures for evaluation of learning systems

6 Learning and teaching
The course is campus-based. The education comprises lectures and laboratory sessions that together contribute to the theoretical understanding and practical ability required to analyze, implement, and evaluate learning systems. The purpose of the laboratory sessions is to introduce platforms, tools and APIs for machine learning. The acquired knowledge is evaluated and increased through
assignments, where subject-related problems must be solved either by implementing custom learning systems or by applying existing tools. In addition, the course includes an individual project in which a subject-related problem must be defined theoretically and solved practically according to the state-of-practice and state-of-the-art. The solution, or solutions, must be evaluated/compared experimentally and the results must be analyzed and summarized in a project report. The assignments and the project must be conducted individually. It is not allowed to collaborate with fellow students or others in any manner. If existing theory, methods, or tools are used, they must be clearly identified by motivation, citation, and description in the assignment submission or project report. This course uses a learning platform for publication of course contents and information. The platform also hosts discussion forums, assignment and project submission, and feedback. The teaching language is English.

7 Assessment and grading

Examination of the course

<table>
<thead>
<tr>
<th>Code</th>
<th>Module</th>
<th>Credit</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>1310</td>
<td>Assignment 1</td>
<td>1 ECTS</td>
<td>G-U</td>
</tr>
<tr>
<td>1320</td>
<td>Assignment 2</td>
<td>1 ECTS</td>
<td>G-U</td>
</tr>
<tr>
<td>1330</td>
<td>Project[1]</td>
<td>5.5 ECTS</td>
<td>A-F</td>
</tr>
</tbody>
</table>

1 Determines the final grade for the course, which will only be issued when all components have been approved.
The course will be graded A Excellent, B Very good, C Good, D Satisfactory, E Sufficient, FX Insufficient, supplementation required, F Fail.

8 Course evaluation

The course coordinator is responsible for systematically gathering feedback from the students in course evaluations and making sure that the results of these feed back into the development of the course.

9 Prerequisites

The student should have completed Applied Artificial Intelligence 7.5 ECTS.

10 Field of education and subject area

The course is part of the field of education and is included in the subject area Computer Science.

11 Restrictions regarding degree

The course cannot form part of a degree with another course, the content of which completely or partly corresponds with the contents of this course. The contents of this course corresponds partly (2 ECTS credit points) to the course Adaptive Learning systems.

12 Additional information

Replaces DV2406 and DV2411.

13 Course literature and other teaching material

Main literature

   Författare: Peter Flach
   Förlag: Cambridge University Press
   Utgiven: 2012, Antal sidor: 396
   ISBN13: 9781107096394

Reference literature

Evaluating Learning Algorithms: A Classification Perspective
   Authors: Japkowicz, N., Shah, M.
   Publisher: Cambridge University Press
   Published: 2011, Number of pages: 424
   ISBN10: 0521196000
   ISBN13: 9780521196000

   Författare: Witten, I., Frank, E., Hall, Mark A. Förlag: Morgan Kaufmann
   Utgiven: 2011, Antal sidor: 664
   ISBN10: 0123748569
   ISBN13: 9780123748560

   Författare: Walpole, R., Myers, R., Myers, S., Ye, K.
   Förlag: Pearson
   Utgiven: 2011, Antal sidor: 816
   ISBN10: 0321748239
   ISBN13: 9780321748232

Main literature

   Författare: Peter Flach
   Förlag: Cambridge University Press
   Utgiven: 2012, Antal sidor: 396
   ISBN13: 9781107096394

Reference literature

Evaluating Learning Algorithms: A Classification Perspective
   Authors: Japkowicz, N., Shah, M.
   Publisher: Cambridge University Press
   Published: 2011, Number of pages: 424
   ISBN10: 0521196000
   ISBN13: 9780521196000

   Författare: Witten, I., Frank, E., Hall, Mark A. Förlag: Morgan Kaufmann
   Utgiven: 2011, Antal sidor: 664
   ISBN10: 0123748569
   ISBN13: 9780123748560

   Författare: Walpole, R., Myers, R., Myers, S., Ye, K.
   Förlag: Pearson
   Utgiven: 2011, Antal sidor: 816
   ISBN10: 0321748239
   ISBN13: 9780321748232