Blekinge Institute of Technology
Department of Computer Science

Revision: 1
Reg.no: BTH-4.1.14-0678-2022

COURSE SYLLABUS

Avancerad maskininlärning
Advanced Machine Learning
7.5 credits (7,5 högskolepoäng)

Course code: DV2627
Main field of study: Computer Science
Disciplinary domain: Technology
Education level: Second cycle
Specialization: A1F - Second cycle, has second cycle course/s as entry requirements

Language of instruction: English
Applies from: 2023-01-16
Approved: 2022-09-01

1. Decision
This course is established by Dean 2022-05-03. The course syllabus is approved by Head of Department of Computer Science 2022-09-01 and applies from 2023-01-16.

2. Entry requirements
Admission to the course requires completed courses in Applied Artificial Intelligence, 6 credits and Machine Learning, 6 credits.

3. Objective and content

3.1 Objective
The main purpose of the course is to introduce students to advanced methods from machine learning and data mining. The current technological development and integration of AI and the Internet of Things (IoT) require new and intelligent solutions for processing and analyzing heterogeneous, multi-dimensional data coming from multiple sources. In order to cope with these new challenges, hybrid and advanced techniques are required, e.g., semi-supervised learning, federated learning, data stream mining, and many others. In addition, it is important that these models are easy to understand and analyze (Explainable AI) and do not treat individuals unfavorably (Ethics and Fairness). The course will cover such methods and provide the necessary skills for the students, broaden their knowledge, and prepare them to deal with real-world industrial challenges.

3.2 Content
The course comprises the following topics, with intention to have at most a lecture per topic:
• overview of the data cleaning, reduction and transformation, and dimensionality reduction
• introducing the problem of association pattern mining and identifying relationships between different attributes.
• introducing the concept of semi-supervised learning and its potential in enhancing the classification process.
• overview of outlier analysis and its application in different application domains, and outlier validation methods
• overview of processes and methods that allow humans to understand and trust the results created by AI models while describing the model's expected impact and potential biases.
• introducing the problem of data biases and model inaccuracies that can lead to models treating individuals unfavorably
• overview of algorithms for stream mining and challenges related to steams such as high volume and concept drift

4. Learning outcomes
The following learning outcomes are examined in the course:

4.1 Knowledge and understanding
On completion of the course, the student will be able to:
• define and describe advanced solvable machine learning and data mining problems
• select suitable machine learning and data mining method for the ML tasks determined by the defined problems
• explain and summarize results from the application and evaluation of the studied problems

4.2 Competence and skills
On completion of the course, the student will be able to:
• identify the key components of the machine learning and data mining pipeline and describe how they are related

• design and execute experiments while considering ethical aspects concerns the machine learning and data mining problems
• design and execute experiments to evaluate and compare advanced machine learning and data mining methods

4.3 Judgement and approach

On completion of the course, the student will be able to:
• evaluate and compare the performance of different machine learning and data mining solutions using proper evaluation criteria
• identify and reason about potential sources of biases while building machine learning models
• analyze and interpret the experimental results from the evaluation of machine learning and data mining solutions

5. Learning activities

The content of this course will be discussed in several lectures. Students are expected to acquire additional knowledge through the self-study of relevant literature. In addition to the lectures, a few seminars will be held, allowing students to discuss and present machine learning and data mining applications in solving real-world challenges.
The students will demonstrate their knowledge in writing a project plan where they will motivate their project idea and will discuss the project implementation details. Upon the project proposal's approval, the students will design and develop the discussed solution for the desired problem, which they evaluate and compare the performance of the proposed solution and analyze and interpret the experimental results.

6. Assessment and grading

Modes of examinations of the course

Code	Module	Credits	Grade
2305	Seminar	1 credits	GU
2315	Project Plan	1 credits	GU
2325	Project assignment	5.5 credits	AF

The course will be graded A Excellent, B Very good, C Good, D Satisfactory, E Sufficient, FX Fail, supplementation required, F Fail.

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The information before a course occasion states the assessment criteria and make explicit in which modes of examination that the learning outcomes are assessed.

An examiner can, after consulting the Disability Advisor at BTH, decide on a customized examination form for a student with a long-term disability to be provided with an examination equivalent to one given to a student who is not disabled.

7. Course evaluation
The course evaluation should be carried out in line with BTH:s course evaluation template and process.

8. Restrictions regarding degree
The course can form part of a degree but not together with another course the content of which completely or partly corresponds with the contents of this course.

9. Course literature and other materials of instruction
Data Mining: The Textbook
Author: Charu C. Aggarwal
Publisher: Springer International Publishing Switzerland
Published: 2015, Number of Pages: 746
ISBN: 978-3-319-14141-1
Semi-Supervised and Unsupervised Machine Learning: Novel Strategies
Author: Albalate, Amparo; Minker, Wolfgang
Publisher: Springer International Publishing Switzerland
Published: 2011, Number of Pages: 256
ISBN: 978-1-848-21203-9
Molnar, C. (2022). Interpretable Machine Learning:
A Guide for Making Black Box Models Explainable (2nd ed.).
Open access via: christophm.github.io/interpretable-ml-book/

10. Additional information
This course replaces the course DV2584