Reg No: DVAE23/20232

Faculty of Health, Science and Technology
Computer Science

Syllabus

Foundations of AI and Optimisation Methods

Course Code:	DVAE23
Course Title:	Foundations of AI and Optimisation Methods *Grunderna inom AI och optimeringstekniker*
Credits:	7.5
Degree Level:	Master's level
Progressive Specialisation:	Second cycle, has second-cycle course/s as entry requirements (A1F)

Major Field of Study:
DVA (Computer Science)

Course Approval
The syllabus was approved by the Faculty of Health, Science and Technology 2023-01-30, and is valid from the Autumn semester 2023 at Karlstad University.

Prerequisites
Calculus and geometry (7.5 ECTS credits), Calculus in several variables (7.5 ECTS credits), Stochastic methods (7.5 ECTS credits), Data structures and algorithms (7.5 ECTS credits), and Systems modeling and simulation (7.5 ECTS credits), plus upper secondary level English 6, or equivalent

Learning Outcomes
Upon completion of the course, students should be able to:
- explain the central paradigms of machine learning;
- give an account of the components included in machine learning algorithms;
- create classic machine learning models with supervised learning;
- explain the theory behind optimisation with and without constraints;
- formulate a problem relevant for engineering as a machine learning problem; and
- model a problem relevant for engineering as an iterative optimisation problem, which can

be solved using for instance deterministic or stochastic gradient descent.

Content
The course comprises two parts. The first part, which constitutes approximately 60% of the course, treats basic concepts and paradigms of artificial intelligence and machine learning, for instance hypothesis space, generalisation error, and limitations. This first part of the course also includes practical components, such as design of algorithms for linear and logistic regression and support vector machines, and practical aspects of machine learning, for instance normalisation and cross-validation. The second part of the course treats optimisation with and without constraints. Among other things, this includes showing how stochastic gradient descent can be used for optimisation without constraints.

Reading List
See separate document.

Examination
Assessment is based on a written exam and mandatory laboratory work.

If students have a decision from Karlstad University entitling them to Targeted Study Support due to a documented disability, the examiner has the right to give such students an adapted examination or to examine them in a different manner.

Grades
One of the grades 5 (Pass with Distinction), 4 (Pass with Some Distinction), 3 (Pass), or U (Fail) is awarded in the examination of the course.

Quality Assurance
Follow-up relating to learning conditions and goal-fulfilment takes place both during and upon completion of the course in order to ensure continuous improvement. Course evaluation is partly based on student views and experiences obtained in accordance with current regulations and partly on other data and documentation. Students will be informed of the result of the evaluation and of any measures to be taken.

Course Certificate
A course certificate will be provided upon request.

Additional information
The local regulations for studies at the Bachelor and Master levels at Karlstad University stipulate the obligations and rights of students and staff.