UNIVERSITY OF GOTHENBURG

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

DIT406 Introduction to Data science and AI, 7.5 credits

Introduktion till Data science och AI, 7,5 högskolepoäng

First Cycle

Confirmation

This course syllabus was confirmed by Department of Computer Science and Engineering on 2020-12-18 to be valid from 2021-08-30, autumn semester of 2021.

Field of education: Science 100%
Department: Department of Computer Science and Engineering

Position in the educational system

The course can be part of the following programmes: 1) Computer Science, Master's Programme (N2COS), 2) Mathematical Sciences, Master's Programme (N2MAT), 3) Computer Science, Bachelor's Programme (N1COS), 4) Bachelor's Programme in Mathematics (N1MAT) and 5) Software Engineering and Management Master's Programme (N2SOF)

Main field of studies	*Specialization*
Computer Science	G1F, First cycle, has less than 60 credits in first-cycle course/s as entry requirements
Data Science	G1F, First cycle, has less than 60 credits in first-cycle course/s as entry requirements

Entry requirements

To be eligible for the course students should have:

- 7,5 hec mathematical thinking (DIT025 or DIT856 or equivalent) or a course in basic mathematics (containing e.g. calculus, linear algebra, discrete mathematics).
- 7,5 hec mathematical statistics (e.g. MSG810 or DIT862 or DIT278 or similar) or the two courses DIT847 and DIT278 (or equivalent).
- 7,5 hec Programming in a General-Purpose Language (e.g. C/C++/Java/Python or similar.

Applicants must prove knowledge of English: English 6/English B or the equivalent level of an internationally recognized test, for example TOEFL, IELTS.

Learning outcomes

On successful completion of the course the student will be able to:

Knowledge and understanding

- describe fundamental types of problems and main approaches in data science and AI;
- give examples of data science and AI applications from different contexts;
- give examples of how stochastic models and machine learning (ML) are applied in data science and AI;
- explain basic concepts in classical AI, and the relationship between logical and data driven, ML-based approaches within AI;
- briefly explain the historical development of AI, what is possible today and discuss possible future development.

Competence and skills

- use appropriate programming libraries and techniques to implement basic transformations, visualizations and analyses of example data;
- identify appropriate types of analysis problems for some concrete data science applications;
- implement some types of stochastic models and apply them in data science and AI applications;
- implement and/or use AI-tools for search, planning and problem solving;
- apply simple machine learning methods implemented in a standard library.

Judgement and approach

- justify which type of statistical method is applicable for the most common types of experiments in data science applications;
- discuss advantages and drawbacks of different types of approaches and models within data science and AI;
- reflect on inherent limitations of data science methods and how the misuse of statistical techniques can lead to dubious conclusions;
- critically analyze and discuss data science and AI applications with respect to ethics, privacy and societal impact;
- show a reflective attitude in all learning.

Course content

During the course, a wide selection of methods for Data Science and AI will be introduced. The course is divided into three parts:

Introduction to data science

- Implementation of data science solutions, using Python, basic data analysis and visualization.
- Introduction of the data science process, and appropriate methodology.
- Examples of core data science methods with case studies such as in clustering, classification and regression.
- Data science put in context regarding ethics, regulations and limitations.

Statistical methods for data science and AI

- Introduction of some common stochastic models with examples of applications in data science and AI (for instance, naive Bayes classifiers, topic models for text and Hidden Markov Models for sequence data).

Artificial Intelligence

- Introduction to classical AI and machine learning, including the relationship to related areas such as algorithms and optimization, and AI philosophy.
- Examples of methods and applications of AI, in classical AI (search and constraint satisfaction), and ML-based (search engines, naive Bayes and neural networks)
- Discussion of ethics and societal impact of AI.

Sub-courses

1. **Assignments** *(Inlämningsuppgifter),* 7.5 credits
   Grading scale: Pass with distinction (5), Pass with credit (4), Pass (3) and Fail (U)

Form of teaching

Language of instruction: English

Assessment

The course is examined via compulsory written assignments, usually one assignment per week. Compulsory lectures and seminars can be added, as specified in the course PM. As a part of the basis for the grading process, the students will declare in writing their respective contributions to the assignments within their group.

If a student, who has failed the same examined element on two occasions, wishes to change examiner before the next examination session, such a request is to be submitted to the department in writing and granted unless there are special reasons to the contrary (Chapter 6, Section 22 of Higher Education Ordinance).

In the event that a course has ceased or undergone major changes, students are to be guaranteed at least three examination sessions (including the ordinary examination session) over a period of at least one year, though at most two years after the course has ceased/been changed. The same applies to work experience and VFU, although this is restricted to just one additional examination session.

Grades

The grading scale comprises: Pass with distinction (5), Pass with credit (4), Pass (3) and Fail (U).
The grading scale comprises Fail (U), 3, 4 or 5.
To pass the course, all mandatory components must be passed. To earn a higher grade than Pass, a higher weighted average from the grades of the components is required.

Course evaluation

The course is evaluated through meetings both during and after the course betweenteachers and student representatives. Further, an anonymous questionnaire is used toensure written information. The outcome of the evaluations serves to improve thecourse by indication which parts could be added, improved, changed or removed.

The results of and possible changes to the course will be shared with students who participated in the evaluation and students who are starting the course.

Additional information

The course is a joint course together with Chalmers.

Course literature will be announced at the latest 8 weeks prior to the start of the course.

The course cannot be included in a degree which contains DIT852.