UNIVERSITY OF GOTHENBURG

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

DIT821 Software Engineering for AI Systems, 7.5 credits

Software engineering för AI-system, 7,5 högskolepoäng

First Cycle

Confirmation

This course syllabus was confirmed by Department of Computer Science and Engineering on 2019-02-07 to be valid from 2019-09-02, autumn semester of 2019.

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

Position in the educational system

The course is offered within the N1SOF Software Engineering and Management Bachelor's Programme.

The course can be part of the following programme: 1) Software Engineering and Management Bachelor's Programme (N1SOF)

Main field of studies	*Specialization*
Software Engineering	G2F, First cycle, has at least 60 credits in first-cycle course/s as entry requirements

Entry requirements

To be eligible for this course, students must have successfully completed 90 higher education credits (hec) in Software Engineering or equivalent, including 7.5 hec in object oriented programming (e.g., DIT042 Object-Oriented Programming, 7.5 hec), 7.5 hec on basic mathematical concepts such as sets, functions, relations, graphs, logarithms and proof by induction (e.g., DIT022 Mathematical Foundations for Software Engineering, 7.5 hec), and 7.5 hec on data structures and algorithms (e.g., DIT181 Data Structures and Algorithms).

Learning outcomes

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

Knowledge and understanding

- explain the lifecycle of data-intensive systems, starting from data creation, to validation, processing, presentation, storage, and archiving
- explain the issues related to the integration of AI techniques in software systems, e.g., machine learning, data analysis, computer vision, or autonomous decision making
- name and describe different common AI techniques and to which problems they are applicable
- explain the impact of different data analysis goals on the required format, content, and quality of the data and the applicability of different AI techniques

Competence and skills

- use common artificial intelligence techniques to solve pre-defined problems
- apply techniques to validate and deploy data-intensive AI systems in the operational context

Judgement and approach

- discuss the advantages and disadvantages of different patterns and architectures for data-intensive systems
- discuss the principles of learning from potentially partial or low-quality data and the impact on the quality of the system
- analyse and discuss the impact of design choices about the different steps in the data lifecycle on ethical issues related to the privacy and security, as well as the ethical use of data

Course content

This course addresses issues relevant for software engineering for systems that use artificial intelligence (AI) techniques such as machine learning or large-scale parallel data processing. The course gives (a) an introduction of basic principles of AI, with emphasis on the principles and techniques used in machine learning (ML) and Deep Learning (DL), and (b) insights to support needed for successful implementation of AI systems. The course addresses the life cycle of AI systems: It includes data preparation (i.e. collecting data, data processing, storage, analysis), and building AI models by training and validation. It also discusses use of data, such as implications of using different data sets for the same goal, or using the same data set for different goals. Furthermore, the course discusses how software systems need to be structured and deployed in order to achieve the performance required for realistic applications.

Relevant software architectures and patterns are introduced and discussed in the context of a realistic application scenario. Finally, the ethical considerations in using data and providing automatically-created solutions are discussed.

The students will learn the basic ML and DL methods, processing and analyzing data in relation to the requirements, and the goals of the system implementation. Further they will learn dependencies of the results to the selected data sets including its annotation. The students will understand different data types, such as static, and streams, and different type of systems that use AI techniques.

Sub-courses

1. **Written exam** *(Tentamen),* 4.5 credits
   Grading scale: Pass with Distinction (VG), Pass (G) and Fail (U)
2. **Assignments** *(Inlämningsuppgifter),* 3 credits
   Grading scale: Pass (G) and Fail (U)

Form of teaching

The teaching consists of lectures, exercises as well as supervision in connection to the exercises.

Language of instruction: English

Assessment

The course is examined through a individual written examination carried out in an examination hall at the end of the course (4.5 hec), and by completed assignments (3 hec). The assignments are in written form, and done in pairs (two students work together).

If a student, who has failed the same examined component twice, wishes to change examiner before the next examination, a written application shall be sent to the department responsible for the course and shall be granted unless there are special reasons to the contrary (Chapter 6, Section 22 of Higher Education Ordinance).

In cases where a course has been discontinued or has undergone major changes, the student shall normally be guaranteed at least three examination occasions (including the ordinary examination) during a period of at least one year from the last time the course was given.

Grades

The grading scale comprises: Pass with Distinction (VG), Pass (G) and Fail (U).
A Pass grade (G) for the entire course requires at least a Pass grade for all sub-courses.

To be awarded Pass with Distinction (VG) for a full course, the student must, in addition, receive a VG on the sub-course written examination.

Course evaluation

The course is evaluated through meeting after the course between teachers and student representatives. Further, an anonymous questionnaire is used to ensure written information. The outcome of the evaluations serves to improve the course by indicating which parts could be added, improved, changed or removed.

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

Additional information

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