IT FACULTY

UNIVERSITY OF
GOTHENBURG

Applied Data Science Master's Programme, 120 credits

Applied Data Science masterprogram, 120 högskolepoäng

Programme code: N2ADS

Second cycle / Avancerad nivå

1. Confirmation

This programme syllabus was confirmed by the IT Faculty Board on 08-04-2020 (GU 2019/2676) and was last revised on 03-09-2021 (GU 2021/2358) to be valid from 29-08-2022, Autumn semester 2022.

Responsible Department/equivalent: Department of Computer Science and Engineering

2. Purpose

The Master's programme in Applied Data Science is intended to be accessible to students with a wide range of Bachelor's degrees. A Master's level education in Applied Data Science will be of benefit to students with backgrounds in many different areas who recognise that being able to work effectively with large data sets will be important in their future careers. The programme is designed for students who aim to pursue a specialist career in Data Science in industry or academic research.

The programme provides a broad overview of the techniques and technologies that are relevant to Data Science, an appreciation of when and how these can be used, and practical skills in their application.

Learning outcomes include knowledge and skills related to the computational techniques needed to process, model and analyse large data sets. On the technical side, this includes detailed understanding of relevant computational, machine learning and statistical methods. It also includes recognising how these methods are applied in different fields, and the challenges of working with large-scale data. Ethical aspects of machine learning and data processing are also taken into account.

Some previous programming experience is required, and the programme will build on this.

3. Entry requirements

A Bachelor's degree of 180 credits including an independent project (degree project) of at least 15 credits or equivalent.

7.5 credits from courses in programming in a general-purpose programming language or equivalent, and 7.5 credits mathematics or statistics, no courses on pre-university level.

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

Specific entry requirements for admission to a course within the study programme

Within the study programme there can be specific entry requirements for admission to individual courses. These specific entry requirements are documented in each course syllabus and state which entry requirements are necessary to be registered on a course within the study programme.

Selection

Selection is according to the Higher Education Ordinance and the University of Gothenburg admission regulations for education on first and second cycle.

4. Higher education qualification and main field of study

This programme leads to a Degree of Master of Science (120 credits) with a major in Data Science (Filosofie masterexamen med huvudområdet Data Science).

5. Outcomes

General outcomes for Degree of Master (120 credits)

Knowledge and understanding

For a Degree of Master (120 credits) the student shall

- demonstrate knowledge and understanding in the main field of study, including both broad knowledge of the field and a considerable degree of specialised knowledge in certain areas of the field as well as insight into current research and development work, and
- demonstrate specialised methodological knowledge in the main field of study.

Competence and skills

For a Degree of Master (120 credits) the student shall

- demonstrate the ability to critically and systematically integrate knowledge and analyse, assess and deal with complex phenomena, issues and situations even with limited information
- demonstrate the ability to identify and formulate issues critically, autonomously and creatively as well as to plan and, using appropriate methods, undertake advanced tasks

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within predetermined time frames and so contribute to the formation of knowledge as well as the ability to evaluate this work
- demonstrate the ability in speech and writing both nationally and internationally to clearly report and discuss his or her conclusions and the knowledge and arguments on which they are based in dialogue with different audiences, and
- demonstrate the skills required for participation in research and development work or autonomous employment in some other qualified capacity.

Judgement and approach

For a Degree of Master (120 credits) the student shall

- demonstrate the ability to make assessments in the main field of study informed by relevant disciplinary, social and ethical issues and also to demonstrate awareness of ethical aspects of research and development work
- demonstrate insight into the possibilities and limitations of research, its role in society and the responsibility of the individual for how it is used, and
- demonstrate the ability to identify the personal need for further knowledge and take responsibility for his or her ongoing learning.

Local outcomes

Knowledge and understanding

For a Degree of Master of Science (120 credits) with a major in Data Science the student shall

- describe and compare different techniques for the analysis and management of data.

Competence and skills

For a Degree of Master of Science (120 credits) with a major in Data Science the student shall be able to

- use tools and technologies for the analysis and management of data,
- apply Data Science methods to solving problems in a variety of application areas, and
- independently, as well as in cooperation with others, investigate and draw relevant conclusions based on the methods of Data Science.

Judgement and approach

For a Degree of Master of Science (120 credits) with a major in Data Science the student shall be able to

- discuss advantages and disadvantages of various techniques and technologies for the analysis, modeling, and management of data,
- determine how different Data Science methods may be applicable in different situations, and
- debate and discuss the consequences of the technologies with respect to different ethical frameworks.

6. Content and structure

The programme consists of courses in Data Science and related subjects. The programme includes a total of 120 credits. Of these, 52.5 credits are from compulsory courses in the main field of Data Science. In addition, an independent project of 30 or 60 credits is compulsory.

The courses are progressively arranged so that they, within the framework of learning outcomes, contribute separately and jointly, with developing the student's skills and abilities in the field.

The academic year is divided into two semesters and four study periods. A semester includes two study periods, each of 15 credits. Students normally attend two courses in parallel in each study period.

The education is conducted in the form of lectures, seminars, teacher-led exercises, and tutoring as well as projects in which students apply and deepen their knowledge.

Study Process

The following compulsory second-cycle courses are included in the main field of Data Science:

- *DIT374 Python for Data Scientists, 7.5 hp*
- *DIT852 Introduction to Data Science, 7.5 credits*
- *DIT856 Applied Mathematical Thinking, 7.5 credits*
- *DIT862 Statistical Methods for Data Science, 7.5 credits*
- *DIT866 Applied Machine Learning, 7.5 credits*
- *DIT872 Techniques for Large-scale Data, 7.5 credits*
- *DIT911 Master's Thesis in Data Science, 30 credits, or DIT921 Master´s Thesis in Data Science, 60 credits*

In addition to these compulsory second-cycle courses, students are required to take the first-cycle course *Databases*, 7.5 credits (DIT621), which is included in the main field of study.

The following elective courses are included in the main field of Data Science:

- *DIT891 Project in Data Science*, 7.5 credits
- *DIT575 Research-oriented course in Computer Science and Engineering*, 7.5 credits
- *DIT868 Deep Machine Learning*, 7.5 credits
- *DIT878 Seminar course in Data Science, 7.5 credits*
- *DIT875 Research methods for Data Science, 7.5 credits*
- *DIT245 Machine learning for natural language processing, 7.5 credits*
- *DIT742 Computational methods for Bioinformatics, 7.5 credits*
- *DIT470 Advanced topics in Machine learning, 7.5 credits*
- *DIT728 Design of AI-systems, 7.5 credits*

Students have the possibility to take optional second cycle courses outside the programme. Entry requirements for optional courses must be satisfied.

The course *Master's Thesis in Data Science* includes an independent project (degree project) of 30 or 60 credits, normally 30 credits. The Master's thesis is normally conducted full-time in study periods 3 and 4.

A schema can be found in Appendix 1.

In exceptional cases, the student carries out a research-oriented 60-credit thesis project instead of a 30-credit project. This option is open exclusively for students who are considered by the program responsible to have demonstrated a high degree of independence and a potential for a career in academic research. In this case, the thesis project is carried out within the whole second year, and the student does not take the course *Research Methods for Data Science*.

Language of tuition

The language of tuition is English.

Please also see the appendix. Appendix_programme_syllabus_N2ADS.

7. Guaranteed admission

Students who are follow the study programme at the prescribed pace have guaranteed admission to all compulsory courses offered within the programme provided that specific entry requirements are fulfilled and the student applies to the course within the study programme within the prescribed application period.

For optional courses outside the study programme local admission regulations are valid and there is no guaranteed admission.

8. Other information

If the student's Bachelor's degree includes a course in databases (or equivalent) or the course Applied Mathematical Thinking (or equivalent), then these courses must not be included in Degree of Master of Science (120 credits) with a major in Data Science.

Credit transfer of former education

In some cases, the student has the right to be given credit for former higher education according to the legislative regulations of the Higher Education Ordinance.

Evaluation

The courses of the study programme are evaluated according to each course syllabus. The result will be used for planning and implementation of upcoming courses. A summary is given to students at the start of the courses.

The study programme will be followed up and evaluated in accordance with the applicable *Policy för kvalitetssäkring och kvalitetsutveckling av utbildning vid Göteborgs universitet* (Policy for the Quality assurance and Quality Development of Education at the University of Gothenburg).

Revision of the syllabus

This syllabus was confirmed by the IT Faculty Board on 17-06-2016 (reg. no. G 2016/183) and was revised on 23-05-2018 (reg. no. G 2018/252). See below Confirmation.

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Appendix. Programme Syllabus Applied Data Science Master´s programme, 120 credits

The courses marked [ ] are compulsory.

1	Period 1	Period 2	Period 3	Period 4
	Introduction to Data Science	Applied Mathematical Thinking	Applied Machine Learning	Techniques for Large-scale Data
	Python for Data Scientists	Statistical Methods for Data Science	Databases (*) *or* *elective course*	*elective course*

2	Period 1	Period 2	Period 3	Period 4
	elective course	Research Methods for Data Science (**) *or elective course*	Master´s thesis in Data Science (30 hec)	
	elective course	*elective course*		

(*) The course Databases is compulsory only for those students that did not take this course, or a corresponding course, during their previous studies.

(**) The course Research Methods in Data Science is strongly recommended for all students that write a 30 hec thesis and that do not participate in an exchange during year 2, period 2.