Department of Computer and Systems Sciences

Stockholm University

Education plan

for

Masterprogram i data science, statistik och beslutsanalys 120.0 Higher Education Credits
Master's Program in Data Science, Statistics and Decision Analysis 120.0 ECTS credits

Programme code:	SDSBO
Valid from:	Autumn 2024
Date of approval:	2023-09-20
Changed:	2023-10-31
Department:	Department of Computer and Systems Sciences

Decision

Finalized by: Samhällsvetenskapliga fakultetsnämnden, 2023-09-20

Prerequisites and special admittance requirements

Degree of at least 180 credits including at least 7.5 credits programming or degree of at least 180 credits in the field of statistics (or equivalent).

English 6.

Programme structure

In today's society, data is generated with great variety, in enormous amounts and at high speed. This data is becoming increasingly complex. We are constantly connected with computers and smart phones, we are surrounded by cameras and sensors that monitor and measure.

Automation and digitization in a large number of areas and industries are becoming increasingly important and most companies and authorities store large amounts of data about their customers, users and processes. Analysis of large amounts of medical data is becoming an increasingly important tool in healthcare.

The program focus on how to draw smart conclusions from large amount of data with the purpose of making well-informed decisions.

The program consists of courses in the three subfields

- Data Science
- Statistics
- Decision analysis

Courses of 30 credits are given within each subfield.

Courses from the three subfields alternate so that at least one course from each subfield is given each semester, for the first three semesters. The program ends with a master thesis in the fourth semester.

Areas within **Data Science** include:

- basic methods and algorithms in data analysis and data mining
- advanced methods and algorithms in machine learning and deep learning
- reinforcement learning and optimization
- ethical aspects of data science with a focus on explainable models
- programming and implementation of various algorithms with a focus on their application to various domains

Areas within **Statistics** include:

- introduction to data analysis, descriptive statistics, collection and handling of data
- the process of statistical analysis i.e. statistical modelling and inference
- Bayesian inference
- forecasting and decision making under uncertainty
- relationship between variables and how they can be used for prediction
- statistical programming in R

Areas within **Decision Analysis** include:

- formal methods for handling bases for decisions in a structured way and with respect to uncertainty, finding decision alternatives and comparing the consequences of the decision alternatives even when there are several criteria and stakeholders
- risk analysis where possible negative consequences are identified and analysed within a business or organisation

All courses are given in English.

Goals

In addition to the general learning goals stated in chapter 1, paragraph 9 of the Swedish Higher Education Act, the following goals, according to Higher Education Ordinance, are applied.

Knowledge and Understanding

For a Degree of Master 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.

Skills and Abilities

For a Degree of Master 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 within predetermined time frames and so contribute to the formation of knowledge as well as the ability to evaluate this work,
- demonstrate the ability to clearly report and discuss, both orally and in writing, own conclusions and the knowledge and argumentation which they are based on, in dialogue with different audiences in national and international contexts, and
- demonstrate the skills required for participation in research and development work or autonomous employment in some other qualified capacity.

Assessment Ability and Approach

For a Degree of Master the student shall:

- demonstrate the ability to make assessments in the main field of study taking into account relevant scientific, social and ethical aspects, and demonstrate an awareness of ethical aspects of research and development,
- 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 needs for further knowledge and to take responsibility for own continuous learning.

Courses

All courses are either within the main field of computer and systems sciences (DSV) or statistics (STAT).

The course *Statistics and data analysis for computer and systems sciences* is at basic level, all other courses are at advanced level.

Semester 1

Foundations of Data Science 7.5 credits (DSV)

Decision analysis I 7.5 credits (DSV)

Statistics and data analysis for computer and systems sciences 15 credits (STAT)

Semester 2

Data mining 7.5 credits (DSV)

Decision analysis II 7.5 credits (DSV)

Statistical theory and modelling 7.5 credits (STAT)

Machine learning 7.5 credits (DSV)

Semester 3

Risk analysis 7.5 credits (DSV)

Bayesian learning 7.5 credits (STAT)

Reinforcement learning 7.5 credits (DSV)

Business analysis 7.5 credits (DSV)

Semester 4

Independent project in computer and systems sciences with a focus on data science, statistics and decision analysis for master's degree 30 credits (DSV)

Degree

The program leads to a Degree of Master of Science in the main field of study: Computer and Systems Sciences.

The area of specialization is Data Science, Statistics and Decision Analysis.

Misc

The program is given in collaboration with the Department of Statistics.

When the program is closed down and its education plan is withdrawn, the student has the right to complete the education according to this education plan, within the time of the program's nominal duration plus two years. The limitations specified in the syllabuses for the courses included in the program primarily apply.