Kristiania

Programme description

Bachelor in Data Science

180 credits

2023-2026

The study programme was accredited: 31.10.19 (HK-case no. 34.7/19
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Content

1. Introduction

The Bachelor in Data Science is a research-based full-time undergraduate level program covering the academic disciplines of computer science, information science, statistics, computational linguistics, and data ethics. The teaching language is English. Throughout the studies, a close collaboration with the (inter)national industry is applied. Guest lectures are organized on a frequently basis and courses are given by a combination of national and international staff from partners in academia and business.
The content of the courses is aligned with industry needs, and real-world cases are applied in assignments and exams. After completing the degree, the candidates can be recruited to several different positions in private and public sector, as well as pursue a master's degree nationally or internationally. Some examples of job opportunities are data analyst, data scientist, business developer, project manager, big data specialist and several more.

The Bachelor in Data Science offers many opportunities for postgraduate studies. The graduate can find relevant master's studies in computer science, artificial intelligence, advanced analytics in information and smart systems. Upon completion of a bachelor's degree from Kristiania, the students will be eligible to apply for a master's degree or experienced based master's program in Norway or abroad.

1.1 Formal requirements

Higher Education Entrance Qualification is required for admission. In addition, sufficient formal mathematic skills need to be documented (equal to Norwegian Mathematics R1 or S1+S2).

For applicants with foreign education a satisfactory English language professioncy is required. Including but not limited to TOEFL, IELTS, etc.

2. Learning outcomes

All study programmes at Kristiania University College have adopted overarching learning outcomes that each student is expected to have achieved having completed the course. The learning outcomes describe what the student is expected to be able to do as a result of the learning acquired throughout the course. The academic outcome is divided into three categories: Knowledge, Skills and General competence.

Knowledge

The student…

- has a broad knowledge of data science fundamentals such as linear algebra, probability & statistics, data structures, data science algorithms, architectures and infrastructures of data science, visual analytics, text analytics, predictive analytics, machine learning, deep learning, data regulation, data security, data privacy, and data ethics
- can understand knowledge on theories, frameworks, algorithms, methods, techniques, and tools to analyze, describe, and solve complex and interdisciplinary challenges within design, development, adoption, implementation, and exploitation of both internal and external data pipelines for organizations
- has a broad knowledge of analyses of various data pipelines (such as text, prediction and visual) with an analytical focus on deriving meaningful facts, actionable insights valuable outcomes, and sustainable impacts to support domain-specific processes and functions
- has a broad understanding of and ability to aid technical aspects of data science applications in organizations and society.
- has knowledge about research, methods, techniques and tools to support data-driven organizational decision making
- has knowledge of frameworks for integrating data-driven decision making into organizational practices
- has a good understanding of global and local perspective on data pipelines and data science applications.

Skills

The student…

- can acquire, produce, apply and update new knowledge in data science using visual, text or predictive analytics and to apply results within new application domain areas
- has a deep insight into use of, comprehensive technical skills in Data Science, in addition to academic skills and the ability to reflect over own practice
- can conceptualize, implement, evaluate and reflect over data-driven architectures and data-driven decision making
- has the ability and capacity to innovative and independently reflect, and take action using the taught methods, techniques and tools

- has achieved writing skills for academic and technical documentation and oral communication and presentation skills

General competence

The student…

- can work independently and in teams including interdisciplinary groups, diverse professional and academic competences
- can understand and reflect upon ethical considerations of the domain of data science in relation to both work and professional scenarios
- can critically reflect upon cases from local, national, and international environments using written, oral and other related forms of expression
- can box-in complex problems and take forward actions in situations with uncertainty of outcome or data in-completeness in order to provide innovative solutions

3. Programme Structure

Bachelor in Data Science is a three-year study with a total of 180 ECTS credits, of which 150 credits is comprised of compulsory courses, and 30 credits comprised of optional (elective courses).
The study programme is implemented over six semesters, and the structure is as follows:

Bachelor in Data Science				
1. semester	**Python Programming** 7,5 ECTS credits	**Linear Algebra** 7,5 ECTS credits	**Data Ethics and Regulations** 7,5 ECTS credits	**Databases** 7,5 ECTS credtis
2. semester	**Probability and Statistics** 7,5 ECTS credits	**Big Data and Cloud Computing** 7,5 ECTS credtis	**Information Security** 7,5 ECTS credits	**Visual Analytics** 7,5 ECTS credits
3. semester	**Machine Learning & Natural Language Processing** 15 ECTS credits		**Advanced Programming for Data Science** 7,5 ECTS credits	**Data Structures and Algorithms** 7,5 ECTS credits
4. semester	**Elective courses** 30 ECTS credits total			
	Alternative course of study: going abroad 30 ECTS credits total			
5. semester	**Deep Learning** 7,5 ECTS credits	**Predictive Analytics** 7,5 ECTS credits	**Software design** 7,5 ECTS credits	**Agile project** 7,5 ECTS credits
6. semester	**Research Methods** 7,5 ECTS credits	**Bachelor Project** 22.5 ECTS credits		

Tabell 1. Oppbygging av emner 1.-3. studieår

Compulsory courses	Elective courses

3.1 Academic progression

The Bachelor in Data Science curriculum consists of mandatory core curriculum courses and elective courses on emerging topics of academic interest and industry relevance. The courses are designed to engage students in a diversity of learning activities in the traditional classroom and blended learning format (lectures, in-class exercises, mandatory assignments, tool-training workshops, individual and group projects, internships, etc.). The program emphasizes socio-technical interactions with other students, real-world datasets, and cutting-edge research prototypes and best-of- breed commercial tools throughout the program.

A foundational first year introduces the underlying concepts of linear algebra and programming, as well as ethical aspects and important laws and regulations in relation to working with data analysis. Through the second and third year the students gain in depth knowledge of the first fundaments of data science from a machine learning and software perspective. Through the first part of year three state of the art analysis paradigms are investigated and will allow the students to solve real world business problems and provide substantial decision support material.

The electives will allow the students to influence the character of their degree, either focusing on breadth or depth in the fields on information technology (IT), business, innovation and other disciplines. The study finishes with a bachelor project in a company, in which the students get to use all the competence acquired through the study to solve a problem or assignment for an external employer.

3.2 Modules 1st academic year

Course	ECTS	Description
Python Programming	7,5	This course teaches Python programming for data science on how to collect, transform, model, analyze and visualizes broad range of datasets. Students will learn on how to use the Python programming language to work with numerical, string, and more complex data formats, and to perform data analysis with basic data mining and machine algorithms using both supervised and unsupervised approaches. The course will focus on open source technologies and consists of lectures and hands-on training with open source libraries in Python for data mining, machine learning and data visualizations. Finally, students will develop practical programming skills in problem solving by working on real-world datasets as part of their course project.
Linear Algebra	7,5	This course teaches Linear algebra and other mathematical/statistical foundations of data science. Linear algebra is the mathematical foundations of data science that deals with planes, vectors and vector spaces matrices and linear transformation of vectors and matrices, which provides basic foundations for many supervised and unsupervised algorithms in machine learning. The course consists of lectures and hands-on training with open source libraries (such as NumPy and SciPy) in Python. Finally, students will develop mathematical and statistical skills that are needed to understand the foundations of various algorithms in the data science.
Data Ethics and Regulations	7,5	The first half of the course introduces the fundamental principles of moral philosophy and ethics and their applications to data science processes and outcomes. The second half of the course discusses the various data regulations at the local, regional, national and international levels that students and provides frameworks for incorporating them into data science projects to evaluate ethical implications as well as to ensure legal compliance.

Databases	7,5	Following the completion of Databases , you will be able to explain what a relational database is, what it can be used for and how it differs from other forms of persistent storage. You will be able to model and structure data for a domain. You will be able to create tables, enter different types of data into them, link them together and extract reports using SQL queries. You will also be able to explain and apply the principles of good design (normalisation, key usage).
Probability and Statistics	7,5	This course introduces theoretical principles of probability and statistics with a focus on practical applications in data science. Topics include but are not limited to: permutations and combinations, frequentist vs. subjectivist probability, parametric vs. non-parametric statistics, probability distributions, Bayesian inference, null hypothesis significance testing, confidence intervals, effect sizes, point estimation, linear regression, multiple regression and logistic regression.
Big Data and Cloud Computing	7,5	The goal of this course are two-folds: First it provides knowledge of key concepts, methods, techniques, and tools of big data. Second, it provides an overview of cloud Computing, its enabling technologies, main building blocks and architectures and hands-on experience through projects utilizing public cloud infrastructures (e.g. Amazon Web Services (AWS) Microsoft Azure). As part of these goals, the course will also introduce and cover the topics of cloud infrastructures, virtualization, software defined networks and storage, cloud storage, and distributed programming models such as map-reduce, parallel programming models like Dryad, dockers and containers and so on. The course will focus on open source technologies to the extent possible and consists of lectures and hands-on training with open source libraries and public cloud infrastructures such as AWS and Azure. Finally, students will develop practical programming skills in cloud storage systems and learn to develop different applications in several distributed programming paradigms.
Information Security	7,5	The aim of this course is to give the students knowledge of business models, ecosystems and technologies used in intelligent systems. Students will acquire knowledge about sensors, steering behavior, networks, infrastructure and applications. The course aims to give skills in evaluation and selection of appropriate technologies/sensors. The students will discuss ethical considerations within the field.
Visual Analytics	7,5	This course teaches theoretical computational techniques for visual analytics of organisational datasets. The course will enable students to design and develop information dashboards for applications in various domains. The students will be able to reflect upon the different models, theories, and frameworks for visual analytics from a a decision-making perspective.

Table 2. Courses first academic year

3.3 Courses 2nd academic year

Course	ECTS	Description
Machine Learning & Natural Language Processing	15	The course provides knowledge of the key concepts, techniques and methods related to machine learning. Topics include an understanding of the mathematical basics of data mining and machine learning, linear models for regression such as maximum likelihood, sequential learning, regularized least squares and classification models such as probabilistic generative models, probabilistic discriminative models. Furthermore, the course provides the students with practical hands-on experience on

		machine learning using open source machine learning libraries such as scikit-learn in Python programming language. The course also provides knowledge of the key concepts, techniques and methods in natural language processing to text analytics. The students gain in depth knowledge of natural language processing and will further apply this to practical scenarios with acquired skills in text classification methods. The course provides students with hands-on experience on text analytics using open source machine learning libraries such as scikit-learn, Natural Language Toolkit (NLTK) in Python programming language. After completing the course, the students will be able to apply and use appropriate machine learning techniques in various data science domains.
Advanced Programming for Data Science	7,5	The course will also discuss different programming approaches (e.g. Object oriented vs functional code) and when it is appropriate to use each to address practical data science problems like developing an efficient data pipeline (e.g. Extract, Transform and Load).
Data Structures and Algorithms	7,5	This course aims to teach the mathematical foundations and computational applications of data structures and algorithms. The first half of the course will cover the topics in and aspects of data structures while he second half of the course will cover the design and analysis of algorithms. The course will focus on the predominant distributed and parallel computing algorithms and how their computing time and memory usage complexity will impact different data science use cases.
Electives	30	Will be announced on KUC website and LMS.

Table 3. Courses second academic year

3.4 Courses 3rd academic year

Course	ECTS	Description
Predictive Analytics	7,5	The course provides knowledge of the key concepts, techniques and methods in predictive analytics. This course will cover methods and tools for data pre-processing for forecasting tasks in data science, techniques for selecting well-suited models for analysis, model performance evaluation tools. The course provides students with hands-on experience on predictive analytics using open source statistics tools. After completing the course, students will be able to apply and use various predictive analytics techniques such as regression, time series on numerical datasets.
Deep Learning	7,5	The course provides knowledge of the key concepts, techniques and methods related to deep learning. The candidate gains in depth knowledge of mathematical foundations of deep learning, neural networks and has advanced skills in applying the appropriate tools, techniques and development of these respective areas. Furthermore, the course provides the students with practical hands-on experience on deep learning using open source deep learning libraries in Python programming language. After completing the course, the students will be able to apply and use appropriate deep learning techniques in various data science domains.
Software Design	7,5	The course will enable the students to design and further develop larger software systems in line with known techniques for modeling, testing and implementation.
Agile Project	7,5	The course will give the student a deeper experience of mastering a larger project, with an emphasis on the application of agile method: Scrum. The

		student will plan and implement a comprehensive project case for a company in an interdisciplinary group, and will receive training in using modern agile techniques and tools along the way.
Research Methods	7.5	The aim of this course is to provide students with a fundamental understanding of research as a conceptual, empirical and practical approach to gathering new insight and knowledge within infomation technology. Teaching centres on applied research from the fields of information systems and computer science and presents students with relevant methods from this domain, along with their possibilities and limitations. For example: How to develop a research strategy for investigating a problem, how to choose a research methods for collecting data and how to critically evaluate the ethical implication of research strategies and methods

Table 4. Courses third academic year

3.5 Elective modules

For the study programme in Bachelor Data Science, students are presented with optional modules in the fourth term that total 30 credits. The electives will allow the students to influence the character of their degree, either focusing on breadth or depth. The students will be offered electives in the fields on information technology (IT), business, innovation and other disciplines. Up-to-date information on elective modules can be found on Kristiania University College's website and through the learning platform.

3.6 Bachelor thesis

Emne	ECTS	Beskrivelse
Research Methods	7.5	The course aims to introduce research methods with a focus on methods that are especially relevant for the IT business. The course supports the bachelor's degree project.
Bachelor Thesis	22.5	The students will get practical, real-life experience by carrying out a project in a company, establish their own business, or participate in a research project. They will be able to demonstrate broad knowledge of central topics and theories and to show skills in using methods, tools and technology.

Table 5. Bachelor thesis sixth semester

4. Teaching and assessment forms

4.1 Pedagogical platform and implementation of teaching

Bachelor in Data Science is designed so that the sum of the courses and the study work with these will lead the students towards the intended learning outcome described in chapter 2 of this program description.

The individual courses are put together to show a breadth of knowledge, skills and general competence that reflects the field of practice. Some of the courses are more oriented towards knowledge exchange, others more oriented towards building specific skills, while others include more skills in links between theory and practice. This is reflected in the teaching.

Types of work and teaching and assessment in the individual courses have been chosen to provide a good and meaningful correspondence between the learning outcome that is desired to be achieved, the teaching methods used and the exam that concludes the course.

The methodological choices also reflect the course's contribution to the study program as a whole. The students therefore encounter a varied set of learning activities throughout their studies, a variation that in total should reflect the field of practice the student is studying for. Bachelor in Data Science emphasizes building a broad competence in the field and training the student's ability to work independently. The teaching aims to comment on, illustrate and elaborate material from teaching materials, as well as to provide additional material that is not available in printed form.

As with all higher education, Kristiania University College also sets requirements for students' own independent learning work. The college sees it as its task to facilitate and facilitate the students' work through good learning designs. At the same time, we emphasize that a teacher can only communicate and facilitate. The actual learning takes place with the individual student as a result of the student's own work. In connection with the teaching, the student must therefore expect a significant personal effort.

The most important forms of work, teaching and assessment the student encounters at *Bachelor in Data Science* are described in the following.

- Lecture / dissemination, instruction, unspecified supervision and other teacher-led activity
- Guidance and formative assessment
- Digital pre- and post-work
- Case, group and / or project work
- Workshops and seminar work
- Independent practice / lab work / practical work individually or in groups
- External and internal projects, productions, assignments, etc.

- Other student activity, including presentations, plenary discussions, dissemination and more
- Business contact and practice
- Colloquium and assignment work
- Independent academic work with syllabus and other

For students who need tutoring beyond scheduled teaching, the college has available subject resources, including administrative staff, librarians, digital learning resources (eg online movies) and student tutors. These can be contacted by the individual student if needed.
In addition to literature and help with literature searches, the library also offers varied training in academic writing.

Project-organised teaching means that all terms have interdisciplinary projects. Through the project work, students are also provided with more individual, professional expertise experience in collaboration with others, project management and project organisation.
Through the course of study, active learning is also employed as an important part of the didactics model and put emphasis on an environment which blends student activity, with self-study, workshop and instructor led exercises.

4.2 Examination and assessment methods

Assessment is a situation where a submitted or presented work is assessed against a set of criteria. Criteria given by the learning outcome that are defined for the individual subject. The assessment can be made by fellow students, teachers or examiners. These will also be happy to provide feedback, either as a guiding feedback or as a grade (exam).

At Kristiania University College, we distinguish between assessment as learning, assessment for learning and assessment of learning. The form of the work being assessed (the form of assessment) can be the same in all three assessment situations while the purpose varies.

In assessment as learning (fellow student assessment) and for learning (feedback from the teacher), the purpose is to shape a learning process, to help the student to achieve the best possible learning outcome. We perceive this type of assessment as part of the teaching methods, and these can be found in Chapter 4.1 above.

Assessment of learning is a final assessment where the actual achieved learning results are assessed, exam. The exam at Kristiania University College is defined as "An exam is a final assignment within a subject or a limited sub-subject". The submitted or presented work is assessed through an examination, and the result of the assessment must appear on the diploma.

At *Bachelor in Data Science*, students will meet the following examination forms:

- Home exam

- Folder exam
- Semester assignment
- Bachelor thesis

In some courses, compulsory activities are defined. A compulsory activity is a requirement that must be approved in order to sit for the exam. The activity can either be a requirement that one or more works must be submitted (work requirements) and / or a requirement for participation in defined activities and / or lectures and / or compulsory practice.

A compulsory activity is assessed as Passed / Failed, and the right to sit for an examination in a subject with compulsory activity requires that this activity is assessed as Passed. Otherwise, the student loses the right to an examination in the course until the activity (ies) has been assessed as Passed.

For additional information about the exam and compulsory activity, see Kristiania University College's website.

5. Internationalization and international student exchange

With reference to the Study Supervision Regulations of February 2017 (§ 2-2, points 7 and 8), the study program has arrangements for internationalization and international student exchange.

The schemes for internationalization are adapted to the level, scope and uniqueness of the study offer. The content of schemes for international student exchange is academically relevant.

5.1 Internationalization schemes

In this context, internationalisation means that the education offered has an international context and that the students are exposed to a diverse range of perspectives.
The education offered has an international context and exposes the student to a varied perspective on Service Management This is achieved through the use of international literature and international cases during classes.

The whole program is conducted in English and the teaching staff is a combination of national and international staff. The many cases used in the courses during teaching and exercises are all based in an international context.

For specific internationalisation arrangements, please see the course descriptions for the study programme.

5.2 Schemes for international student exchange

Kristiania University College has agreements with several foreign educational institutions that give students the opportunity to take a semester abroad.
The college has the following mobility program:

- Nordplus in the Nordic or Baltic countries
- ERASMUS + in Europe
- "Exchange" or "Study Abroad" program, for students in and outside Europe

For Bachelor in Data Science, arrangements are made for exchange in 4th semester.
Kristiania University College has agreements on exchange stays for the students and the relevance of the study stay is ensured by the study program leader. Exchange courses from partners are approved by the study program leader, for admission to relevant bachelor's degrees, here with a scope corresponding to 30 credits.

Exchange schemes apply to students who have an agreement on graduate studies and who have obtained a minimum of 60 credits at Kristiania University College at the time of departure. For both on-site and online studies, the exchange is site-based.

For nomination for student exchange, there are usually requirements for standardized study progression, grades and motivation letters. Requirements can also be set for documentation of creative work / portfolios and Kristiania University College can conduct interviews of applicants for exchange. Kristiania University College aims to send well-qualified and motivated students to reputable foreign institutions. Please note that there are a limited number of exchange places at the campuses.

We reserve the right to make changes to relevant study places, and updated information is published on the university college's website. See supplementary information about exchanges here: https://www.kristiania.no/for-studenter/studier-i-utlandet/utveksling/