DATA SCIENCE - MASTER OF SCIENCE (MS)

The on-campus Master of Science in Data Science program focuses on developing knowledge and skills in interdisciplinary and collaborative data science competencies including statistical analysis, data structures and algorithms, data mining, machine learning, big data architecture and data visualization.

Data science is a multidisciplinary field that focuses on the extraction of knowledge and insight from large datasets. Data scientists are tasked with using a range of skills in applied mathematics, statistics and computer science, and in domain applications such as information science, geography, business, media and the humanities.

The MS-DS provides learners with a strong foundation in acquiring, cleaning and managing data. Learners will learn to analyze large datasets using data mining and machine learning techniques. Students will also design, conduct and run statistical experiments and models; draw rational conclusions from data using probability theory and statistics; and more.

Graduates of the MS-DS program will be well-prepared to apply data science skills to a specific domain area. Graduates will also be able to clearly communicate the results of data science analysis to a non-technical audience; structure effective meetings and projects using collaboration skills; and act ethically in the role of professional data scientist.

Topic Areas

Applied Mathematics

The Department of Applied Mathematics in the College of Arts and Sciences offers a range of courses and research opportunities in many areas, including computational mathematics, mathematical biology, nonlinear phenomena, physical applied mathematics, and probability and statistics.

Computer Science

Computer science is an exciting and challenging field that impacts many parts of our lives. Computer scientists craft the technologies that enable the digital devices we use every day. They develop the large-scale software that powers business and industry, and they advance the computational techniques and write the software that supports scientists in their study of the world around us. Many new applications of computing technology remain to be discovered. Computing will be at the heart of future revolutions in business, science and society. Students who study computer science will be at the forefront of these important advances.

General Data Science

Data science is a multidisciplinary field that uses scientific methods, processes, algorithms and systems to extract knowledge and insights from structured and unstructured data.

Information Science

Information science considers the relationships between people, places and technology and the information those interactions yield. The internet is a broad example of a socio-technical system that is comprised of hardware and software, but in daily life is better understood as a constantly changing social infrastructure upon which complex forms of human-human and human-information interaction rest. Scholars and students of information science develop new methods to study these socio-technical phenomena and translate those findings to the design and development of useful and meaningful technology.

Bachelor's–Accelerated Master's Degree Program

Students may earn this degree as part of the Bachelor's–Accelerated Master's (BAM) degree program, which allows currently enrolled CU Boulder undergraduate students the opportunity to earn a bachelor's and master's degree in a shorter period of time.

For more information, see the Accelerated Master's tab for the associated bachelor's degree(s):

- Applied Computer Science - Post-Baccalaureate Bachelor of Science (BSACS) (https://catalog.colorado.edu/undergraduate/colleges-schools/engineering-applied-science/programs-study/computer-science/applied-computer-science-post-baccalaureate-bachelor-science-bsacs/)
- Computer Science - Bachelor of Arts (BA) (https://catalog.colorado.edu/undergraduate/colleges-schools/engineering-applied-science/programs-study/computer-science/computer-science-bachelor-arts-ba/)
- Computer Science - Bachelor of Science (BSCS) (https://catalog.colorado.edu/undergraduate/colleges-schools/engineering-applied-science/programs-study/computer-science/computer-science-bachelor-science-bscs/)

Requirements

Admission Requirements

Applicants are eligible to apply to the program if they have earned a bachelor's degree or its equivalent from a regionally accredited college or university. Applicants must show promise of their ability to pursue advanced study and research, as judged by the student's scholastic record. Applicants must have a minimum of a 2.75 cumulative GPA in their prior degree program to be considered. International students may have country-specific requirements and/or English proficiency requirements.

Strong applicants will also have an undergraduate GPA of 3.2 or higher on a 4.0 scale (3.0 = B)

Prerequisite Knowledge

Applicants with the following prior knowledge or equivalent experience are eligible for admission to the Direct to Data Science Pathway and can complete the degree with 30 total credits:

- Mathematics:#Applicants should be familiar with differential calculus (including derivatives), integral calculus, linear algebra, and have some experience with infinite sequences and series. Multivariate calculus is preferred but not required.
- Programming:#Applicants should have some programming experience, whether it is formal, informal or on the job. Some advanced knowledge of R is also helpful before starting the program.

Applicants without the specific math and programming experience above are eligible for admission to the Bridge to Data Science Pathway and can complete the degree with 30–34 total credits as

determined by the graduate committee upon a review of the student's prior experience.

Potential Additional Curriculum

The graduate committee may require students in this pathway to complete one or more of the following courses (up to 7 credits) . Courses should be taken in the first year and are subject to Graduate School grade and cumulative GPA standards. Up to 3 hours of bridge courses which meet applicable standards can count toward the degree in the electives category.

- INFO 5651 Fundamental Concepts in Data Science (3)
- INFO 5652 Statistical Programming in R (3)
- DTSC 5003 Programming for Data Science - Python for Data Science (1)

Application Requirements

To apply, applicants must submit the following:

- A completed graduate admission application
- An application fee
- Unofficial undergraduate transcripts and, if applicable, any graduate transcripts
- A statement of purpose that briefly describes the applicant's background, academic goals, and professional goals
- Two to three letters of recommendation
- A current curriculum vitae or resume

An applicant whose native language is not English must provide proof ofEnglish proficiency by submitting documents. A TOEFL score of at least 80, IELTS score of at least 6, or Duolingo score of at least 100 is required. To report TOEFL and IELTS scores, students should request that the testing agency submit scores directly to the Office of Admissions. They can also ask the agency to automatically submit TOEFL scores to CU Boulder using institution code 4841. To report official Duolingo scores, click Send Results from inside the application, then choose University of Colorado Boulder – Undergraduate.

See the Data Science website for details about application deadlines.

For information about application deadlines, please see the Graduate School's Admissions Deadlines (https://www.colorado.edu/graduateschool/admissions/prepare-apply/program-information-deadlines/).

Program Requirements

The on-campus data science master's degree seeks to shape tomorrow's leaders by providing learners with the skills, competencies and knowledge necessary to fuel creative problem-solving, adaptability, and the capability to communicate effectively across diverse organizations.

The MS degree is a non-thesis degree, though students may have the opportunity to complete a capstone or project as part of the 30 required credit hours.Students in the Bridge to Data Science Pathway may be required to complete up to 4 additional credits as determined by the graduate committee upon a review of the student's prior experience.

All students must complete 21 credits of core coursework in statistics, computer science and general core concepts as well as 9 credits of elective coursework.#The degree does not require a master's final/comprehensive examination.

Courses by Topic Area

Code	Title	Credit Hours
Applied Mathematics		
STAT 5000	Statistical Methods and Application I	3
STAT 5010	Statistical Methods and Applications II	3
STAT 5600	Methods in Statistical Learning [1]	3
Computer Science		
DTSC 5501	Data Structures and Algorithms [1]	
CSCI 5502	Data Mining	3
CSCI 5622	Machine Learning	3
General Data Science		
DTSC 5301	Data Science as a Field	1
DTSC 5302	Ethical Issues in Data Science	1
DTSC 5303	Cybersecurity for Data Science	1
Data Science Electives		
CSCI 5253	Datacenter Scale Computing - Methods, Systems and Techniques	3
CSCI 5302	Advanced Robotics	3
CSCI 5314	Dynamic Models in Biology	3
CSCI 5322	Algorithmic Human-Robot Interaction	
CSCI 5352	Network Analysis and Modeling	3
CSCI 5402	Research Methods in Human-Robot Interaction	
CSCI 5403	Cybersecurity	3
CSCI 5423	Biologically-inspired Multi-Agent Systems	
CSCI 5454	Design and Analysis of Algorithms	3
CSCI 5576	High-Performance Scientific Computing	4
CSCI 5722	Computer Vision	3
CSCI 5822	Probabilistic Models of Human and Machine Learning	3
CSCI 5832	Natural Language Processing	3
CSCI 5880	Interactive Machine Learning for Customizable and Expressive Interfaces	3
CSCI 5922	Neural Networks and Deep Learning	3
CSCI 6502	Big Data Analytics: Systems, Algorithms, and Applications	3
CSCI 7000	Current Topics in Computer Science	1-4
DTSC 5810	Capstone	
DTSC 5840	Independent Study	
DTSC 5900	Special Topics	
DTSC 5930	Professional Internship	
GEOG 4303/5303	Geographic Information Science: Spatial Programming	4
GEOG 5103	Geographic Information Science: Spatial Analytics	4
GEOG 5203	Geographic Information Science: Spatial Modeling	4
GEOG 5563	Earth Analytics	3
IPHY 5262	Application of Bioinformatics and Genomics	3
IPHY 5800	Advanced Statistics and Research Methods in Integrative Physiology	4

IPHY 6010	Seminar	1-3
INFO 5507	Data and the Humanities	3
INFO 5601	Ethical and Policy Dimensions of Information and Technology	3
INFO 5602	Information Visualization	3
INFO 5612	Recommender Systems	
INFO 5613	Network Science	3
MATH 5440	Mathematics of Coding and Cryptography	3
MBAX 6330	Market Intelligence	3
MBAX 6410	Process Analytics	3
MSBC 5070	Survey of Business Analytics	3
MSBC 5680	Optimization Modeling	3
MSBX 5310	Customer Analytics	2-3
MSBX 5405	Structured Data Modeling and Analysis	3
MSBX 5420	Unstructured and Distributed Data Modeling and Analysis	3
STAT 5680	Statistical Collaboration	3

[1] Option: Methods in Statistical Learning (STAT 5600); Datacenter Scale Computing - Methods, Systems and Techniques (CSCI 5253) *or* Big Data Architecture (ATLS 5214); Information Visualization (INFO 5602); Design and Analysis of Algorithms (CSCI 5454).

Time Limit

All degree requirements must be completed within four years of the date of commencing coursework. Most students complete the degree in one-and-a-half to two years.

Plans of Study

Data Structures and Algorithms Option

Year One		
Fall Semester		**Credit Hours**
DTSC 5301	Data Science as a Field	1
DTSC 5302	Ethical Issues in Data Science	1
DTSC 5303	Cybersecurity for Data Science	1
DTSC 5501		3
STAT 5000	Statistical Methods and Application I	3
	Credit Hours	**9**
Spring Semester		
STAT 5010	Statistical Methods and Applications II	3
CSCI 5502	Data Mining	3
Elective		3
	Credit Hours	**9**
Year Two		
Fall Semester		
CSCI 5622	Machine Learning	3
Option [1]		3
	Credit Hours	**6**
Spring Semester		
Electives		6
	Credit Hours	**6**
	Total Credit Hours	**30**

[1] Intro to Statistical Learning (STAT 5600); Datacenter Scale Computing (CSCI 5253) *or* Big Data Architecture (ATLS 5214); Information Visualization (INFO 5602)

Non-Data Structures and Algorithms Option

Year One		
Fall Semester		**Credit Hours**
DTSC 5301	Data Science as a Field	1
DTSC 5302	Ethical Issues in Data Science	1
DTSC 5303	Cybersecurity for Data Science	1
STAT 5000	Statistical Methods and Application I	3
CSCI 5502	Data Mining	3
	Credit Hours	**9**
Spring Semester		
STAT 5010	Statistical Methods and Applications II	3
CSCI 5622	Machine Learning	3
Option [1]		3
	Credit Hours	**9**
Year Two		
Fall Semester		
Option [1]		3
Elective		3
	Credit Hours	**6**
Spring Semester		
Electives		6
	Credit Hours	**6**
	Total Credit Hours	**30**

[1] Intro to Statistical Learning (STAT 5600); Datacenter Scale Computing (CSCI 5253) *or* Big Data Architecture (ATLS 5214); Information Visualization (INFO 5602); Design and Analysis of Algorithms (CSCI 5454)