DATA SCIENCE, MASTER OF SCIENCE (M.S)

Program mission

The M.S. in Data Science degree program educates students with the advanced knowledge, skills and tools necessary to analyze and interpret complex data and help solve real-world problems. Data science is an interdisciplinary field that combines expertise in statistics, computer science and domain-specific knowledge to extract valuable insights and knowledge from data. This degree program will prepare students to excel in using data to drive data-driven decision-making in various industries and domains. An M.S. in Data Science prepares students to work as data analysts, data scientists, machine learning engineers, data engineers, business analysts, research scientists, data consultants, etc. They may also specialize in specific domains like healthcare or biomedical data analysis and can find opportunities in government, startups, academia, and industry research.

Program goals

1. **Advanced data science skills:** To produce graduates who can apply data science tools and techniques, including data cleaning and reprocessing, data presentation/visualization, mathematical modeling, statistical learning, machine learning and big data technologies, to solve complex problems and generate novel insights in real-world scenarios
2. **Advanced skills in statistics:** To produce graduates who demonstrate the ability to apply statistical concepts and data analysis techniques by testing hypotheses, designing experiments and collecting data in real-world applications and through the use of data structures and algorithms to interpret and analyze large-scale data

Student learning outcomes

Students will be able to:

1. Apply data science tools and techniques, including data cleaning and preprocessing, data presentation/visualization, mathematical modeling, statistical learning, machine learning, and big data technologies, to solve complex problems and generate novel insights in real-world scenarios

2. Apply statistical concepts and data analysis techniques by testing hypotheses, designing experiments and collecting data in real-world applications

3. Utilize data structures and algorithms to interpret and analyze large-scale data

4. Develop data science applications (e.g. SQL, R, Python) to obtain proficiency in programming

5. Create clear and effective visualizations of data and communicate results both in writing and oral presentation

6. Apply data management skills and ethical considerations in data science to real-world applications

7. Develop collaboration and communication in a data science team environment

VCU Graduate Bulletin, VCU Graduate School and general academic policies and regulations for all graduate students in all graduate programs

The VCU Graduate Bulletin website documents the official admission and academic rules and regulations that govern graduate education for all graduate programs at the university. These policies are established by the graduate faculty of the university through their elected representatives to the University Graduate Council.

It is the responsibility of all graduate students, both on- and off-campus, to be familiar with the VCU Graduate Bulletin as well as the Graduate School website (http://www.graduate.vcu.edu/) and academic regulations in individual school and department publications and on program websites. However, in all cases, the official policies and procedures of the University Graduate Council, as published on the VCU Graduate Bulletin and Graduate School websites, take precedence over individual program policies and guidelines.

Visit the academic regulations section for additional information on academic regulations for graduate students. (https://bulletin.vcu.edu/academic-regs/)

Graduation requirements

As graduate students approach the end of their academic programs and the final semester of matriculation, they must make formal application to graduate. No degrees will be conferred until the application to graduate has been finalized.

Graduate students and program directors should refer to the following graduation requirements as published in the Graduate Bulletin for a complete list of instructions and a graduation checklist.

Visit the academic regulations section for additional information on graduation requirements. (https://bulletin.vcu.edu/academic-regs/grad/graduation-info/)

Admission requirements

Degree:	Semester(s) of entry:	Deadline dates:	Test requirements:
M.S.	Fall	Mar 1	TOEFL (international students only)
	Spring	Oct 1	

In addition to the general admission requirements of the VCU Graduate School (https://bulletin.vcu.edu/graduate/study/admission-graduate-study/admission-requirements/), the following requirement represents the minimum acceptable standards for admission:

- Applicants must have earned a bachelor's degree in computer science, statistics, operations research, analytics, engineering, physics or a closely related quantitative discipline from an accredited institution of higher education.

With program adviser approval, a maximum of six credits of graduate-level course work may be transferred from VCU's non-degree status or from another accredited institution. Credits must be fewer than six years old from the time of admission and completed with a minimum grade of

B (3.0). Credits applied to a degree previously earned at VCU or at another institution may not be transferred.

Provisional admission may be granted when deficiencies exist. These deficiencies must be removed by the end of the first year of residence (or its part-time equivalent) when the student's application will be re-examined. Courses that are remedial or designed to remove deficiencies will not be accepted for credit hours toward the fulfillment of the course requirements for the master's degree.

Degree requirements

In addition to the VCU Graduate School graduation requirements (https://bulletin.vcu.edu/academic-regs/grad/graduation-info/), students are required to complete course work in core and elective courses and to meet the following requirements.

Credit hour requirements: Students in the M.S. in Data Science program are required to earn a minimum of 30 graduate-level credit hours. At least one-half of the credit hours presented for graduation must be at the 600 level or higher.

Curriculum requirements

Course	Title	Hours
Core courses		
CMSC 535	Introduction to Data Science	3
CMSC 608	Advanced Database	3
CMSC/SSOR 681	Data Science Capstone Project I	3
CMSC/SSOR 682	Data Science Capstone Project II	3
STAT 534	Statistical Data Science I	3
STAT 641	Applied Data Analysis	3
Additional courses		
Restricted electives (Choose two courses from each list below.)		12
Total Hours		**30**

The minimum number of graduate credit hours required for this degree is 30.

List one: Computer science electives

Course	Title	Hours
Select two courses from:		
CMSC 502	Parallel Algorithms	3
CMSC 510	Regularization Methods for Machine Learning	3
CMSC 516	Advanced Natural Language Processing	3
CMSC 603	High Performance Distributed Systems	3
CMSC 606	Introduction to Machine Learning	3
CMSC 630	Image Analysis	3
CMSC 635	Knowledge Discovery and Data Mining	3
CMSC 636	Artificial Neural Networks and Deep Learning	3
CMSC 691	Special Topics in Computer Science	3

List two: Statistics and operations research electives

Course	Title	Hours
Select two courses from the following:		
OPER 528	Stochastic Simulation	3
STAT 545	Applied Bayesian Statistics	3
STAT 621	Nonparametric Statistical Methods	3
STAT 625	Applied Multivariate Analysis	3
STAT/OPER 636	Machine Learning Algorithms	3
STAT 642	Design and Analysis of Experiments I	3
STAT 643	Applied Linear Regression	3
STAT 675	Time Series Analysis I	3
STAT 691	Special Topics in Statistics	3

Contact

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Program website: https://egr.vcu.edu/academics/grad-degrees/data-science-masters/