Data Science, MS

Learning Outcomes

Graduates will be able to:

- understand the fundamental concepts in probability and statistics that underlie commonly used data science algorithms;
- write efficient Python and R codes for data processing and data wrangling (data storage, access, and management) and computing for data analysis and modeling;
- use visualization techniques to display salient data features;
- use data technologies to process complex data;
- correctly and effectively implement appropriate algorithms for learning with data;
- identify and criticize inappropriate/unethical uses of data and/or algorithms;
- acquire effective communication skills for disseminating findings; and
- work with data stakeholders to help collect and analyze data.

The program aims to train the next generation of data scientists with the analytical and technical skills to explore, formulate, and solve complex data-driven problems in science, industry, business, and government. The program focuses on the theory, methodology, application, and ethics for working with and learning from data. Students acquire the ability to develop and implement new or special-purpose analysis and visualization tools, and a fundamental understanding of how to quantify uncertainty in data-driven decision-making.

Requirements

The Master of Science in data science requires 30 s.h. of graduate credit. Students must maintain a Graduate College program grade-point average of at least 3.00 in all coursework.

Coursework includes core courses covering the fundamentals of data science including probability and statistics; data storage, access, and management; and data visualization, exploration, modeling, analysis, and uncertainty quantification. Students acquire hands-on experience in solving real-world problems, communication skills, and data ethics via a required capstone project. Students may choose from a wide variety of electives or supplemental courses on specialized data science topics offered by the departments of Statistics and Actuarial Science, Computer Science, Business Analytics, and Biostatistics to enhance their skill sets based on their interests and career goals.

Students who have received a waiver for certain required courses must select from the list of approved supplemental courses to reach 30 s.h. of graduate credit; see the " Elective and Supplemental Courses" section. In particular, this may be the case for some undergraduate to graduate students; see the Undergraduate to Graduate website for more information.

The MS in data science requires the following coursework.

Required Courses

All required courses must be taken on an A–F graded basis, except DATA:4890, DATA:5890, and DATA:6220, which may be taken for a S/U grade.

Course #	Title	Hours
All of these:		
DATA:3120/ IGPI:3120/ STAT:3120	Probability and Statistics	4
DATA:3200/ IGPI:3200/ISE:3760/ STAT:3200	Applied Linear Regression	3
DATA:4540/ BAIS:4540/ IGPI:4540/ STAT:4540	Statistical Learning	3
DATA:4580/ IGPI:4580/ STAT:4580	Data Visualization and Data Technologies	3
DATA:4600/ STAT:4600	Causal Inference for Data Science	3
DATA:4750/ STAT:4750	Probabilistic Statistical Learning	3
DATA:5400/ IGPI:5400/ STAT:5400	Computing in Statistics	3
DATA:6220/ STAT:6220	Consulting and Communication With Data	3
DATA:7400/ IGPI:7400/ STAT:7400	Computer Intensive Statistics	3
One of these:		
DATA:4890	Data Science Practicum	3
DATA:5890	MS Data Science Practicum	2

Elective and Supplemental Courses

Course #	Title	Hours
DATA:3120/ IGPI:3120/ STAT:3120	Probability and Statistics	4
DATA:4610	Data Acquisition and Management	3
DATA:4620	Text Data Analysis	3
DATA:4890	Data Science Practicum	3
DATA:6200/ ACTS:6200/ STAT:6200	Predictive Analytics	3
BAIS:6040	Data Programming in Python	3
BAIS:6100	Text Analytics	3
BAIS:6130	Applied Optimization	3
BAIS:6210	Data Leadership and Management	3
BAIS:9100	Data and Decisions	3
BIOS:4510	Data Science Foundations in R	2
BIOS:5310/ IGPI:5310/ STAT:5810	Research Data Management	3

BIOS:6310/ IGPI:6310/ STAT:6550	Introductory Longitudinal Data Analysis	3
BIOS:6720	Statistical Machine Learning for Biomedical and Public Health Data	3
BIOS:6810	Bayesian Methods and Design	3
BIOS:7410/ STAT:7510	Analysis of Categorical Data	3
BIOS:7600/ IGPI:7600	Advanced Biostatistics Seminar	0-3
BME:5240	Deep Learning in Medical Imaging (DLMI)	3
CS:4310	Design and Implementation of Algorithms	3
CS:4400	Database Systems	3
CS:4420	Artificial Intelligence	3
CS:4470	Health Data Analytics	3
CS:4980	Topics in Computer Science II	3
CS:5430	Machine Learning	3
CS:5630	Cloud Computing Technology	3
CS:5800/ECE:5800	Fundamentals of Software Engineering	3
CS:5820/ECE:5820	Software Engineering Languages and Tools	3
ECE:5845	Modern Databases	3
ECE:5995	Contemporary Topics in Electrical and Computer Engineering	arr.
MATH:4840	Mathematics of Machine Learning	3
STAT:4520/ IGPI:4522/ PSQF:4520	Bayesian Statistics	3
STAT:4560	Statistics for Risk Modeling I	3
STAT:6530/ IGPI:6530	Environmental and Spatial Statistics	3
STAT:6560	Applied Time Series Analysis	3
STAT:6970	Topics in Statistics	3

Admission

Applicants must meet the admission requirements of the Graduate College; see the Manual of Rules and Regulations on the Graduate College website.

Career Advancement

The program prepares graduates for careers in academia, industry, business, or government that involve data visualization and modeling, managing reproducible data analysis workflows, and collaborating and communicating with scientists and other data stakeholders.

Academic Plans

Sample Plan of Study

Sample plans represent one way to complete a program of study. Actual course selection and sequence will vary and should be discussed with an academic advisor. For additional sample plans, see MyUI.

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Course	Title	Hours
Academic Career		
Any Semester		
30 s.h. must be graduate level coursework; graduate transfer credits allowed upon approval. More information is included in the General Catalog and on department website. [a]		
	Hours	**0**
First Year		
Fall		
DATA:3120	Probability and Statistics [b]	4
DATA:3200	Applied Linear Regression	3
DATA:4540	Statistical Learning	3
DATA:5400	Computing in Statistics	3
	Hours	**13**
Spring		
DATA:4580	Data Visualization and Data Technologies	3
DATA:4750	Probabilistic Statistical Learning	3
	Hours	**6**
Second Year		
Fall		
DATA:4600	Causal Inference for Data Science	3
DATA:4890 or DATA:5890	Data Science Practicum or MS Data Science Practicum	2 - 3
	Hours	**5-6**
Spring		
DATA:6220	Consulting and Communication With Data	3
DATA:7400	Computer Intensive Statistics	3
	Hours	**6**
	Total Hours	**30-31**

a Students must complete specific requirements in the University of Iowa Graduate College after program admission. Refer to the Graduate College website and the Manual of Rules and Regulations for more information.

b If a student has completed STAT:3100 and STAT:3101 or STAT:4100 and STAT:4101 they will not need to take DATA:3120. However, another higher-level course must be taken to reach the 30 s.h. minimum total required for the degree.