Master of Science in Data Science

Program Guidelines

The Master's of Science in Data Science degree at Montana State University is interdisciplinary program that draws on courses in three programs: Computer Science, Mathematics, and Statistics. The broad goal is to provide students with foundational training in data analysis, with equal emphasis on the principles of computer science, mathematics, and statistics, and the ability to apply these principles to a range of data-driven problems. More specifically, the learning outcomes for graduates of the program are:

- Demonstrate knowledge of essential deterministic, randomized and approximation algorithms for data classification and clustering, dimensionality reduction, regression, and optimization.
- Demonstrate knowledge in the principles and practice of statistical experimental design, statistical inference, and decision theory.
- Demonstrate the ability to take a real-world data analysis problem, formulate a conceptual approach to the problem, match aspects of the problem to previously learned theoretical and methodological tools, break down the solution into a step-by-step approach, and implement a working solution in a modern software language.
- Communicate data science problems, analyses, and solutions effectively to both specialists and non-specialists through the use of effective technical writing, presentations, and data visualizations, and teamwork and collaboration.

Program Prerequisites

The prerequisites for the master's degree program in data science consist of the following course work, or their equivalent if a student is coming from another institution.

1. 3 semesters of Calculus (through Multivariable Calculus M 273) or equivalent
2. Linear Algebra (M 221) or equivalent
3. Data Structures and Algorithms (CSCI 232) or equivalent
4. Methods of Proof (M 242) or Discrete Structures (CSCI 246) or equivalent
5. Introductory Statistics (STAT 216Q) or equivalent (additional statistics coursework such as Intermediate Statistical Methods (STAT 217) or STAT 401 or STAT 337 and then STAT 511, STAT 512 preferred)
6. At least three senior level courses in mathematics, statistics, or computer science or equivalent

Program Requirements

The master's degree program in data science requires a total of 30 credits, which is typically satisfied by taking 10 3-credit courses. There are three essential domains in this program: Computer Science, Statistics, and Mathematics. Each student is required to take:

- At least 2 courses (=6 credits) in each of the three essential domains.
- The foundational course in each domain

Additionally, students can choose among the following courses:

- CSCI 440 (Database Systems),CSCI 540 (Advanced Database Systems), CSCI 446 (Artificial Intelligence), CSCI 447 (Machine Learning: Soft Computing), CSCI 535 (Computational Topology), CSCI 547 (Machine Learning), CSCI 546 (Advanced Artificial Intelligence), CSCI 550 (Data Mining),
- STAT 408 (Statistical Computing and Graphical Analysis), STAT 511 (Methods of Data Analysis I), STAT 512 (Methods of Data Analysis II), STAT 436 (Introduction to Time Series Analysis) or STAT 536 (Time Series Analysis),STAT 437 (Introduction to Applied Multivariate Analysis), STAT 537 (Applied Multivariate Analysis I), or STAT 576 (Internship, 3 credits).
- M 441 (Numerical Linear Algebra & Optimization), M 442 (Numerical Solution of Differential Equations), M 507 (Mathematical Optimization)

Required Foundational Courses

CSCI 532	Algorithms	3
STAT 541	Experimental Design	3
M 508	Mathematics of Machine Learning	3

Curriculum for a student with a dominant interest in Computer Science:

Year 1	Credits
CSCI 532 - Algorithms	3
CSCI 540 - Advanced Database Systems	3
CSCI 547 - Machine Learning	3
M 441 - Numerical Linear Algebra & Optimization	3
STAT 408 - Statistical Computing and Graphical Analysis	3
Year Total:	15
Year 2	**Credits**
CSCI 535 - Computational Topology	3
CSCI 550 - Advanced Data Mining	3
M 508 - Mathematics of Machine Learning	3
STAT 511 - Methods of Data Analysis I	3
STAT 541 - Experimental Design	3
Year Total:	15
Total Program Credits:	**30**

Curriculum for a student with a dominant interest in Mathematics:

Year 1	Credits
CSCI 532 - Algorithms	3
CSCI 547 - Machine Learning	3
M 441 - Numerical Linear Algebra & Optimization	3
M 560 - Methods of Applied Mathematics I	3
STAT 408 - Statistical Computing and Graphical Analysis	3
Year Total:	15
Year 2	**Credits**
CSCI 535 - Computational Topology	3
CSCI 540 - Advanced Database Systems	3
M 508 - Mathematics of Machine Learning	3
STAT 511 - Methods of Data Analysis I	3
STAT 541 - Experimental Design	3
Year Total:	15
Total Program Credits:	**30**

Curriculum for a student with a dominant interest in Statistics:

Year 1	Credits
CSCI 532 - Algorithms	3
M 441 - Numerical Linear Algebra & Optimization	3
STAT 408 - Statistical Computing and Graphical Analysis	3
STAT 511 - Methods of Data Analysis I	3
STAT 512 - Methods of Data Analysis II	3
Year Total:	15
Year 2	**Credits**
CSCI 547 - Machine Learning	3
M 508 - Mathematics of Machine Learning	3
STAT 536 - Time Series Analysis	3
STAT 537 - Multivariate Analysis I	3
STAT 541 - Experimental Design	3
Year Total:	15
Total Program Credits:	**30**