MASTER OF SCIENCE IN DATA SCIENCE

The School of Engineering and Computing offers a master's degree in data science (MSDS). Advances in technology have contributed to a deluge of data in virtually any domain. Computational techniques are being developed to store, process, and interpret data. New insights into data contribute to increased productivity, correlations among previously distinctive domains, and improved decision-making.

Data science is an interdisciplinary field of scientific methods, processes, and systems to extract knowledge or insights from data in various forms, either structured or unstructured. It employs techniques and theories drawn from many fields within the broad areas of statistics and computer science, in particular from the subdomains of machine learning, classification, cluster analysis, uncertainty quantification, computational science, data mining, databases, and visualization. At the same time, it requires domain-specific knowledge to apply the techniques and theories effectively. Bob Hayes, Chief Research Officer at AnalyticsWeek thinks of 'data science' as "a flag that was planted at the intersection of several different disciplines that have not always existed in the same place." Current Data Science programs are either too technical or too specialized.

As an interdisciplinary program, the Master of Science in Data Science (MSDS) decouples the computational techniques from the domains of interest, thus allowing all students to learn data science techniques, while concentrating on learning about data in one or more domains of interest.

Learning Goals

The MSDS provides outcomes for students from any domain, who are seeking a graduate program focused on obtaining non-trivial insight from Big Data. These outcomes cover not only the development of critical academic and professional skills, but also opportunities for employment in highly visible and needed sectors of the marketplace.

Students in the MSDS program will gain:

- Advancement of data science and analytics through teaching and research in an environment that is conducive to achieving educational excellence.
- Exposure to data science and analytics techniques, tools, and methodologies.
- Exposure to domain-related issues related to data in any domain of interest.
- Fundamental discovery in data science and analytics.
- The ability to attain the highest standards in professional and ethical practice.

In sum, students will acquire the skills and real-world knowledge to succeed in applied data sciences through an in-depth exposure to the methodologies and tools of data science. A sequence of required courses and elective courses, and the final team-driven capstone project provide depth and breadth to the students' learning experiences.

In addition to required courses, those in specialization areas build in-depth knowledge and skills in the area of student's interest. Courses in other engineering and management fields are available as electives.

Students

Students who wish to pursue the MSDS come from many different backgrounds. Some come from engineering and computing. Others come from specific domain backgrounds, like biology, healthcare, behavioral sciences, or business. All have a desire to use data to make deeper connections within their field and drive decision making.

Companies across industries and governments reap the benefit of using skills from data science to tackle complex Big Data challenges. Career opportunities can be found in commerce, government, for-profit and not-for-profit organizations, and the services and manufacturing sectors. Examples of employment opportunities for MSDS graduates include:

- Applied Data Science Enterprise professional
- Big Data consultant
- Business intelligence reporting professional
- Data Analyst
- Data Controller
- Data mining or Big Data Engineer
- Health Data Analyst
- Statistician
- Research Data Scientist

Students may enter the MSDS program from any background, but may expect to take up to six credits of bridge course work to prepare for the program, depending on their background. For example, students with no prior programming experience would be required to take CPSC 1101 Introduction to Computing (Python programming). Students seeking to pursue a particular concentration may need to take a course in that field. These additional prerequisites will be determined on an individual basis at the time an offer of admission is made.

Data is ubiquitous in the modern world, and data scientists with skills and knowledge to analyze that data are a valuable, sought-after resource.

Program

Prerequisites and Foundation Competencies

The MSDS degree requires students to have competencies that will allow them to pursue graduate coursework. Knowledge and/or experience in data science, programming, and specific domains is necessary. Gaps in knowledge and experience in these areas can be remedied by domain-specific bridge courses offered in the MSDS program:

Code	Title	Credits
BIOL 1171	General Biology I	4
CPSC 1101	Introduction to Computing	3
PSYC 1010	General Psychology	3
SOCI 1100	Introduction to Sociology	3

Students who are accepted into the program with certain bridge courses should complete the bridge requirement in the first semester with a grade of B or higher to satisfy the bridge requirement. Students may take graduate level courses and bridge courses at the same time. Bridge courses do not count for credit towards the degree.

Program Requirements

MSDS students will complete four required courses, as described below. In addition, students should select a concentration from one or more specialization areas in which they have an interest with their advisor's guidance. Concentrations currently include computational analytics, bioinformatics, social analytics, behavioral analytics, or health analytics. Additional individual areas of interest may be discussed with the advisor. Students may also take two elective courses from the list below.

The program requires two capstone courses and four required core courses listed below. Completion of a minimum of eight three-credit courses, plus the two-semester capstone sequence, for a total of 30 credits, comprise the graduation requirements for the MSDS program.

To earn the Master of Science in Data Science, students complete the following:

Code	Title	Credits
MATH 5417	Applied Statistics I	3
SWEG 5322	Visual Analytics	3
SWEG 6508	Data Warehouse Systems	3
SWEG 6518	Data Mining and Business Intelligence	3
Concentration Courses		
Select two courses in one of the following concentration areas:		6
Computational Analytics		
SWEG 5357	Database Management Systems	
SWEG 6461	Pattern Recognition	
Health Analytics		
NURS 7602	Healthcare Economics and Marketing	
NURS 7613	Finance and Quality Management in Healthcare Organizations	
Bioinformatics		
BIOL 5365	Evolutionary Biology	
SWEG 5315	Computational Biology	
SWEG 5317	Computational Statistics for Biomedical Sciences	
Social Analytics		
SOCI 5100	American Class Structure	
SOCI 5110	Race, Cities, and Poverty	
SOCI 5300	Sociology of Education	
Elective Courses		
Select two elective courses from the following: [1]		6
Computing Technical Electives		
SWEG 5349	Cloud Computing	
SWEG 5355	Artificial Intelligence	
SWEG 5360	Machine Learning	
SWEG 6499	Algorithms	
SWEG 6505	Advanced Database Concepts	
SWEG 6530	Applications and Data Security	
Mathematics Electives		
MATH 5418	Applied Statistics II	
MATH 5451	Probability Theory	
MATH 5452	Statistics Theory	
Capstone Sequence		
SWEG 6961	Capstone Professional Project I	3
SWEG 6962	Capstone Professional Project II	3
Total Credits		**30**

[1] Electives may be chosen from courses listed, SWEG 5990 Independent Study, or any other graduate-level course from a concentration or another area, under advisement of the department chair or academic advisor.