

# M.S. IN DATA SCIENCE

<https://msdatascience.miami.edu/>

## Program Overview

The Master of Science in Data Science is an interdisciplinary graduate program that combines the teaching of domain-specific and technical skills for analyzing large data sets. Built upon a core of foundational data science courses in Computer Science, Electrical Engineering, and Mathematics, and a selection of courses from data science application domains, the program is interdisciplinary in nature. Students interested in data science tools will be able to focus on tool principles and tool development, and students interested in data science application domains will be able to focus on the application of data science tools with a selection of courses that develop skills in one of three application areas. The program also provides its students the option of doing an industrial internship, to acquire professional experience. The program allows the various academic units involved to add courses in their specific application domains, thus keeping the program updated and relevant to current practice and industrial needs. The program is both academic and professional in nature, providing courses that are true to a Master's level degree and courses that reflect the needs of the profession.

## Admission Requirements

1. Completion of an application.
2. A Baccalaureate degree for an accredited institution.
3. A minimum cumulative undergraduate GPA of 3.0.
4. Introduction to Probability and Statistics and Computer Programming I (or equivalents). Students may be admitted with deficiencies, which must be completed in addition to the degree requirements.

5. GRE general test scores

Applicants must rank in the 65% percentile or higher in the Quantitative Reasoning Test. There is no minimum score requirement for other parts of the GRE.

6. Students from non-English speaking countries must send either TOEFL or IELTS

TOEFL minimum score: Internet based - 92; Computer based - 237; Paper based 580

IELTS minimum score: 6.5

7. A personal statement of intent in which the applicant details reasons for pursuing the degree.

## Curriculum Requirements - General

Code	Title	Credit Hours
<b>Core Courses</b>		
Machine Learning or Data Mining		3
CSC 687 or ECE 648/677	Topics in Computer Science Machine Learning	
Data Visualization		3
CSC 688 or JMM 622	Topics in Computer Science Introduction to Infographics and Data Visualization	
Statistics		3
IEN 713 or EPS 702/MTH 642	Applied Regression Analysis Quantitative Methods II	
<b>Electives</b>		12
Programming (at least 3 elective credits have to be in Programming)		
CSC 686	Topics in Computer Science	
CSC 632	Introduction to Parallel Computing	
CSC 640	Algorithm Design and Analysis	
EPS 704	Computer Applications in Educational and Behavioral Science Research	
Database Systems		

CSC 623 or ECE 672	Theory of Relational Databases Object-Oriented and Distributed Database Management Systems	
ECE 697	Special Topics in Electrical Engineering	
<b>Machine Learning and Data Mining</b>		
CSC 687	Topics in Computer Science	
CSC 746 or ECE 653	Neural Networks and Deep Learning Neural Networks	
ECE 648	Machine Learning	
ECE 677	Data Mining	
ECE 730	Statistical Learning	
ECE 753	Pattern Recognition and Neural Networks	
<b>Mathematics and Statistics</b>		
EPS 703	Applied Multivariate Statistics	
EPS 705	Measurement and Psychometric Theory	
EPS 706	Categorical Data Analysis	
<b>Data Science Applications (at least 6 credits; some tracks may specify additional courses)</b>		<b>6-9</b>
ARC 594	Geographic Information Systems in Urban Design	
ARC 684	Special Problems	
ARC 685	Special Problems	
CSC 645 or ECE 637	Introduction to Artificial Intelligence Principles of Artificial Intelligence	
GEG 680	Spatial Data Analysis I	
JMM 692	Special Topics in Journalism and Media Management	
<b>Internship/Capstone</b>		<b>3-6</b>
<b>Total Credit Hours</b>		<b>30</b>

## Curriculum Requirements - Technical Data Science Track

Code	Title	Credit Hours
<b>Core</b>		<b>9</b>
<b>Data Science Tools (choose one course from each domain)</b>		<b>12</b>
Programming		
CSC 686	Topics in Computer Science	
CSC 632	Introduction to Parallel Computing	
CSC 640	Algorithm Design and Analysis	
Database Systems		
CSC 623 or ECE 672	Theory of Relational Databases Object-Oriented and Distributed Database Management Systems	
ECE 697	Special Topics in Electrical Engineering	
Data Analysis		
ECE 697	Special Topics in Electrical Engineering	
ECE 677	Data Mining	
Statistics		
MTH 624	Introduction to Probability Theory	
MTH 625	Introduction to Mathematical Statistics	
<b>Data Science Application/Electives</b>		<b>6</b>
<b>Internship/Capstone</b>		<b>3</b>
<b>Total Credit Hours</b>		<b>30</b>

## Curriculum Requirements - Smart Cities Track

Code	Title	Credit Hours
<b>Core</b>		<b>9</b>
<b>Data Science Tools/Electives (3 credits must be taken in Programming)</b>		<b>9</b>

<b>Data Science Applications</b>	<b>9</b>
ARC 594	Geographic Information Systems in Urban Design
ARC 694	Geographic Information Systems in Urban Design
ARC 686	Special Problems
<b>Internship/Capstone</b>	<b>3</b>
Total Credit Hours	30

## Curriculum Requirements - Data Visualization Track

Code	Title	Credit Hours
<b>Core</b>		<b>9</b>
<b>Data Science Tools/Electives (3 credits must be taken in Programming)</b>		<b>9</b>
Students interested in spatial visualization may also take any of the following electives:		
GEG 691	Geographic Information Systems I	
GEG 692	Remote Sensing of the Environment	
GEG 680	Spatial Data Analysis I	
GEG 681	Spatial Data Analysis II	
<b>Data Science Applications</b>		<b>9</b>
CSC 688	Topics in Computer Science	
JMM 622	Introduction to Infographics and Data Visualization	
JMM 692	Special Topics in Journalism and Media Management	
<b>Internship/Capstone</b>		<b>3</b>
Total Credit Hours		30

## Curriculum Requirements - Marine and Atmospheric Sciences

Code	Title	Credit Hours
<b>Core</b>		<b>9</b>
<b>Programming</b>		<b>3</b>
CSC 686	Topics in Computer Science	
CSC 632	Introduction to Parallel Computing	
CSC 640	Algorithm Design and Analysis	
<b>Data Science Applications</b>		<b>15</b>
OCE 642	Physics of Remote Sensing I - Passive Systems	
OCE 686	Applied Remote Sensing	
OCE 642	Physics of Remote Sensing I - Passive Systems	
OCE 687	Applied Radar Remote Sensing	
MES 660	Introduction to Marine Geographic Information Systems	
MES 661	Introduction to Marine Geographic Information Systems - Laboratory	
Or any other courses selected from the concentration course lists for the RSMAS Master of Professional Science (MPS), with advisor approval		
<b>Internship/Capstone</b>		<b>3</b>
Total Credit Hours		30

## Sample Plan of Study - General

Year One		Credit Hours
Fall		
CSC 687	Topics in Computer Science (or another approved Data Science Tools course)	3
CSC 688	Topics in Computer Science (or another approved Data Visualization course)	3
MTH 642	Statistical Analysis (or another approved statistics course)	3

CSC 686	Topics in Computer Science (or another approved Programming course)	3
	Credit Hours	12
<b>Spring</b>		
CSC 632	Introduction to Parallel Computing (or another approved Programming course)	3
CSC 623	Theory of Relational Databases (or another approved Database Systems course)	3
CSC 746	Neural Networks and Deep Learning (or another approved Machine Learning or Data Mining course)	3
EPS 703	Applied Multivariate Statistics (or another approved Statistics course)	3
	Credit Hours	12
<b>Summer</b>		
CSC 793	Research Project (or internship experience)	3
CSC 794	Research Project (or internship experience)	3
	Credit Hours	6
	Total Credit Hours	30

## Sample Plan of Study - Technical Data Science

<b>Year One</b>		
<b>Fall</b>		<b>Credit Hours</b>
CSC 687	Topics in Computer Science (or another approved Data Science Tools course)	3
CSC 688	Topics in Computer Science (or another approved Data Visualization course)	3
MTH 642	Statistical Analysis (or another approved statistics course)	3
CSC 686	Topics in Computer Science (or another approved Programming course)	3
	Credit Hours	12
<b>Spring</b>		
CSC 623	Theory of Relational Databases (or another approved Database Systems course)	3
ECE 697 or 677	Special Topics in Electrical Engineering or Data Mining	3
MTH 624 or 625	Introduction to Probability Theory or Introduction to Mathematical Statistics	3
CSC 645	Introduction to Artificial Intelligence (or another approved Data Science Applications course)	3
	Credit Hours	12
<b>Summer</b>		
GEG 680	Spatial Data Analysis I	3
CSC 793	Research Project (or internship experience)	3
	Credit Hours	6
	Total Credit Hours	30

## Sample Plan of Study - Smart Cities

<b>Year One</b>		
<b>Fall</b>		<b>Credit Hours</b>
CSC 687	Topics in Computer Science (or another approved Data Science Tools course)	3
CSC 688	Topics in Computer Science (or another approved Data Visualization course)	3
MTH 642	Statistical Analysis (or another approved statistics course)	3
CSC 686	Topics in Computer Science (or another approved Programming course)	3
	Credit Hours	12

<b>Spring</b>		
ARC 594	Geographic Information Systems in Urban Design	3
ARC 684	Special Problems	3
ARC 685	Special Problems	3
ARC 697	Designing for the Internet of Things (or another approved ARC elective)	3
	Credit Hours	12
<b>Summer</b>		
ARC 701 or 810	Masters Final Project or Master's Thesis	6
	Credit Hours	6
	<b>Total Credit Hours</b>	<b>30</b>

## Sample Plan of Study - Data Visualization

<b>Year One</b>		
<b>Fall</b>		<b>Credit Hours</b>
CSC 687	Topics in Computer Science (or another approved Data Science Tools course)	3
CSC 688	Topics in Computer Science (or another approved Data Visualization course)	3
MTH 642	Statistical Analysis (or another approved statistics course)	3
CSC 686	Topics in Computer Science (or another approved Programming course)	3
	Credit Hours	12
<b>Spring</b>		
JMM 622 or CSC 688	Introduction to Infographics and Data Visualization or Topics in Computer Science	3
JMM 692	Special Topics in Journalism and Media Management	3
JMM 663	Applied Data Analytics for Journalism and Media Management (or another approved Data Visualization elective)	3
JMM 696	Special Topics in Visual Journalism (or another approved Data Visualization elective)	3
	Credit Hours	12
<b>Summer</b>		
JMM 815	Multimedia Project	6
	Credit Hours	6
	<b>Total Credit Hours</b>	<b>30</b>

## Sample Plan of Study - Marine and Atmospheric Science

<b>Year One</b>		
<b>Fall</b>		<b>Credit Hours</b>
CSC 687	Topics in Computer Science (or another approved Data Science Tools course)	3
CSC 688	Topics in Computer Science (or another approved Data Visualization course)	3
MTH 642	Statistical Analysis (or another approved statistics course)	3
CSC 686	Topics in Computer Science (or another approved Programming course)	3
	Credit Hours	12
<b>Spring</b>		
MES 660	Introduction to Marine Geographic Information Systems (or another approved Marine & Atmospheric Science elective)	3
OCE 642	Physics of Remote Sensing I - Passive Systems (or another approved Marine & Atmospheric Science elective)	3
OCE 643	Physics of Remote Sensing II - Active Systems (or another approved Marine & Atmospheric Science elective)	3

OCE 686	Applied Remote Sensing (or another approved Marine & Atmospheric Science elective)	3
	Credit Hours	12
<b>Summer</b>		
OCE 805	MPS Internship	6
	Credit Hours	6
	Total Credit Hours	30

## Student Learning Outcomes

Upon completion of the MS in Data Science, students will be able to:

1. Use mathematical, statistical, and computational techniques to analyze large datasets, including collecting data, cleaning data, integrating multiple data sets, and applying the analytical techniques to the data.
2. Write computer programs for accomplishing the aforementioned analysis tasks and the analysis results obtained.
3. Interpret domain data appropriately, and provide insights into the data at hand.
4. Communicate the results of their analysis clearly to the relevant people, including decision-makers, stakeholders, and managers.
5. Generalize data analysis skills to problems in a real-world setting.

Specific to the individual tracks.

(a) For the Technical Data Science track

1. Use machine learning to discover the underlying structures and relationships in large datasets.
2. Apply data analysis and data mining to identify patterns in large datasets and develop classification/prediction models.
3. Deploy appropriate tools for visualizing data and their analysis results.

(b) For the Smart Cities track:

1. Use data science techniques to collect and analyze data from buildings and infrastructure.
2. Use data analysis and visualization skills to inform the design, development, and management of sustainable and resilient environments.

(c) For the Data Visualization track:

1. Use interactive and static visualization techniques for communication and dissemination to audiences with diverse levels of technological background/sophistication.
2. Use visualization techniques for advocacy.

(d) For the Marine and Atmospheric Science track:

1. Use public, private data sets, and their aggregates for domain-specific inquiries.
2. Analyze data that covers large areas over time.
3. Use data science skills to develop plans for analysis and execute them.
4. Apply appropriate technologies to analyze marine and atmospheric data.