

# DATA SCIENCE, MS

## Data Everywhere

There has been an explosion of data over the last decade. Everything that people do like listening to music, streaming shows, using social media or rideshares generates data. In fact, almost everything that goes on in the world today is measured and recorded somewhere. Analyzing that data can vastly improve human lives and business performance. So, it's not surprising that analytics are now used routinely even in fields that did not use much data before like the Arts, Music, and Creative Writing. Analytics are also extensively deployed in Business, Engineering and Manufacturing and Government and even in many not-for-profit sectors like education, fundraising and social welfare. It is safe to say that virtually all human activity that affects our lives uses analytics in some way today.

## Why should you Consider a Master of Science in Data Science (MSDS)?

With every field turning to data to improve decision-making and performance, Data Science is one of the fastest growing professions today but there aren't enough trained data analysts to fill that need. A Master's degree in Data Science that trains you to analyze data can therefore help you in finding jobs with attractive salaries.

A report from the employment outlook firm Burning Glass produced jointly with IBM and the Business Higher Education Forum identified several job categories in the data science and analytics field, including data driven decision makers ("leverage data to inform strategic and operational decisions") and functional analysts ("utilize data and analytical models to inform specific functions and business decisions"). They estimated a national demand of 1.8 million job postings nationwide for 2020, with a 5-year growth rate of approximately 15%. Importantly, the report also states: "39% of Data Scientists and Advanced Analysts require a Master's or Ph.D. These degrees take additional years of schooling to complete, so it will take a significant time investment to train a larger pool of workers. Therefore, because these roles are already undersupplied and projected to grow rapidly, the skills shortage is in danger of worsening."

The Bureau of Labor Statistics also projects that Computer and Information Research Scientists category of jobs will grow 15% over the 2019-2029 period and describes this as: "...much faster than average for all occupations[1] (p. ). Job prospects are expected to be excellent" and states that the "median annual wage for computer and information research scientists was \$126,830 in May 2020." BLS also classifies this as a category in which most jobs require a master's degree.

Additional evidence of demand is also seen in investments made by employers like Northwestern Mutual that have invested significant resources of \$15 million in the establishment of the Northwestern Mutual Data Science Institute to support the launch and growth of undergraduate and graduate programs related to data including data science and data analytics.

## Why UWM?

The MSDS at UWM is unique because its goal is to train graduates to practice data analytics in a field they are most passionate about. For example, if your interest is healthcare, you can become a data analyst in healthcare. If your passion is education, you can get the training to become an analyst in the field of education. The MSDS is therefore designed to give you the flexibility to build a career in data science in whatever field you want.

## Ready to Apply?

The Data Science program is a multidisciplinary program. To apply go to: [graduateschool-apply.uwm.edu](https://graduateschool-apply.uwm.edu) (<https://graduateschool-apply.uwm.edu/>) and click on the Apply Now tab to find the MS Data Science degree under **Multidisciplinary Programs**. Or go directly to the **MS Data Science application**.

[1] Bureau of Labor Statistics, U.S. Department of Labor, Occupational Outlook Handbook, Computer and Information Research Scientists, at <https://www.bls.gov/ooh/computer-and-information-technology/computer-and-information-research-scientists.htm> (visited *January 04, 2022*)

## Admission Requirements

### Application Deadlines

Application deadlines vary by program, please review the application deadline chart (<http://uwm.edu/graduateschool/program-deadlines/>) for specific programs. Other important dates and deadlines can be found by using the One Stop calendars (<https://uwm.edu/onestop/dates-and-deadlines/>).

### Admission

For admission to the M.S. in Data Science program, students must meet the general requirements of admission to a graduate program at UW-Milwaukee. As stated by the Graduate School, these requirements include: (1) a baccalaureate degree, or its equivalent as determined by the UWM Center on International Education, from a regionally accredited institution, completed before the first term of enrollment in the Graduate School; (2) Proficiency in the English language; and (3) A minimum cumulative undergraduate grade point average (GPA) of 2.75 on a 4.0 scale, or an equivalent measure on a grading system that does not use a 4.0 scale. Students applying to the program are expected to have proficiency, demonstrated through coursework, exams or a portfolio, in the following areas: Linear Algebra (3 credits), Multivariable Calculus (4 credits), Statistics (3 credits), and Computer Literacy (6 credits). Those without these proficiencies may be admitted when they have 6 credits or fewer of the proficiency requirements remaining to be completed, but proficiency coursework does not count towards the MS.

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## Credits and Courses

Code	Title	Credits
<b>Core Areas</b>		
Complete 18 credits; 1 course from each sub-area below:		
<i>Developing insights from data for applications</i>		3
Complete 1 course:		
ATM SCI 600	Data Analytics	
COMPSCI 425	Introduction to Data Mining	
INFOST 687	Data Analysis for Data Science	
<i>Organizing and maintaining large data sets</i>		3
Complete 1 course:		
BUS ADM 749	Data and Information Management	

COMPSCI 557	Introduction to Database Systems
INFOST 691	Special Topics in Information Science: (Topic: Data Management and Curation)
INFOST 714	Metadata
INFOST 780	XML for Libraries
INFOST 783	Information Storage and Retrieval
INFOST 785	Database Management Systems for Information Professionals
PH 718	Data Management and Visualization in R

*AI and Machine Learning to extract insight from Data* 3

Complete 1 course:

BUS ADM 767	Ideas and Applications of Data Science in Different Fields
COMPSCI 411	Machine Learning and Applications
COMPSCI 422	Introduction to Artificial Intelligence
COMPSCI 710	Artificial Intelligence
COMPSCI 711	Introduction to Machine Learning
INFOST 582	Introduction to Data Science
MATH 804	Industrial Mathematics II

*Probabilistic methods to analyze uncertainty in data* 3

Complete 1 course:

ATM SCI 500	Statistical Methods in Atmospheric Sciences
ATM SCI 700	Statistical Methods in Atmospheric Sciences II: Signal Detection
BUS ADM 754	Statistical Analysis
BUS ADM 713	Business Forecasting Methods
BUS ADM 714	Multivariate Techniques in Management Research
BUSMGMT 709	Predictive Analytics for Managers
COMPSCI 720	Computational Models of Decision Making
COMPST 701	Computing Fundamentals for IT Professionals
ECON 411	Economic Forecasting Methods
ECON 413	Statistics for Economists
ECON 513	Introduction to Econometrics
ED PSY 724	Educational Statistical Methods II
ED PSY 820	Multiple Regression
GEOG 747	Spatial Analysis
GEOG 827	Qualitative Research
IND ENG 575	Design of Experiments
IND ENG 765	Operations Research Methods
MATH 583	Introduction to Probability Models
MTHSTAT 361	Introduction to Mathematical Statistics I
MTHSTAT 362	Introduction to Mathematical Statistics II
MTHSTAT 563 or MTHSTAT 763	Regression Analysis
MTHSTAT 564 or MTHSTAT 764	Time Series Analysis
MTHSTAT 871	Mathematical Statistics I

MTHSTAT 872	Mathematical Statistics II
PH 711	Intermediate Biostatistics
PH 818	Statistical Computing
POL SCI 701	Techniques of Political Science Research
POL SCI 702	Advanced Techniques of Political Science Research
PSYCH 510	Advanced Psychological Statistics
PSYCH 610	Experimental Design
SOCIOL 461	Social Data Analysis Using Regression
SOCIOL 760	Advanced Statistical Methods in Sociology
SOCIOL 982	Advanced Quantitative Analysis

*Advanced Programming for Data Collection and Data Science* 3

Complete 1 course:

BUSMGMT 744	R Programming for Business Analytics
COMPST 702	Software Development in Python
COMPST 751	Data Structures and Algorithms
GEOG 748	ArcGIS Programming with Python
MTHSTAT 566 or MTHSTAT 766	Computational Statistics
URBPLAN 794	Internet Geographic Information Systems (GIS)

*Ethics* 3

Complete 1 course:

BUS ADM 743	Information Privacy, Security & Continuity
INFOST 465	Legal Aspects of Information Products and Services
INFOST 583	Survey of Information Security
INFOST 660	Information Policy
INFOST 661	Information Ethics
INFOST 761	Information Privacy
INFOST 784	Information Security Management

**Electives**<sup>1</sup> 12

Complete 4 courses:

ANTHRO 380	Anthropological Applications of GIS
ANTHRO 562	Techniques and Problems in Archaeology
ANTHRO 768	Topics in Advanced Research Design in Anthropology
ART 313	Creative Coding
ART 316	Creative Interfaces
ART 317	3D Modeling and XR
ART 427	Advanced Design Workshop:
ART 526	Research in Universal Design and Fabrication
BUS ADM 741	Web Mining and Analytics
BUS ADM 742	Big Data in Business
BUS ADM 745	Artificial Intelligence for Business
BUS ADM 763	Marketing Analytics
BUS ADM 769	Database Marketing
BUS ADM 812	Machine Learning for Business
BUS ADM 813	Social Media Analytics for Business

BUS ADM 816	Business Intelligence Technologies & Solutions
BUS ADM 817	Connected Systems for Business
COMPSCI 423/723	Introduction to Natural Language Processing
COMPSCI 444/744	Introduction to Text Retrieval and Its Applications in Biomedicine
COMPSCI 469	Introduction to Computer Security
COMPSCI 535	Algorithm Design and Analysis
COMPSCI 704	Analysis of Algorithms
COMPSCI 712	Image Processing
COMPSCI 725	Robot Motion Planning
COMPSCI 755	Information and Coding Theory
COMPSCI 759	Data Security
CRM JST 520	Analysis Oriented Technology: Spatial Data Analysis; Crime Mapping; ArcGIS
CRM JST 713	Measuring Crime & Analyzing Crime Data
CRM JST 716	Advanced Analytic Techniques for Crime Analysts
CRM JST 910	Methods and Practice Capstone for Crime Analysts
ED PSY 821	Psychometric Theory and Practice
ED PSY 822	Item Response Theory
ED PSY 823	Structural Equation Modeling
ED PSY 824	Advanced Experimental Design and Analysis
ED PSY 825	Multivariate Methods
ED PSY 826	Analysis of Cross-Classified Categorical Data
ED PSY 827	Survey Research Methods in Education
ED PSY 832	Theory of Hierarchical Linear Modeling
GEOG 704	Remote Sensing: Environmental and Land Use Analysis
GEOG 705	Cartography
GEOG 716	Watershed Analysis and Modeling
GEOG 726	Geographic Information Science
GEOG 804	Advanced Remote Sensing
GEOG 826	Intermediate Geographic Information Science
GEOG 834	GIS and Society
GEOG 904	Remote Sensing and Urban Analysis
GEOG 926	Advanced Geographic Information Science: Geographic Modeling
GEOG 960	Seminar: Geographic Techniques:
GEOG 999	Independent Work
MATH 803	Industrial Mathematics I
PH 812	Statistical Learning & Data Mining
POL SCI 392	Survey Research
SOCIOL 750	Research Methods in Sociology
SOCIOL 752	Fundamentals of Survey Methodology
SOCIOL 952	Social Network Analysis

URBPLAN 692	Special Topics in Urban Planning: (Topic: Transportation Planning and GIS)
URBPLAN 791	Introduction to Urban Geographic Information Systems for Planning
URBPLAN 792	Using Urban Geographic Information Systems (GIS) for Planning
URBPLAN 999	Independent Study
<i>Optional: Internship/Thesis Capstone</i> <sup>2</sup>	
COMPSCI 990	Masters Thesis
COMPSCI 995	Master's Capstone Project
GEOG 798	GIS/Cartography Internship
MATH 890	Master's Thesis
URBPLAN 793	Applied Projects in Urban Geographic Information Systems
URBPLAN 991	Legislative/Administrative Agency Internship

*Qualifying Exam*<sup>3</sup>

**Total Credits** **30**

<sup>1</sup> INFOST 691 (Topic: Artificial Intelligence and Disruptive Technologies) may also be used as an elective. Every student's program of electives must be approved by the program director; students may be able to count as Electives some courses in the "core" categories not applied to the core requirements (subject to Director's approval). Students wishing to apply other courses not listed here towards these electives must have each course approved by the program director.

<sup>2</sup> Of the required 12 elective credits, up to 3 degree credits may be awarded for a thesis or internship. Students who choose this option must complete a relevant thesis or internship that is approved by the program director. Students who choose to complete a thesis must work with a thesis advisor and have the thesis approved by the advisor and the program director. Students who choose to pursue an internship must also obtain approval from the program director. Students may select from courses such as those listed in the table or enroll for thesis credits with their thesis advisor (in the advisor's department).

<sup>3</sup> Students who do not choose to pursue the optional capstone course/thesis/internship option are required to pass a qualifying exam. During this exam, students are given a data set and a research problem to be addressed with the data, using data science techniques. Students must submit a final report in which they use the provided data set to address the research question and demonstrate that they have developed a sufficient level of expertise to work as a data scientist. This is a take-home exam and students have seven days to complete it.

## Additional Requirements

### Major Professor as Advisor

Admitted students are assigned a faculty advisor who will work with the student to assemble a program of study.

### Time Limit

The student must complete all degree requirements within five years of initial enrollment.