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. 180). 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 MSDS?
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/) 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.

Credits and Courses

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>ATM SCI 600</td>
<td>Data Analytics</td>
<td></td>
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<tr>
<td>COMPSCI 425</td>
<td>Introduction to Data Mining</td>
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<tr>
<td>INFOST 687</td>
<td>Data Analysis for Data Science</td>
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<tr>
<td>BUS ADM 749</td>
<td>Data and Information Management</td>
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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 744  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  Regression Analysis
- MTHSTAT 763  Regression Analysis
- MTHSTAT 564  Time Series Analysis
- 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  Computational Statistics
- 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** 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:
URBPLAN 791  Introduction to Urban Geographic Information Systems for Planning
URBPLAN 792  Using Urban Geographic Information Systems (GIS) for Planning
URBPLAN 999  Independent Study

Optional: Internship/Thesis Capstone 2

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 3

Total Credits 30

1 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.

2 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).

3 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.