

DATA SCIENCE

The Data Science master's degree program is designed as a 30-credit hour interdisciplinary graduate program. The curriculum consists of required core courses and technical electives, providing opportunities to build knowledge and professional skills in various Data Science areas that are highly demanded in the current job market. This program can be completed fully online, in person, or a combination of both. Four specializations are recommended (not mandatory) for students with different interests in Data Science:

Computational Intelligence Specialization

This specialization is recommended for those students who are interested in building their knowledge and professional skills to solve complex data analytics problems through learning and adapting based on data.

Applications Specialization

This specialization is recommended for those students who are interested in building their knowledge and professional skills to develop effective data analytics solutions in selected application domains.

Business Analytics Specialization

This specialization is recommended for those students who are interested in building their knowledge and professional skills to apply intelligent strategies and technologies to support the collection, data analysis, presentation and dissemination of business information in enterprises.

Big Data Informatics Specialization

This specialization is recommended for those students who are interested in building their knowledge and professional skills to apply cutting-edge technologies and tools to tackle Big Data challenges that are essential for data processing and analytics in numerous applications.

Accelerated Master's Options for Undergraduate Students (4+1 Program)

The Computer and Information Science (CIS) department proposes the introduction of new accelerated master's (4+1) programs designed to allow qualified undergraduate students to seamlessly transition into the department's graduate programs. These programs will enable students to earn both a bachelor's and a master's degree in a reduced timeframe, enhancing their academic experience and providing a cost-effective pathway to advanced degrees.

Students enrolled in this option can take eligible 500-level courses during their junior and senior years, with up to 9 credit hours of such coursework being double-counted toward both degrees. Additionally, another 6 credit hours earned but not applied to the bachelor degree can later be counted toward the master's degree. Depending on the number of graduate courses taken while working toward the bachelor program, students will need to complete 15-21 credit hours to finish the master's program after earning their undergraduate degree.

BS in Computer and Information Science (CIS) or Software Engineering (SWE) can advance to MS in CIS, Data Science (DATA), Artificial Intelligence (AI), Software Engineering (SWE) or Cybersecurity and Information Assurance (CIA).

A maximum of 9 credits from combined undergraduate and graduate courses can be double-counted toward both the undergraduate and

graduate degrees. This will streamline the process and reduce the total credit load required to complete both degrees. Any 500-level course that is part of the respective master's program can be selected for double-counting, as shown in the following table. If there is a mismatch in credit hours between the combined course pair, only the smaller number of credits will be counted.

In addition, students may apply up to 6 additional credits of 500-level courses toward their master's degree, taken during their undergraduate study, though these credits cannot be double-counted. This allows students to make substantial progress toward their graduate degree while still completing their undergraduate requirements. However, the courses of these six additional credits should be listed in the corresponding graduate program.

To ensure that students entering the 4+1 programs are well-prepared for the academic rigor of graduate-level coursework, the following admission criteria will apply:

- A minimum cumulative GPA of 3.2 at the University of Michigan-Dearborn after completing at least 60 credits.
- Letters of recommendation are waived.
- A regular admission review will be streamlined for students with a cumulative GPA of 3.4 or higher at the University of Michigan-Dearborn after completing at least 85 credits.
- Students must have completed CIS 310, CIS350/3501, CIS 375, and CIS 427 with a grade of B or better.

The following undergraduate programs are approved for the MS-DATA 4+1 program:

1. BS in Computer Information Science (CIS)
2. BS in Software Engineering (SWE)

Degree Requirements

Regular admission to the program requires a Bachelor degree in a Science, Technology, Engineering, or Mathematics (STEM) field earned from an accredited program with an average of B or better. Each applicant is required to present official, complete transcripts of prior college work. Two letters of recommendation are required for admission. At least one letter must be from someone familiar with the candidate's academic performance. An entering student should have completed one course in probability and statistics, one course in programming, and one course in calculus II. A course in calculus III and a course in linear algebra are recommended but not required.

To satisfy the requirements for the MS degree in Data Science, all students admitted to the program are expected to complete 30 credit hours of approved graduate coursework, with a cumulative grade point average of B or better.

Minimum Grade Requirement in addition to maintaining a minimum cumulative GPA of 3.0 or higher every semester:

- Courses in which grades of C- or below are earned cannot be used to fulfill degree requirements.
- A minimum of a 3.0 cumulative GPA or higher is required at the time of graduation.

Requirements

Core Courses (18 credit hours)

Code	Title	Credit Hours
Required		
CIS/IMSE 556	Database Systems ¹	3
Choose one course (3 credit hours) from:		
CIS 5570	Introduction to Big Data	3
IMSE 586	Big Data Aanal & Visuliztn	3
Choose one course (3 credit hours) from:		
ECE 537/CIS 568	Data Mining	3
ECE 579	Intelligent Systems	3
CIS 581	Computational Learning ¹	3
CIS 583	Deep Learning ¹	3
STAT 531	Machine Learning and Computational Statistics	3
DS 633	Machine Learning for Business Intelligence	3
Choose one course (3 credit hours) from:		
IMSE 514	Multivariate Statistics	3
STAT 530	Applied Regression Analysis	3
STAT 535	Data Analysis and Modeling	3
STAT 560	Time Series Analysis	3
Choose one course (3 credit hours) from:		
DS 570	Prescriptive Business Analytics	3
IMSE 500	Models of Oper Research	3
IMSE 516	Project Management and Control	3
IMSE 561	Tot Qual Mgmt and Six Sigma	3
Choose one course (3 credit hours) from:		
CIS 545	Data Security and Privacy ¹	3
CIS 546	Security and Privacy in Wireless Networks ¹	3
ECE 527	Multimedia Secur & Forensics	3
HHS 570	Information Science and Ethics	3

¹ Simultaneous credit toward eligible undergraduate majors and MS Artificial Intelligence for students admitted to the 4+1 option. Please see the College's website for admission requirements and program details.

Specialization Courses (9 credit hours)

Note that the specializations are offered for guidance only. Students may select three courses from one specialization or three courses from multiple specializations for a broader approach to the degree. For students who are interested in selecting the Business Analytics Specialization, they need to choose 3 courses in that specialization as specified.

One of the following specializations is recommended:

Computational Intelligence Specialization

This specialization is recommended for those students who are interested in building their knowledge and professional skills to solve complex data analytics problems through learning and adapting based on data.

Code	Title	Credit Hours
CIS 511	Introduction to Natural Language Processing ¹	3
CIS 512	Introduction to Quantum Computing ¹	3
CIS 5570	Introduction to Big Data	3

CIS 5700	Advanced Data Mining	3
CIS 579	Artificial Intelligence ¹	3
CIS 581	Computational Learning ¹	3
CIS 582	Trustworthy Artificial Intelligence ¹	3
CIS 583	Deep Learning ¹	3
CIS 585	Advanced Artificial Intelligence	3
CIS 685	Research Advances in Artificial Intelligence	3
ECE 537/CIS 568	Data Mining	3
ECE 552	Fuzzy Systems	3
ECE 555	Stochastic Processes	3
ECE 579	Intelligent Systems	3
ECE 5831	Pat Rec & Neural Netwks	3
ECE 588	Robot Vision	3
ECE 679	Adv Intelligent Sys	3
IMSE 505	Optimization	3
IMSE 5205	Eng Risk-Benefit Analysis	3
IMSE 559	System Simulation	3
IMSE 605	Advanced Optimization	3
MATH 520	Stochastic Processes	3
MATH 523	Applied Linear Algebra	3
MATH 562	Mathematical Modeling	3
STAT 530	Applied Regression Analysis	3
STAT 531	Machine Learning and Computational Statistics	3
STAT 560	Time Series Analysis	3

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Applications Specialization

This specialization is recommended for those students who are interested in building their knowledge and professional skills to develop effective data analytics solutions in selected application domains.

Code	Title	Credit Hours
CIS 580	Data Analytics in Software Engineering	3
ESCI 585	Spatial Analysis and GIS	3
FIN 531	Fin Fundament & Value Creation	3
HIT 520	Clinical & Evidence Based Med	3
IMSE 516	Project Management and Control	3
IMSE 561	Tot Qual Mgmt and Six Sigma	3
IMSE 5655	Supply Chain Management	3
IMSE 567	Reliability Analysis	3
IMSE 580	Prod & Oper Engineering I	3
MKT 515	Marketing Management	3
OM 521	Operations Management	3
OM 571	Supply Chain Management	3
STAT 560	Time Series Analysis	3

Business Analytics Specialization

This specialization is recommended for those students who are interested in building their knowledge and professional skills to apply intelligent strategies and technologies to support the collection, data

analysis, presentation and dissemination of business information in enterprises.

Code	Title	Credit Hours
Choose two courses from:		
DS 630	Applied Forecasting with Python	3
DS 631	Decision Analysis and Simulation	3
DS 632	System Simulation	3
Choose one course from:		
FIN 531	Fin Fundament & Value Creation	3
ISM 525	Fundamentals of Information Systems	3
MKT 515	Marketing Management	3
OM 521	Operations Management	3

Big Data Informatics Specialization

This specialization is recommended for those students who are interested in building their knowledge and professional skills to apply cutting-edge technologies and tools to tackle Big Data challenges that are essential for data processing and analytics in numerous applications.

Code	Title	Credit Hours
CIS 511	Introduction to Natural Language Processing ¹	3
CIS 515	Computer Graphics and Visual Computing ¹	3
CIS 525	Web Technology ¹	3
CIS 534	Semantic Web	3
CIS 536	Text Mining and Information Retrieval ¹	3
CIS 540	Foundation of Information Security	3
CIS 545	Data Security and Privacy ¹	3
CIS 546	Security and Privacy in Wireless Networks ¹	3
CIS 548	Security and Privacy in Cloud Computing	3
CIS 552	Information Visualization with Parallel Computing ¹	3
CIS 559	Principles of Social Network Science	3
CIS 562	Web Information Management	3
CIS 5570	Introduction to Big Data	3
CIS 5700	Advanced Data Mining	3
CIS 571	Web Services	3
CIS 577	S/W User Interface Dsgn&Analys	3
CIS 586	Advanced Data Management	3
CIS 589	Edge Computing ¹	3
CIS 652	Advanced Information Visualization and Virtualization	3
CIS 658	Research Advances in Data Management	3
ECE 524	Interactive Media	3
ECE 525	Multimedia Data Stor & Retr	3
ECE 5251	MM Design Tools I	3
ECE 5252	MM Design Tools II	3
ECE 528	Cloud Computing	3
ECE 576	Information Engineering	3
ESCI 585	Spatial Analysis and GIS	3
IMSE 564	Applied Data Analytics and Modeling for Enterprise Systems	3
IMSE 570	Enterprise Information Systems	3

IMSE 577	Human-Computer Interaction	3
IMSE 586	Big Data Aanal & Visuliztn	3
OM 665	ERP in SCM	3

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Coursework/Capstone/Thesis (3 credit hours)

Students in this program should choose one of three options: (1) coursework, (2) capstone project, or (3) thesis.

Option 1: Coursework. Students choosing this option must take one additional course (3 credit hours) from a specialization area listed above.

Option 2: Capstone Project. Students choosing this option must complete a capstone project under the supervision of a faculty advisor through a capstone course (3 credit hours). Acceptable capstone courses are:

Code	Title	Credit Hours
CIS 695	Master's Project	3
DS 635	Business Analytics Experience	3
ECE 695	Master's Project	3
EMGT 590	Capstone Project	3

Option 3: Thesis. Students choosing this option must complete a thesis under the supervision of a faculty advisor through a thesis course (6 credit hours). Acceptable thesis courses are: CIS 699, IMSE 699, and ECE 699. Students only need to take two (instead of three) specialization courses (6 credit hours) in this option.

Note that no more than a total of 15 credit hours may be taken in the College of Business for this degree (core, specializations, and capstone/thesis).