

ARTIFICIAL INTELLIGENCE

The MS in Artificial Intelligence program consists of 30 graduate-level semester credit hours, of which 12 are foundation, 9 are concentration, and 9 are elective (including the three options of coursework or project or thesis). A concentration must be declared by admitted students.

The program includes 4 concentrations, in (1) Computer Vision, (2) Machine Learning, (3) Knowledge Management and Reasoning, and (4) Intelligent Interaction. Students must choose one of three options: coursework, MS project, or MS thesis.

The program may be completed entirely on campus, entirely online, or through a combination of on-campus and online courses.

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

Accelerated master's (4+1) programs in the Computer and Information Science (CIS) department 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.

Applying to the 4+1/Accelerated option is a two-stage process coordinated with both your undergraduate and graduate advising teams. For detailed instructions and application links, please visit the central 4+1 programs webpage (<https://umdearborn.edu/academics/program/41-programs/>).

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

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

Requirements

To satisfy the requirements for the MS degree in Artificial Intelligence, all students admitted to the program are expected to complete a minimum of thirty semester hours of graduate coursework, with a cumulative grade point average of B or better. The program of study consists of core courses, concentration courses, and electives with coursework/project/thesis options.

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.

Code	Title	Credit Hours
Required Core (12 credits):		12
CIS 505	Algorithm Analysis and Design ¹	
CIS 553	Software Engineering	
CIS 579	Artificial Intelligence ¹	
CIS 581	Computational Learning ¹	
	or ECE 579 Intelligent Systems	

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.

Concentrations

Students must choose one concentration (Computer Vision, Intelligent Interaction, Knowledge Management and Reasoning, Machine Learning) and complete 3 courses (9 credits) from the selected concentration.

Electives and Options

(9 credits): Any course(s) from an MS in AI concentration area(s) outside the student's selected concentration can be an elective course(s). Additionally, the elective course(s) can be drawn from other CECS and partner college courses by faculty advisor or program director approval (excluding ENGR 500 and ENGR 501). The total number of elective courses should be three, including one of three options: (i) Coursework: taking three elective courses; (ii) Project: taking an MS Project by completing a 1-semester project (through the MS Project course in lieu of an elective) and two additional elective courses, or (iii) Thesis: taking an MS Thesis by completing a 2-semester thesis project (through the MS Thesis course in lieu of two electives) and one additional elective course. It is mandatory that the student select one of these three options.

Option 1: Coursework. This option requires three elective courses from an MS in AI concentration area(s) outside the student's selected concentration. The minimum requirements for this option are as follows:

- Foundation courses – 12 credit hours
- Concentration courses – 9 credit hours
- Elective courses – 9 credit hours

Option 2: MS Project. This option requires a project report describing the results of an independent study project under the supervision of the advisor. The scope of the research topic for the project should be defined in such a way that a full-time student could complete the requirements for a master's degree in 24 months or 6 semesters following the completion of course work by regularly scheduling graduate research credits. The minimum requirements for this option are as follows:

- Foundation courses – 12 credit hours
- Concentration courses – 9 credit hours
- Elective courses – 6 credit hours
- Master's project – 3 credit hours

Option 3: MS Thesis. This option requires a research thesis prepared under the supervision of the advisor. The thesis describes a research investigation and its results. The scope of the research topic for the thesis should be defined in such a way that a full-time student could complete the requirements for a master's degree in 24 months or 6 semesters following the completion of course work by regularly scheduling graduate research credits. The minimum requirements for this option are as follows:

- Foundation courses – 12 credit hours
- Concentration courses – 9 credit hours
- Elective courses – 3 credit hours
- Master's Thesis – 6 credit hours

Concentrations

Select one of the following concentrations and complete 3 courses (9 credits) from the selected concentration:

Code	Title	Credit Hours
Computer Vision Concentration		
Select 3 courses (9 credits) from the following:		9
CIS 515	Computer Graphics and Visual Computing ¹	
CIS 551	Advanced Computer Graphics	
CIS 552	Information Visualization with Parallel Computing ¹	
CIS 652	Advanced Information Visualization and Virtualization	
ECE 577	Engineering in Virtual World	
ECE 585	Pattern Recognition	
ECE 586	Digital Image Processing	
ECE 587	Sel Top:Image Proc/Mach Vision	
ECE 588	Robot Vision	
ECE 5831	Pat Rec & Neural Netwks	
HCDE 530	Information Visualization	

¹ Students admitted to the 4+1 program may substitute CIS 515 for CIS 451, and CIS 552 for CIS 452.

Code	Title	Credit Hours
Intelligent Interaction Concentration		
Select 3 courses (9 credits) from the following:		9
CIS 556	Database Systems	
CIS 5570	Introduction to Big Data	
CIS 569	Internet of Things and Smart Cities	
CIS 582	Trustworthy Artificial Intelligence ¹	
CIS 585	Advanced Artificial Intelligence	
CIS 587	Computer Game Design and Implementation ¹	
CIS 588	Computer Game Design II ¹	
CIS 589	Edge Computing ¹	
CIS 679	Research Advances in Computational Game Theory and Economics	
ECE 531	Intelligent Vehicle Systems	
ECE 532	Auto Sensors and Actuators	
ECE 545	Intro Robot Syst	
ECE 544	Mobile Robots	
IMSE 548	Res.Meth.Human Fctrs/Ergonomic	
IMSE 577	Human-Computer Interaction	

¹ Students admitted to the 4+1 program may substitute CIS 582 for CIS 482, CIS 587 for CIS 487, CIS 588 for CIS 488, and CIS 589 for CIS 489.

Code	Title	Credit Hours
Knowledge Management and Reasoning Concentration		
Select 3 courses (9 credits) from the following:		9
CIS 511	Introduction to Natural Language Processing ¹	
CIS 536	Text Mining and Information Retrieval ¹	
CIS 540	Foundation of Information Security	
CIS 552	Information Visualization with Parallel Computing ¹	
CIS 568	Data Mining	
or ECE 537	Data Mining	
CIS 581	Computational Learning ¹	
CIS 582	Trustworthy Artificial Intelligence ¹	
CIS 583	Deep Learning ¹	
CIS 585	Advanced Artificial Intelligence	
CIS 586	Advanced Data Management	
CIS 685	Research Advances in Artificial Intelligence	
CIS 5700	Advanced Data Mining	
ECE 5001	Analytic and Comp Math	
IMSE 510	Probability & Statistical Mod	
IMSE 514	Multivariate Statistics	

¹ Students admitted to the 4+1 program may substitute CIS 511 for CIS 411, CIS 536 for CIS 439, CIS 552 for CIS 452, CIS 581 for CIS 481, CIS 582 for CIS 482, and CIS 583 for CIS 483.

Code	Title	Credit Hours
Machine Learning Concentration		
Select 3 courses (9 credits) from the following:		9

CIS 511	Introduction to Natural Language Processing ¹
CIS 512	Introduction to Quantum Computing ¹
CIS 536	Text Mining and Information Retrieval ¹
CIS 5570	Introduction to Big Data
CIS 581	Computational Learning ¹
CIS 583	Deep Learning ¹
CIS 585	Advanced Artificial Intelligence
ECE 552	Fuzzy Systems
ECE 555	Stochastic Processes
ECE 579	Intelligent Systems
ECE 5831	Pat Rec & Neural Netwks
ECE 679	Adv Intelligent Sys
IMSE 505	Optimization
IMSE 606	Advanced Stochastic Processes

¹ Students admitted to the 4+1 program may substitute CIS 511 for CIS 411, CIS 512 for CIS 412, CIS 536 for CIS 439, CIS 581 for CIS 481, and CIS 583 for CIS 483.

Learning Goals

1. Understand representations, algorithms and techniques used across works in artificial intelligence and be able to apply and evaluate them in applications as well as develop their own.
2. Understand and apply machine-learning techniques, in particular to draw inferences from data and help automate the development of AI systems and components.
3. Understand the various ways and reasons humans are integrated into mixed human-AI environments, whether it is to improve overall integrated system performance, improve AI performance or influence human performance and learning.
4. Understand the ethical concerns in developing responsible AI technologies.
5. Implement AI systems, model human behavior, and evaluate their performance.