Artificial Intelligence, Minor

Minor in Artificial Intelligence

The AI minor aims to introduce students to both technical and societal issues associated with artificial intelligence, and provides students with exposure to some of the mathematical and algorithmic underpinnings of the field — including problem solving and machine learning. Students will be introduced to applications of AI in areas as diverse as computer vision, speech recognition and language understanding, robotics, human-AI interaction, and engineering. They'll also get a taste of ethical, policy and economic issues that arise from the growth of AI, as well as the connections between artificial and human intelligence. The AI minor is designed to be widely accessible to CMU students who have an appropriate background in math and programming.

Note: The AI minor is not available to SCS students, nor is there an AI concentration. Instead, SCS students can take a concentration (http://coursecatalog.web.cmu.edu/schools-colleges/schoolofcomputerscience/scs-concentrations/) in related areas, including machine learning, robotics, language technologies and human-computer interaction.

What You'll Learn

Students who minor in AI will:

- Understand how to distill a real-world challenge into an artificial intelligence problem.
- Understand, implement, and use state-of-the art AI and machine learning techniques for dealing with real-world problems.
- Design AI systems that can learn from and interact effectively with people.
- Analyze the commercial and societal impact of AI technologies and understand the underlying responsibility to consider the ethical, privacy, moral and legal implications of AI technologies.

How to Apply

Complete our application (https://www.cs.cmu.edu/bs-in-artificial-intelligence/forms/ai-additional-major-minor-request) including a statement (maximum one page) of why you want to take the minor and how it fits into your career goals. Students must have all prerequisites completed and 07-280, while maintaining a "C" average in aforementioned courses.

Students must apply for admission no later than the semester before they intend to graduate. An admission decision will usually be made within one month. Students are encouraged to apply as early as possible in their undergraduate careers so the advisor of the AI minor can provide advice on their curriculum. Applications can be accepted based on midterm grades.

Students interested in pursuing a minor in Artificial Intelligence should first consult with the Program Administrator (bsai@cs.cmu.edu) after completion of the prerequisites and 07-280. Students must earn a "C" average in all prerequisite coursework (including 07-280) in order to be admitted to the minor.

Curriculum

The minor consists of six courses, including three courses in the AI core, two technical electives and one elective in societal aspects of AI.

Prerequisites

(4 courses)		Units
15-122	Principles of Imperative Computation	12
21-112	Integral Calculus	10
or 21-120	Differential and Integral Calculus	
or 21-259	Calculus in Three Dimensions	
21-127	Concepts of Mathematics	12
or 21-128	Mathematical Concepts and Proofs	
or 15-151	Mathematical Foundations for Computer Science	
21-240	Matrix Algebra with Applications	10
or 21-241	Matrices and Linear Transformations	

The following courses are required for the Minor in Artificial Intelligence:

Required Core Courses

(3 courses)		Units
15-259	Probability and Computing	9-12
or 21-325	Probability	
or 21-425	Probability and Martingales	
or 36-218	Probability Theory for Computer Scientists	
or 36-225	Introduction to Probability Theory	
or 36-235	Probability and Statistical Inference I	
07-280	Artificial Intelligence and Machine Learning I	12
07-380	Artificial Intelligence and Machine Learning II	12

Technical Electives

Students are required to take an approved course from two of the following three cluster areas. Each course must be a minimum of 9 units.

(2 courses from any of the three areas)		Units
Cognition and Action Cluster		
15-386	Neural Computation	9
15-482	Autonomous Agents	12
15-494	Cognitive Robotics: The Future of Robot Toys	12
16-350	Planning Techniques for Robotics	12
16-362	Mobile Robot Algorithms Laboratory	12
16-384	Robot Kinematics and Dynamics	12
85-213	Human Information Processing and Artificial Intelligence	9
85-412	Cognitive Modeling	9
85-419	Introduction to Parallel Distributed Processing	9
85-420	Biologically Intelligent Exploration	9
85-472	Cognitive Neuropsychology	9
Machine Learning Cluster		
10-403	Deep Reinforcement Learning & Control	12
10-405	Machine Learning with Large Datasets (Undergraduate)	12
10-414	Deep Learning Systems: Algorithms and Implementation	12
10-417	Intermediate Deep Learning	12
10-418	Machine Learning for Structured Data	12
10-422	Foundations of Learning, Game Theory, and Their Connections	12
10-423	Generative AI	12
10-424	Bayesian Methods in Machine Learning	12
10-425	Introduction to Convex Optimization	12
11-441	Machine Learning with Graphs	9
11-485	Introduction to Deep Learning	12
15-388	Practical Data Science	9
or 67-364	Practical Data Science	
36-401	Modern Regression	9
36-402	Advanced Methods for Data Analysis	9
Perception and Language Cluster		
11-411	Natural Language Processing	12
11-442	Search Engines	9
11-492	Speech Technology for Conversational AI	12
15-387	Computational Perception	9
15-463	Computational Photography	12
16-385	Computer Vision	12
85-370	Cognitive Neuropsychology Research Methods	9
85-408	Visual Cognition	9

Societal Aspects of AI

Students are required to take an approved course from one of the following two cluster areas. Each course must be a minimum of 9 units.

(1 course from one of the two cluster areas)		Units
Human-AI Interaction Cluster		
05-317	Design of Artificial Intelligence Products	12
05-318	Human AI Interaction	12

05-391	Designing Human Centered Software	12
16-467	Introduction to Human Robot Interaction	12
AI and Humanity Cluster		
16-161	Artificial Intelligence and Humanity	12
16-735	Ethics and Robotics	12
17-200	Ethics and Policy Issues in Computing	9
79-302	Killer Robots? The Ethics, Law, and Politics of Drones and A.I. in War	9
80-249	AI, Society, and Humanity	9
88-230	Human Intelligence and Human Stupidity	9
88-275	Bubbles: Data Science for Human Minds	9

***Two mini courses can be combined to form one 9 unit course.**

Double Counting

Students pursuing a minor in AI can double count, at most, **two courses** total from the AI course requirements (not counting the prerequisite courses) towards all other majors and minors they're pursuing. Students with majors that overlap substantially with AI should consult with the Program Administrator (bsai@andrew.cmu.edu) to review their audit for any potential issues.