

AIM 5014: Special Topics, Artificial General Intelligence

Prof. Iddo Drori, Fall 2025

Prerequisites. Any one of the following classes or an equivalent course
Machine Learning, AI, Deep Learning, Computer Vision, Natural Language Processing.

Activities. The course includes a competition, project, and presentations.

Level. Graduate class, 3 credits, elective.

Description

The Artificial General Intelligence course provides the mathematical foundations and definitions of robust, responsible, and safe AGI systems. The class covers the five levels of development toward AGI: (i) Chatbots and coders (such as ChatGPT and Claude code); (ii) Reasoning LLMs (with human-level problem solving); (iii) AI Agents (systems that use tools and take actions); (iv) AI innovators that participate in scientific discovery; and (v) AI organizations (capable of performing work of an entire lab or organization). The class addresses reasoning, decision-making, consciousness, and intelligence. It covers foundation models, attention mechanisms, optimization, pre-training, and post-training. Topics include video analysis and synthesis, autonomous agents and world models, self and social models, multi-agent systems, collective intelligence, self-improvement, genetic and evolutionary methods, continuous learning, and open exploration. The course emphasizes robustness, safety, and control by examining misuse, risks, and mitigation strategies. It concludes with discussions on applications of AGI and their societal impact in climate science, education, quantum computing, finance, and robotics. The course combines mathematical foundations with research from top academic venues (e.g., Nature, Science, PNAS, NeurIPS, ICLR, ICML) and insights into commercial AI systems.

Textbook.

- Artificial General Intelligence: Mathematical Foundations, Iddo Drori, Cambridge University Press, In progress

Schedule. Class meets Wednesdays between 5:30-7:30pm.

Lectures

- First day of classes (Monday, August 25)
- Lecture 1 (Wednesday, August 27): Introduction
- Labor Day (Monday, September 1): University holiday, no classes held
- Lecture 2 (Wednesday, September 3): Reasoning LLMs, synthetic data, perfect verifiers, evaluation
- Lecture 3 (Wednesday, September 10): AI agents, self-improving agents
- Lecture 4 (Wednesday, September 17): AI innovators for scientific discovery
- Rosh Hashanah Eve (Monday, September 22): No classes after 1pm.
Rosh Hashanah (Tuesday, September 23 - Wednesday, September 24): No classes, University closed.
- Yom Kippur Eve (Wednesday, October 1): No classes after 1pm.
Yom Kippur (Thursday, October 2): No classes, University closed.
- Sukkot Eve (Monday, October 6): Sukkot Eve, no classes after 1pm.
Sukkot (Tuesday, October 7 - Wednesday, October 8): No classes, University closed.
- Shemini Atzeret Eve (Monday, October 13): No classes after 1pm.
Shemini Atzeret and Simchat Torah (Tuesday, October 14 - Wednesday, October 15): No classes, University closed.
- Lecture 5 (Wednesday, October 22): World, self, and social models
- Lecture 6 (Wednesday, October 29): Genetic and evolutionary methods, open-ended autonomous agents
- Lecture 7 (Wednesday, November 5): Collective intelligence, multi-agent systems, AI organizations
- Lecture 8 (Wednesday, November 12): Real-time text, audio, and video generative models
- Lecture 9 (Wednesday, November 19): Humanoid robots
- Lecture 10 (Wednesday, November 26): Drosophila brain connectome, human brain connectome and function
- Thanksgiving (Thursday, November 27 - Friday, November 28): No classes, University closed.
- Lecture 11 (Wednesday, December 3): Cognitive architectures, consciousness, and self-awareness, human-AI co-evolution
- Lecture 12 (Wednesday, December 10): AGI for climate science, education, and finance
- Lecture 13 (Wednesday, December 17): Social responsibility, safety, and security
- Last day of classes (Tuesday, December 23)