

How to AI (ALMOST) ANYTHING – SPRING 2025

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Instructors: Paul Liang, ppliang@mit.edu, TAs: Chanakya Ekbote, David Dai

Class: Tues and Thurs 1-2pm, in Media Lab complex classroom E15-341

Office hours: Tues and Thurs 2-230pm, in Media Lab area E15-384 (Multisensory Intelligence Group)

Recommended preparation: Students are expected to have some basic experience in machine learning and artificial intelligence through coursework or research.

Introduction

Artificial Intelligence (AI) holds great promise as a technology to enhance digital productivity, physical interactions, overall well-being, and the human experience. To enable the true impact of AI, these systems will need to be grounded in real-world data modalities, from language-only systems to vision, audio, sensors, medical data, music, art, smell, and taste. This course will introduce the basic principles of AI (focusing on modern deep learning and foundation models) and how we can apply AI to novel real-world data modalities. In addition, we will introduce the principles of multimodal AI that can process many modalities at once, such as connecting language and multimedia, music and art, sensing and actuation, and more.

Through lectures, readings, discussions, and a significant research component, this course will develop critical thinking skills and intuitions when applying AI to new data modalities, knowledge of recent technical achievements in AI, and a deeper understanding of the AI research process.

Course format

The course will be in-person, given its hands-on and discussion-based approach. Students are expected to read papers before each course session, and discussions will be moderated to ensure a deep understanding of all papers and critical thinking of the paper's strengths and possible avenues for future research. In addition, students will complete hands-on intermediate assignments on applying AI to their data modalities and tasks of interest, culminating in a novel research project. These course projects are expected to be done in teams, with a research topic on AI for new data modalities and/or multimodal AI, and pre-approved by the course instructors.

Piazza We will be using Piazza for class communication and announcement. The system is highly catered to getting you help fast and efficiently from classmates and instructors. You can post publicly or privately to the instructor and TAs through the Piazza website.

<https://piazza.com/mit/spring2025/mass60>

Website The main public course website is available online:

<https://mit-mi.github.io/how2ai-course/spring2025/>

Course Material

Required:

- Reading material will be based on published technical papers available via the ACM/IEEE/Springer digital libraries or freely available online (e.g., arxiv.org). All MIT students have already free access to these digital archives.
- For project assignments, previous experience in Python and deep learning (e.g., Pytorch) programming is expected.

Course Topics

*** Exact topics and schedule are subject to change, based on student interests and course discussions. ***

- Tentative [course calendar here](#)

Course Project Timeline

(Exact timeline is subject to change)

- **Pre-proposal** (Due Tuesday 2/11 at 9pm ET) – You should have selected your teammates, dataset, and task.
- **Proposal report** (Due Tuesday 2/25 at 9pm ET) - Description of your research ideas, review of relevant papers, and initial results.
- **Midterm report** (Due Tuesday 4/1 at 9pm ET) – Intermediate report documenting the updated results in exploring new research ideas.
- **Final report** (Due Tuesday 5/20 at 9pm ET) – Final report describing explored research ideas, with experimental results, analysis, and discussion.

Grades

The first 40% comes from reading assignments and discussions:

- o Reading assignments 20%
- o Presentation leads 20%
- Reading assignments
 - o There are a total of 7 reading assignments planned this semester. Each reading assignment will consist of 2 main parts:
 - Assigned reading paper: Read the assigned papers and summarize the main takeaway points of each paper.
 - Research question probes: Reflect on the question probes related to the reading papers and prepare discussion points.
 - o The grading for each reading assignment is planned as:
 - **1 point** for scouting relevant papers, blog posts, or other resources
 - **2 points** for the takeaway points of all assigned reading papers
 - **3 points** for the discussion points related to the question probes
 - o Reading assignments will also contain a section for students to share their clarification questions about the reading papers. This section is optional and is not directly graded. This section will help instructors and discussion leads prepare for the main discussion during lecture time.

- o Students are expected to submit all reading assignments. If a reading assignment is not submitted (see the late submission section below for details), 0 points will be given to that assignment.
- Presentation leads
 - o 3 or 4 times during the semester (depending on the number of registered students), each student will be scheduled to lead a presentation in a specific role. There are around 5 roles, including reviewing the paper, understanding and explaining the paper's codebase, looking for prior inspirations and future work inspired by the paper, and so on.
 - o The assigned students will complete these tasks (in addition to the reading assignments) and present their findings to the class during Thursday's discussion period.
 - o The grading for each presentation leads is planned as follows:
 - **5 points** for creating and presenting their findings to the class
 - o The final score will be computed by taking the top 2 scores for the weeks you have been assigned as a presentation lead.
 - o Please refer to the detailed instructions for presentation leads posted on Piazza.

The second 60% comes from the course project:

- o Proposal report and presentation 10%
- o Midterm report and presentation 15%
- o Final report and presentation 25%
- o Bi-weekly written updates 10%
- Project preference form
 - o This form is designed to help students with the team-matching process, for the course research project.
- Pre-proposal
 - o This short 1-page pre-proposal is designed to confirm teams and share thoughts about the research project, including key related work, main ideas, and datasets + evaluation.
- Proposal and literature review
 - o The proposal report should present the initial research ideas for the course project. Students are expected to explore a new data modality or task understudied in AI and new research ideas to process this new data modality or task. The proposal should summarize these new data modalities, new research ideas, and a robust evaluation plan.
 - o An important part of this proposal report will be a detailed literature review, including recent papers and models related to the data modality, research tasks, and new research ideas.
- Bi-weekly updates
 - o Project teams are expected to meet weekly with instructors after Thursday's class.
 - Project meetings will be about 20–30 minutes long.
 - Each meeting will usually be with one instructor.
 - o To help streamline the project meetings, team members need to submit a written update document before each Thursday meeting.
 - Updates are due Tuesdays at 9pm before the meeting, reports (proposal + midterm+final) are also due Tuesdays at 9pm.
 - Each team can decide to use Google Docs or Google Slides for these updates.
 - The goal is to keep these updates informal, with only the main points highlighted in the updates.
 - For example, a bullet list with 3-4 main takeaways, along with a few figures and tables, may be sufficient.

- The same online document should be used for all weekly meetings so that instructors can easily review previous updates.
 - Bi-weekly updates will be graded by instructors, with 10 points per update meeting.
- Schedule for bi-weekly written updates and reports:
 - Week 3 (2/20): **Proposal presentations**
 - Week 4 (2/25): **Proposal report**: data collection and preprocessing, initial AI ideas
 - Week 6 (3/13): Initial implementation of new ideas
 - Week 9 (4/1): **Midterm report**: first complete round of results for idea
 - Week 9 (4/3): **Midterm presentations**
 - Week 11 (4/17): Updated results for research idea
 - Week 13 (5/1): Error analysis, ablations, and visualizations
 - Week 14 (5/8): **Project presentations**
 - Week 16 (5/20): **Final report**
- Midterm report and presentation
 - The goal of the midterm report is to summarize the current research progress. Students should have started already exploring new research ideas. The midterm report should summarize these initial results and discuss them. This report should also present the updated list of research ideas that the team plans to explore.
- Final report
 - The final report should follow a similar structure to a research paper. It should motivate the problem and research ideas. It should present the novel approaches, describe the experiment, and discuss the results.
- Final presentation
 - The final project assignment will also include either an in-person poster or oral presentation, to be confirmed. The poster presentations may be open to the general MIT Media Lab population.

Notes about absences and late submissions

In general, submitting assignments on time lets the instructional team provide feedback in a more timely and efficient manner. Timely submissions are particularly important for assignments with discussions and peer feedback. Also, it is expected that students will attend the lectures in person (or via Zoom when the course is required to be performed remotely). Live attendance is an essential component of this course, given that it is centered around live discussions. Given the live nature of the discussions, course sessions will not be recorded.

Medical-related absences If for a medical reason, you require some extra time for an assignment or may not be able to attend the lecture in person, please contact instructors as soon as possible (the best option is usually via Piazza) and we will help define a new plan that aligns with your constraints.

- Absence requests
 - Students should contact instructors as promptly as possible regarding course absences, with a preference before the course lecture itself.
 - If you plan to be absent for more than one class, please contact the instructors as promptly as possible.

Late submission wildcards We offer students and project teams some late submission wildcards to help deal with potential overlaps with other courses or research deadlines. The details are expressed below:

- Reading assignment wildcards (2 per student)

- Each wildcard gives the student a 24-hour extension for the reading assignment deadline.
- Maximum of 1 wildcard per week
 - This constraint is to ensure that sufficient time is made available to prepare for the discussion.
- o Project assignment wildcards (2 per team)
 - This gives the project team a 24-hour extension for their project assignment deadline.
 - These can be used for proposal, midterm and/or final deadlines
 - It is possible to use 2 wildcards for the same deadline, giving the team 48 hours extension.
 - Teams are required to message instructors via Piazza before the deadline, to inform them that they will be using 1 or 2 wildcards.

Academic integrity

From the Office of Student Citizenship, W20-507, (617) 258-8423

In this course, I will hold you to the high standard of academic integrity expected of all students at the Institute. I do this for two reasons. First, it is essential to the learning process that you are the one doing the work. I have structured the assignments in this course to enable you to gain a mastery of the course material. Failing to do the work yourself will result in a lesser understanding of the content, and therefore a less meaningful education for you. Second, it is important that there be a level playing field for all students in this course and at the Institute so that the rigor and integrity of the Institute's educational program are maintained.

Violating the Academic Integrity policy in any way (e.g., plagiarism, unauthorized collaboration, cheating, etc.) will result in official Institute sanction. Possible sanctions include receiving a failing grade on the assignment or exam, being assigned a failing grade in the course, having a formal notation of disciplinary action placed on your MIT record, suspension from the Institute, and expulsion from the Institute for very serious cases.

Please review the Academic Integrity policy and related resources (e.g., working under pressure; how to paraphrase, summarize, and quote; etc.) and contact me if you have any questions about appropriate citation methods, the degree of collaboration that is permitted, or anything else related to the Academic Integrity of this course.

Special accommodations for students with disabilities

MIT is committed to the principle of equal access. Students who need disability accommodations are encouraged to speak with Disability and Access Services (DAS), prior to or early in the semester so that accommodation requests can be evaluated and addressed in a timely fashion. If you have a disability and are not planning to use accommodations, it is still recommended that you meet with DAS staff to familiarize yourself with their services and resources. Please visit the DAS website for contact information.

Once you have been approved for accommodations, inform us so we can assist with implementation.

Website: <https://studentlife.mit.edu/das>

Student mental health

Undergraduate Students: Personal and medical issues can make it hard to focus on academics. If you find that something is getting in the way of your ability to attend class, complete work, or take an exam, you should contact a dean in Student Support Services (S3). The deans will provide you with support and help you work with us to determine next steps. We ask that you go to S3 so we know you have had a chance to talk through your situation with someone and to connect with any resources you might need. You can reach out to a dean you have worked with in the past, join their virtual help queue (<https://sicp-s3.mit.edu/queue>), or e-mail s3-support@mit.edu.

*If you would like to consult with S3 about any aspects of your syllabus, you can reach out to a dean you know or e-mail s3-support@mit.edu to request a consultation.

Website: <https://studentlife.mit.edu/s3>

Graduate Students: As a graduate student, a variety of issues may impact your academic career, including faculty/student relationships, funding, and interpersonal concerns. In the Office of Graduate Education (OGE), GradSupport provides consultation, coaching, and advocacy to graduate students on matters related to academic and life challenges. If you are dealing with an issue that is impacting your ability to attend class, complete work, or take an exam, you may contact GradSupport by email at gradsupport@mit.edu or via phone at (617) 253-4860.

*If you would like to consult with GradSupport about any aspects of your syllabus, please email gradsupport@mit.edu to request a consultation.

Website: <https://oge.mit.edu/development/gradsupport/>

Diversity

MIT values an inclusive environment. I hope to foster a sense of community in this classroom and consider this classroom to be a place where you will be treated with respect. I welcome individuals of all backgrounds, beliefs, ethnicities, national origins, gender identities, sexual orientations, religious and political affiliations – and other visible and nonvisible differences. All members of this class are expected to contribute to a respectful, welcoming, and inclusive environment for every other member of the class. If this standard is not being upheld, please feel free to speak with me.