Fall 2023: Incentives and Learning

Meetings: Tuesdays and Thursdays 9:45am-11:00am ET, SEC 1.402
Instructor: Yiling Chen, yiling@seas.harvard.edu
Teaching fellow: Safwan Hossain, shossain@g.harvard.edu
Office Hours:
Yiling: After 9/4, Tuesdays 11:00-12:00 or by appointment, SEC 5.306. (I will hold a Zoom office hour on Tuesday August 22, 10:30am - 11:30am,
Safwan: Mondays 10am-11am or by appointment, SEC 5.421.

Note: Enrollment of this course will be limited to facilitate seminar-style discussion of papers. If you are interested in enrolling, please comple

Note+: Since I posted a draft reading list late, I've extended the time to complete the above survey to Friday August 25.

General Information

This is a rotating topics course that studies the interplay between computation and economics. The class is mostly seminar style. Readings are drawn from artificial intelligence, theoretical computer science, machine learning, multi-agent systems, economics, psychology and operations research.

The topic of Fall 2023 is **incentives and learning**. We aim to expose students to a diverse set of topics at the intersection of machine learning and incentive alignment. Machine learning traditionally focuses on deriving rules and predictions from past observations. Implicitly, this assumes that (1) past observations are representative of the underlying data-generation process and (2) future data-generation process will stay unchanged. Neither remains true when machine learning is used for decision making (hence affects utility of agents) and when data are generated by people or other strategic identities. From a different perspective, in strategic interactions, agents can now be assisted by algorithmic predictions. Having access to algorithmic predictions may change the game that the agents play: the predictions may lead agents to deviate from equilibrium behavior or possibly coordinate agent behavior to help achieving a more desirable out. In Fall 2023, we'll take an adventure to explore recent works that novelly emphasizes on the interaction between learning and incentives.

Course Goals

The main goal of this course is to provide an introduction to the interdisciplinary literature for students looking to identify research directions in this area. Along the way, we will also develop some technical background in game theory, economic modeling, machine learning and algorithms, and hopefully also more general skills related to reading papers and thinking about research problems. *This is a seminar course and students will be expected to participate in class discussion, present one or more papers, and write a final course paper.* Students are expected to achieve a comfort level with both economic and computational thinking, become familiar with the status quo in the area, and, to the extent possible, work on an open research problem.

Prerequisites

Formal requirements include a basic course in calculus (AM 21a or equivalent), a linear algebra course (AM 21b or equivalent), probability course (STAT 110 or equivalent) and a background in either AI or microeconomic theory (CS 181, CS 182, EC 1011a, or equivalent). The informal requirement is a reasonable level of mathematical maturity. *CS 136 is helpful but not required. Familiarity with economic theory is helpful but not required. Familiarity with AI, especially machine learning, is helpful but not required.*

Mathematical analysis and formalism will be fundamental to the course, and students should expect to learn additional mathematics on their own as necessary. I recommend that students unsure about their background read a couple of papers from the reading list (after we have populated it), and email or talk to us during the first week.

Course Structure and Grading Policy

This course is primarily a seminar course. We will spend most of the term reading and discussing research papers. However, we will include lectures on some important background materials that will help with understanding the material in the papers that we will read. There will be 2 problem sets.

The final grade in the class will break down roughly as: participation and comments 25%, problem sets 20%, presentation of research papers 20%, project 35%.

Students are expected to read the papers in advance, submit comments about the papers and interact with peers on Perusall before class, participate in class discussion, and present and lead discussion on one or more sets of papers (typically in a pair).

In lieu of a final exam there will be a final research paper, on a topic of the student's choice. Good papers can form a foundation for a research leading to a conference publication, or a senior thesis for undergraduates. *Students are encouraged to work in pairs for final projects other than exposition papers*.

Collaboration Policy: Discussion and the exchange of ideas are essential to academic work. If you work in a team for final project, collaboration within the team is essential and strongly encouraged. However, it is expected that each member of a team makes roughly equal contributions. For final projects, you are encouraged to consult with your classmates outside of your team on the choice of topics and to share sources. You may find it useful to discuss your chosen topic with your peers, particularly if you are working on the same topic as another team. However, you should ensure that any written work your team submit for evaluation is the result of your team's research and writing and that it reflects your team's approach to the topic. You must also adhere to standard citation practices in this discipline and properly cite any books, articles, websites, lectures, etc. that have helped you with your work. If you received any help with your writing (feedback on drafts, etc), you must also acknowledge this assistance.

Policy on Use of AI tools: CS 236r is a research-oriented course that calls for independent thinking and novelty. We are adopting a maximally restrictive policy regarding use of generative AI tools this semester, but we welcome feedbacks on appropriate use of AI tools that does not compromise the learning goal of the course. In this year's CS 236r, we expect that all work students submit for this course will be their own. We specifically forbid the use of ChatGPT or any other generative AI tools at all stages of the work process, including preliminary ones. Violations of this policy will be considered academic misconduct. We draw your attention to the fact that different classes at Harvard could implement different AI policies, and it is the studentâ€™s responsibility to conform to expectations for each course.

Submitting Comments and Presenting Papers

You are required to read papers and other listed reading materials before each class. (Materials listed under Extra Readings on the Schedule page are optional.) We'll use Perusall for pre-class readings. You MUST complete the Perusall assignment (by interacting and commenting while you read) by 6am before class. We typically will post a few reading questions for each paper to help guiding your reading. For research papers, some example things to think about during your reading are:

- what is the main contribution of the paper?
- is this important, why?
- what was the main insight in getting the result?
- what is not clear to you?
- what did the authors not do?
- what are the most important assumptions, are they limiting?
- if applicable, what applications does this suggest?
- how does this relate to other things we have seen?
- what extensions does this suggest?
- can you suggest a two-sentence project idea based around the ideas in this paper?

You won't be graded on the correctness or the rigorousness of your comments. However, we'd like to emphasize that spending time to read papers before class is crucial for your learning in this course. We don't expect that you'll fully understand the papers before class. But it's important that you come to class prepared and being prepared could mean that bringing in your questions and points of confusion.

Presenting papers: Students will present papers (likely with a partner) and, in addition to the presentation, be ready to lead a discussion in class. Students presenting papers must come by to office hours one week before their presentation and talk with me about the paper(s) before their presentation. Students are also asked to propose reading questions for the papers they present. Please read the Presentation Notes for expectations on student presentations.

Course Reading

There is no required text. All readings will be distributed electronically and sometimes in class.

Final Paper

The goal of the final paper is to develop a deep understanding of a specific research area related to the topic of the class, and to the extent possible to work on an open research problem. Although paper topics must be approved, students are free to pick a topic of interest in the general field related to the topic of the semester. Students are required to submit a proposal, give a short presentation, and submit a final paper (maximum 10 pages except for Appendix material). Papers may be computational, theoretical, experimental or empirical. Students may write an exposition paper (maximum 10 page) on at least three related technical papers of their choice that are related to the course material. Such a paper MUST include an exposition of formal results in these papers, provide a critical discussion of assumptions made by the authors and suggestions about future work, and provide a new perspective.

Tentative schedule:

- Tuesday 10/17: project proposal due

- Thursday 11/30 and Tuesday 12/5: project presentation

- Sunday 12/10: final paper due