This course examines the wide-ranging impact data science has on the world and how to think critically about issues of fairness, privacy, ethics, and bias while building algorithms and predictive models that get deployed in the form of products, policy and scientific research. Topics will include algorithmic accountability and discriminatory algorithms, black box algorithms, data privacy and security, ethical frameworks; and experimental and product design. We will work through case studies in a variety of contexts that may include media, tech and sharing economy platforms; medicine and public health; data science for social good, and politics. We will look at the underlying machine learning algorithms, statistical models, code and data. Threads of history, philosophy, business models and strategy; and regulatory and policy issues will be woven throughout the course.

This course does **not** satisfy the distribution requirement for an undergraduate degree in computer science. It does satisfy part of the technical elective requirement for the undergraduate concentration or secondary field.

***Prerequisites**:* This course has no formal prerequisites, but students should have some background in programming (especially with Python) and statistics. You should also have some experience in data science before taking the course.

Meeting times and location: Tu/Th 9:45-11am in Room 2111. This classroom is located in the building at 114 Western Ave, Allston (across from the iLab and next to the SEC building).

What's covered on this page

Instructional staff

Instructors:

Mike Smith (mike [underscore] smith [at] harvard [dot] edu) | OHs: Fridays from 11am-12noon in SEC 4.302. Also by appointment (email me, please).

Simson Garfinkel (sgarfinkel@fas.harvard.edu) | OHs: Tuesday from 11:15-12:00 (immediately after class) in [Office TBA]. Also by appointment (email me, please).

Teaching Fellows: for their office hours, please see this Ed post

- Jessica Kwon (jessicakwon[at]mde[dot]harvard[dot]edu)
- Nancy Li (nancy_li[at]fas[dot]harvard[dot]edu)
- Queenie Luo (queenieluo[at]g[dot]harvard[dot]edu)
- May Soshi (maysoshi[at]college[dot]harvard[dot]edu)

To reach the entire staff, contact us at: ac221-staff@googlegroups.com

Office Hours:

Staff	Office Hours:	Where
Mike Smith	Fri 11am - 12noon	SEC 4.302
Simson Garfinkel	Thu 11:15 am - 12:30 pm	SEC LL1.207
Jessica Kwon	Thu 1:00 pm - 3:00 pm	Zoom
May Soshi	Sun 2:00 pm - 4:00 pm	Adams Dining Hall
Nancy Li	Thu 3:00 pm - 5:00 pm	Zoom
Queenie Luo	Tue 12:00 - 2:00pm	

Learning goals

In this course, you'll learn:

1. To think critically about issues of privacy, bias, and fairness in data science.
2. To identify the range of stakeholders in a data-science problem.
3. To balance the potential benefits and possible harms in a data-science solution.
4. To come to a reasoned decision in problems with no clear right answer.
5. To argue effectively for your position.
6. To listen carefully and generously to others.
7. And lots of other stuff.

Course organization

The course is structured around **shared readings done prior to each class** and **in-person discussions where we explore, make mistakes, and learn together**. Unless you have permission from Professor Smith to miss class, **please attend every scheduled class session**.

Because the concepts in this course are best learned through **interaction and discussion with others that come from different backgrounds and life experiences**, we expect that youâ€™ll regularly attend and participate during class so that you come to know your classmates as individuals and develop a trusting relationship with them. From time to time, some individuals may feel strongly about some of the concepts we discuss, and we also want everyone to feel that they can express what they think and know that theyâ€™ll be **generously heard**.

And on this topic, please make sure you have read our handout titled â€œGuidelines for Class Discussionsâ€ and the section below on diversity and inclusion.

Beyond our class discussions (from which you'll submit participation highlights), the course requires you to write a number of **critical-thinking responses**, complete a smaller number of **programming problem sets**, and undertake **a final project**. Papers will be done individually; programming assignments will be done in teams of two; and the course project may be done in small groups of up to four. There are **no exams**.

You can find the assignments for this course in two places: (1) to find the readings for our course meetings, click the Perusall link in the navigation bar to the left and then select the Assignments tab in Perusall; and (2) to find the programming and written assignments, click the Modules link in the navigation bar to the left.

In terms of **topics**, there are five major sections to this course.

1. We start with a grounding discussion of the intersection of ethics and technology, and our responsibilities as researchers, technologists, and users.
2. We then dive into issues of privacy, techniques for data sharing such as de-identification and differential privacy, and the ways in which these techniques can fail in practice.
3. Next comes a focus on foundational challenges and ongoing hard problems in the ethics of data.
4. This leads us to ethical issues regarding the use of AI, including algorithmic fairness and bias, the curation of appropriation of data for training, and various ethical quandries caused by the use of generative AI.
5. The course concludes with discussions of governance and power in technology-focused organizations and how change occurs.

Canvas, Perusall, and Ed. All course interactions will take place through one of these three online tools. You can access the class instance of Perusall and Ed through the sidebar.

Weâ€™ve found it helps if we tell you the AC221 purpose of each tool:

- If youâ€™re looking for general information about the class, its syllabus, a listing of the assignments, how we will grade you, or other course policies, you should visit our **Canvas** class site.
- To submit your participation highlights, individual papers, problem sets, and final project pieces, you will use **Canvas**. More details when we start assigning these things.
- If you want to ask a question about the course, the class schedule, or specific assignments, you should post your questions on our **Ed** class site. The teaching staff will also post class-wide announcements on our Ed class site.
- All readings in this course will appear in our **Perusall** class site. You should do the readings before the class for which theyâ€™re assigned. We use Perusall so that you can discuss your thoughts on each reading with your student peers.

Perusall-specific notes. To get the most out of Perusall, we recommend that you:

- Use Perusall to annotate the readings with your questions and initial thoughts BEFORE class. The â€œAssignmentsâ€ tab in Perusall tells you when readings are due.
- Respond to the thoughts and questions posted by your classmates.
- Treat Perusall as **a student-owned space**. The instructors wonâ€™t be answering questions on Perusall, but we might up-vote particularly thoughtful comments.
- Remember to **always be respectful** in your comments on Perusall.
- Ignore anything about the â€œMy Scoresâ€ part of Perusall. We donâ€™t use it.

The morning of class for which a set of readings is due, we (the instructional staff) will review what has been posted by you and your classmates. We do this because we use what youâ€™ve written to help focus on classes on what is of interest to you or where youâ€™ve had questions. As such, we greatly appreciate it when some large number of students do the reading and post their responses by 7am on the day of class. Thank you!

Grading

Final letter grades will be weighted as follows:

- 1/3 critical-thinking exercises
- 1/6 programming assignments
- 1/6 final project
- 1/3 discussion and class participation

Please read the AC221 grading description to understand exactly how we will grade these assignments and produce your final letter grade in the course. This document also describes how you can resubmit some of the assignments to raise your grade and better reflect your learning. You'll also want to read about our approach to participation.

Our policy on late submission can be found at this Ed post.

Academic integrity

Critical-thinking assignments and your final project should be your own work and your own writing. You may discuss the prompt with your classmates, but what you write should be your own thoughts and reasoning. You may use tools that suggest grammatical changes and fix spelling errors.

Programming assignments are done in pairs. Again, your group may discuss the prompt with others in the class, but the code you write should be your own. You may use tools that do a limited amount of autocompletion (e.g., suggest a variable name based on the first few letters typed) and catch syntax errors.

Generative artificial intelligence (GAI). The use of GAI tools, such as ChatGPT and Copilot, is **allowed unless otherwise stated**. However, you should never use a GAI tool to do your entire assignment. Use it as a tool to assist you in writing or help you in coding. Because the use of these tools is new and our policies are evolving, any such **use must be acknowledged and cited in a preamble** to the submitted work.

Examples of **acceptable** uses:

- In a critical-thinking writing assignment, you may use GAI to help you explore the ethical ramifications of an issue. You may use it to identify different contexts in which an ethical issue might arise. You can use it to improve **one or two sentences** you wrote.
- In a programming assignment, you may use GAI to help you to understand the code we provide or to provide a template for calling an API. You may also use it to help you find syntax and semantic errors by feeding **a few lines** to the GAI tool.

Examples of **unacceptable** uses:

- In a critical-thinking writing assignment, you give the assignment prompt to the GAI tool and submit its response as your own work. Or you ask it to give you examples of an ethical situation and you submit one of the situations and reasoning as your own. These are both examples of plagiarism, which is widely regarded as the theft of ideas as much as the theft of direct quotations without attribution.

Citing that you got the answer from the GAI tool doesn't make this an acceptable use.
- In a programming assignment, you give the assignment prompt to the GAI tool and submit its response as your own work. Citing that you got the answer from the GAI tool doesn't make this an acceptable use.

Warning: It is each studentâ€™s responsibility to assess the validity and applicability of any GAI output that is submitted; you bear the final responsibility. We acknowledge that different classes at Harvard implement different GAI policies, and it is your responsibility to conform to expectations for each course.

If you have any questions about our academic integrity policy, please come see Professor Smith or Dr. Garfinkel. We encourage high-level collaboration with your peers and experimentation with GAI tools. This is a new world, and we'll all be figuring out how to best to navigate it. We hope you will share with us some of the interesting ways you accelerated your learning through collaboration and the use of GAI. If you're not sure if your use case falls within course policy, come to talk to any member of the course staff.

Diversity, inclusion, and accommodations

It is our goal to create a learning environment in this class that supports diversity of thought, perspective, experience, background, and honors your identity no matter what that might be. We (like many others) believe we are in a continual state of learning about diverse perspectives and identities. If something is said in the class, by the instructors or anyone else, that makes you feel uncomfortable, please let us know.

If your performance in class is being impacted by your experience outside of the class, please don't hesitate to come talk with any of the instructors. As a participant in the course discussion, you should strive to honor the diversity and experience of your classmates. This is especially true in this course, where there are very few right and wrong answers. We will be talking about personal values, which rightfully differ from person to person. Listen to those with whom you disagree and try to understand why they are holding the position they hold. Be a generous listener. You don't have to agree with what someone else says, but we all should work hard to understand and respect each other.

Finally, if there is any reasonable accommodation that you need, please speak with any member of the course staff, or check out the full list of available support resources (link in the navigation bar).

What should I do if this happens?

As the semester proceeds, it is possible that you will find that **you cannot attend one or more classes** during the semester. In this situation, your first course of action would be to reach out to Professor Smith. It is likely that he'll have you review the video-capture of the missed class. As watching a video is a poor substitute for attending in person, please feel free to ask any of the instructors questions about the material covered.

It is also possible that we, as a class, may be **forced online** at some point. As we did in the spring of 2020, we'll adjust. We'll adjust what we expect to accomplish in our class meetings, and we'll adjust our expectations for your work. Our 2021 offering of the class and the discussions that took place were quite successful, despite the remote format, and we are confident we can deliver a good learning experience no matter what the world throws our way.

If you find that **your technology fails at a most inconvenient time**, please try to reconnect as soon as youâ€™re able. If you get disconnected for a significant amount of time (e.g., more than half the class in a synchronous connection or more than a day from Perusall or Canvas), please contact a member of the teaching staff when your connectivity returns. We probably canâ€™t solve your technical problems, but we can make sure you donâ€™t get penalized in our class for something you canâ€™t control.

If the class is forced online and an instructor's technology fails him, we will have prepared another member of the teaching staff to take over and continue the class as best as we can. Please support this person as best you can.

Our digital infrastructure has worked amazingly well these past years, but **if Zoom goes down for more than 10 minutes in the middle of a remote, synchronous class session**, please know that we wonâ€™t switch to a new platform. Please enjoy your day doing something else. Professor Smith and Dr. Garfinkel will write up some notes on what we had hoped to discuss and post them on Perusall. Please read them and discuss them with a few friends in the class. Again, you'll learn the material in this class best if you discuss it with your peers!

We hope that each of you and your loved ones remain healthy this semester, but **if you fall ill or need to care for sick family members**, please know that your health always comes first. Then contact the instructional staff, as soon as you are able, so that we can make accommodations.

If you discover that you **need help with your writing**, please take advantage of the Harvard GSAS Fellowships & Writing Center or the Harvard College Writing Center.

Remember, as we state in the â€œDiversity, Inclusion, and Accommodationsâ€ section of the course syllabus, â€œif there is any reasonable accommodation that you need for any reason, [please do not hesitate to contact] any member of the course staff.â€ We promise to do our best to create an effective and engaging learning environment, but if something isnâ€™t working for you, please let us know as soon as possible so that we can work together.

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