11.520: GIS Workshop

Lecture
MW: 2:30-4:00 PM (EDT/EST)
https://mit.zoom.us/j/93900283738

Lab
W: 4:30-6:30 PM (EDT/EST)
https://mit.zoom.us/j/98139425936

Th: 12:00-2:00 PM (EDT/EST)
https://mit.zoom.us/j/96913546468

Course Site
https://canvas.mit.edu/courses/3377

All students attend one lab!

Course Description

Geographic Information Systems (GIS) are tools for managing data that represent the location of features (geographic coordinate data) and what they are like (attribute data); they also provide the ability to query, manipulate, and analyze those data. Put simply: a GIS permits planners to make maps that answer questions. GIS has become an important analytical tool for a variety of fields that study and shape cities: planning, architecture, engineering, public health, environmental science, economics, epidemiology, and business. As GIS has become more accessible, it has also become an important political instrument that allows communities, neighborhoods, and activists to graphically tell their story. This class will introduce the basics and offer a survey of what GIS makes possible.

Even as we learn to leverage spatial data to answer questions and tell stories, we will also be developing tools and frameworks to do so *reflexively*. Maps have been (and are) essential instruments for enacting racist urban policy, enabling colonial expansion, and justifying oppression; they have also been (and are) tools for resisting the same. Maps, map-makers and their institutions have positions and histories, and we will build this assumption into all of our mapping work.

Instructors

Catherine D'Ignazio
dignazio@mit.edu
She/her/hers.

Office Hours:
Mon 4:30-5:30pm & Fri 3:30-4:30pm
Sign up for office hours
Zoom 'office'

Eric Robsky Huntley
ehuntley@mit.edu
They/them/theirs.

Office Hours:
Thu 11:00am-12:00pm & Fri 9:00am-10:00am
Sign up for office hours
Zoom 'office'

Lab Instructor

Priyanka deSouza
desouzap@mit.edu
She/her/hers.

Office Hours
Thursday 2-4 pm
Zoom 'office'

Teaching Assistants

Angeles Martinez Cuba

angelesm@mit.edu
She/her/hers.

Office Hours:
Monday 7-8 pm, Tuesdays 10-11 am
Zoom 'office'

Matias Williams

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He/him/his.

Office Hours:
Wednesdays 12-2pm
Zoom 'office'

Course Objectives

Introduction to Spatial Analysis (11.205) and GIS Workshop (11.520) are modular courses which together make up the Introduction to GIS series. **GIS Workshop (11.520)** focuses on developing a research project using GIS, and introduces additional methods that are frequently used by planners. We encourage even those students with a GIS background to take 11.520, as it is tailored to GIS applications within *planning* and *design*. It's also a great venue in which to test out projects that may turn into theses (or other investigative projects!) Specifically, students will learn to...

- Formulate and refine spatial research questions
- Incorporate an analysis of structural oppression, inequality and positionality into your spatial research projects
- Develop data acquisition and critical skills necessary for GIS project work
- Practice finding and using publicly accessible data sets
- Create novel spatial data sets using a variety of methods including GPS surveys and georeferenced historical records and atlases.
- Develop and publish basic web maps

Assessment

Assignment	% of Total	Due
Exercise A	20%	11/5
Exercise B	20%	11/12
Exercise C	20%	11/19
Project Proposal	15%	11/5
Final Project	25%	12/7

Late Policy

Turning in assignments promptly is important both for keeping current with the subject matter, which is cumulative, and to keep all students on a relatively level playing field. A late assignment will be accepted up until one week after the original due date for a loss of one letter grade (e.g., an A becomes an A-). After that point, late assignments will receive no credit and will not be accepted.

There will of course be situations where we are willing to bend these rules. These are regulatory ideals, not absolutes. We are human beings; you are human beings. Life happens. We will strive to respect you by taking your requests seriously if you similarly strive to not take advantage of our inclination to respect them. We're all in this weird boat together---let's be good to each other.

All assignments will be posted on the Canvas website.

Email

We will not always be able to respond to email right away. If we have not answered an email by the next time we see you in class please be sure to remind us in class. It is likely that we did not see your email yet. We will do our best to respond to your emails in 24-48 hours during the week. Instructors do not respond to emails on the weekends. The labor movement fought long and hard to secure your weekend! It is truly remarkable that we live in a world in which an email can travel to space and divebomb from the exosphere to our pockets in a matter of seconds; this does not imply that our response must be equally instantaneous!

There are a lot of ways to find help for this class: Discord, peer support and instructor/TA office hours are other good strategies to use. Please don't let an unanswered email hold you back.

On Mental Health…

Academic environments are taxing places. For reasons structural, institutional, financial, and interpersonal, they do not always lend themselves to what most reasonable people would think of as human flourishing. Your instructors went to graduate school. In fact, your instructors both went to graduate school twice. We also went to college. We are both intimately familiar with the toll that institutions of higher education can exact on our mental health and wellbeing.

We have two points here:

1. MIT offers a range of counseling and mental health resources for students. We would really encourage you to be proactive about taking advantage of them; and
2. Do not hesitate to let us know if you're struggling. It is not our intention to mine for the details of your private lives! It is only to let you know that we are sensitive to the distinctive difficulties of the environment we inhabit and that help is available.

Special Accommodations for Students with Disabilities

If you need disability-related accommodations, we encourage you to meet with us early in the semester. If you have not yet been approved for accommodations, please contact Student Disability Services at sds-all@mit.edu.

We look forward to working with you to assist you with your accommodations!

Diversity & Inclusion

MIT values an inclusive environment. We 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. We 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 come speak with us immediately.

Indigenous Land Acknowledgement

> *"MIT [and the instructor of this class!] acknowledge Indigenous Peoples as the traditional stewards of the land, and the enduring relationship that exists between them and their traditional territories. The land on which we sit is the traditional unceded territory of the Wampanoag Nation. We acknowledge the painful history of genocide and forced occupation of their territory, and we honor and respect the many diverse indigenous people connected to this land on which we gather from time immemorial."*

– Developed and vetted by the MIT Indigenous Peoples Advocacy Committee (IPAC) in partnership with MIT's American Indian Science and Engineering Society (AISES), the Native American Students Association (NASA), and other Native American MIT students.

Materials

Hard Drive

It is recommended (though not required) that you buy an external hard drive to store your coursework - for this class and beyond. While it's true that cloud backups are the more common way of working these days, it's always good practice to have your work backed up and stored locally as well.

If you want to go the cloud route, you can check out MIT's licenses for:

- Dropbox: Up to 500GB for students.
- Google Drive: A.k.a. GSuite for Education: Up to 2TB storage for students.

Just remember that you won't retain access to these services after you no longer have an account with MIT so you will need to migrate your files at that point.

Is there a book to buy?

No! All readings are uploaded to the course Canvas site. In fact, many, if not all, of the texts are available digitally to MIT affiliates through the libraries. Just remember this favor when you ask yourself how much of the reading to complete... 😉

Getting Help

There are many, many ways to get help for this class!

Office Hours

Each member of the teaching team will have their own office hours - because we have a large teaching team, this means that help will be available during a pretty astonishing proportion of the work week! **All office hours will be hosted in the given instructor or TA's Zoom room, unless otherwise noted.**

GIS+Data Lab

GIS is such an important part of planning research and practice that MIT's Rotch Library has its own large, skilled, and friendly research staff. They can help you find data and help with technical hurdles you encounter along the way. Reach out to gishelp@mit.edu.

- Lab computers: In addition to helping with data and methods, the GIS + Data Lab has quite a few computers that you can use from the comfort of your own home using remote desktop technology. This is very helpful if you find yourself needing more computing 'oomph' than your laptop can provide.

The Documentation

It's never a bad idea to read the manual! Learning how to read technical documentation is its own special skill to build, and once you master it you can do anything. QGIS documentation is here: https://docs.qgis.org/3.10/en/docs/index.html

Stack Overflow

A well-known, community-driven, tech help forum, Stack Overflow has become the go-to venue for tech help - which includes GIS!

Abbreviated Schedule

Date	Week	Due	Assigned
10/19	**Week 0:** Data Discovery and Data Collection with GPS	Problem Set 2 *(If in 205...)*	Project Proposals
10/26	**Week 1:** Digitizing and Georeferencing	🥳*Nothing!*🥳	Exercise A
11/2	**Week 2:** Rasters and Overlay Analysis	Exercise A Project Proposals	Exercise B
11/9	**Week 3:** Network Analysis/CARTO *Veteran's Day, no class Monday.*	Exercise B	Exercise C
11/16	**Week 4:** Work on Projects	Exercise C	🥳*Nothing!*🥳
11/23	**Week 5:** *Thanksgiving: No Class*	🥳*Nothing!*🥳	🥳*Nothing!*🥳
11/30	**Week 6:** Work on Projects	🥳*Nothing!*🥳	🥳*Nothing!*🥳
12/7	**Week 7:** Project Presentations	Presentations	🥳*Nothing!*🥳

Schedule

Week 0 | Data Discovery and Data Collection with GPS

`October 19 - October 23`

- **Monday:** Visit from Trish Cafferky (MCP2) and David Robinson (MCP '20).
- **Wednesday:** Visit from Jennie Murack, Rotch Library GIS+Data Librarian.

Due

(If in 11.205...) Problem Set 2: Thursday, October 22 by 11:59PM EDT.

Assigned

Project Proposals: Due Thursday, November 5 by 11:59PM EST.

Readings

- Paul Bolstad. *GIS fundamentals: A first text on geographic information systems*. Sixth edition. 2020. "Chapter 7: Digital Data." **Note: Skim this to know about a range of data sources.**
- Jeremy Hsu. 2018. "The Strava Heat Map and the End of Secrets." *Wired*, January 29.
- Browse GPS drawings

Case Study Readings:

- No reading! Bring 1-3 preliminary project idea(s) for brainstorming with the group.

Supplementary Readings

- William Rankin. 2016. "The Politics of Global Coverage: The Navy, NASA, and GPS, 1960-2010." In *After the Map: Cartography, Navigation, and the Transformation of Territory in the Twentieth Century*. Chicago, IL: University of Chicago Press, p. 253-294
- Jacqueline Klopp, Sarah Williams, Peter Waiganjo, Dan Orwa, and Adam White. "Leveraging Cellphones for Wayfinding and Journey Planning in Semi-formal Bus Systems: Lessons from Digital Matatus in Nairobi" *Planning Support Systems and Smart Cities*, Springer, 2015.

Week 1 | Digitizing and Georeferencing

`October 26 - October 30`

- **Wednesday:** Visit from Belle Lipton and Garrett Dash Nelson, Leventhal Map & Education Center.

Due

😻*Nothing!*😻

Assigned

Exercise A: Due Thursday, November 5 by 11:59PM EDT.

Readings

- Paul Bolstad. *GIS fundamentals: A first text on geographic information systems*. Sixth edition. 2020. "Chapter 4: Maps, Data Entry, Editing, and Output," **p. 156-173, 177-180**

Case Study: Atlases and Urban History

- Belle Lipton. 2019. "Opening Access to Historical Urban Atlases of Boston." Annual Meeting of the North American Cartographic Information Society. Tacoma, WA. https://www.youtube.com/watch?v=y6wolT1jbso&t=184s
- Baics, Gergely, and Leah Meisterlin. "The Grid as Algorithm for Land Use: A Reappraisal of the 1811 Manhattan Grid." *Planning Perspective*s 34, no. 3 (2019): 391–414. https://doi.org/10.1080/02665433.2017.1397537.

Week 2 | Map Algebra + Raster Operations

`November 2 - November 6`

- **Election Day!**

Due

- Exercise A: Thursday, November 5 by 11:59PM EDT.
- Project Proposals: Thursday, November 5 by 11:59PM EDT.

Assigned

- Exercise B: Due Thursday, November 12 by 11:59PM EDT.

Readings

- Paul Bolstad. *GIS fundamentals: A first text on geographic information systems*. Sixth edition. 2020. "Chapter 10: Topics in Raster Analysis."
- C. Dana Tomlin. 2017. "The Bird's-Eye View from a Worm's-Eye Perspective." In Griffith, D., Chun Y., Dean D. (eds) *Advances in Geocomputation*. Springer. http://doi-org-443.webvpn.fjmu.edu.cn/10.1007/978-3-319-22786-3_3
    - For more C. Dana Tomlin... https://vimeo.com/46106213

Case Study: Air Quality Analysis

- deSouza, Priyanka., Anjomshoaa, Amin., Duarte, Fabio., Kahn, Ralph., Kumar, Prashant. and Ratti, Carlo., 2020. Air quality monitoring using mobile low-cost sensors mounted on trash-trucks: Methods development and lessons learned. *Sustainable Cities and Society*, *60*.

Additional Reading on Suitability Analyses

- Shoshkes, Ellen. "Jaqueline Tyrwhitt: A Founding Mother of Modern Urban Design." Planning Perspectives 21, no. 2 (2006): 179–97. https://doi.org/10.1080/02665430600555339.
- Carlsson, Moa Karolina. "Environmental Design, Systems Thinking, and Human Agency: McHarg's Ecological Method and Steinitz and Rogers's Interdisciplinary Education Experiment." *Landscape Journal* 36, no. 2 (2017): 37–52. https://doi.org/10.3368/lj.36.2.37.
- McHarg, Ian. 1969. "Processes as Values." In *Design with Nature*. Natural History Press: , p. 103-115.

Week 3 | Network Analysis + CARTO

`November 9 - November 13`

- **Monday:** Visit from Laura Krull, Bay Area Metropolitan Transportation Commission (MTC).
- No class Wednesday for Veteran's Day

Due

- Exercise B: Due Thursday, November 12 by 11:59PM EDT.

Assigned

- Exercise C: Due Thursday, November 19 by 11:59PM EDT.

Readings

- Paul Bolstad. *GIS fundamentals: A first text on geographic information systems*. Sixth edition. 2020. "Chapter 9: Basic Spatial Analysis." Network Analysis section. **pp. 420-428**
- Jonas Lohmann Elkjær Andersen, Alex Landex. 2009. "GIS-based Approaches to Catchment Area Analyses of Mass Transit." In *Proceedings of the Esri Users Conference*.

Case Study: Analyzing Women's use of Public Transit

- Readings from Laura Krull, TBA.

Week 4 | Project work

`November 16 - November 20`

- **Monday:** Visit from Adriana Jacobson.

Due

- Exercise C: Due Thursday, November 19 by 11:59PM EDT.

Assigned

🥳*Nothing!*🥳

Readings

🥳*Nothing!*🥳

Week 5 | Thanksgiving: No Class

`November 23 - November 27`

Due

🥳*Nothing!*🥳

Assigned

🥳*Nothing!*🥳

Readings

🥳*Nothing!*🥳

Week 6 | Work on Projects

November 30 - December 4

Due

Project Pin-ups! (Ungraded.)

Assigned

🥳 Nothing! 🥳

Readings

🥳 Nothing! 🥳

Week 7 | Final Presentations

December 7 - December 11

Due

Final Project Presentations: **All materials must be submitted by Monday, December 7 at noon.**

Assigned

🥳 Nothing! 🥳

Readings

🥳 Nothing! 🥳