W25: Urban AI

Course Staff and Schedule

Instructor: Prof. Xiaofan Liang

Email: xfliang@umich.edu

Slack: um-wn25-urp610.slack.com

Canvas: https://canvas.it.umich.edu/

Interactive Syllabus: https://www.xiaofanliang.com/w25urp610

Lecture: Th 2:30-5:30pm, 2222 A&AB

Office: 2364 A&AB

Office hours: Monday 9:00-11:30am; Thursday 1:30-2:30pm in person, or by request for virtual. All OH are appointments (book here).

📜 Course Description

Artificial Intelligence (AI) is making waves across various fields, including urban planning. However, the implications of AI in urban applications still holds many unknowns. This advanced course equips students with essential skills and knowledge to understand how machine learning and AI (ML/AI) systems work, apply ML/AI models in geospatial/urban tasks, and evaluate the benefits (e.g., innovation, opportunity) and constraints (e.g., AI hallucination, social inequality, regulatory and environmental impacts) of these systems. Students will also experiment with generative AI tools for learning, prototyping, and analysis. The advanced course provides a survey of both technical and social perspectives on ML/AI in urban contexts, with an emphasis on understanding the possibilities and

limitations of existing models. The course is structured with a series of lectures and technical labs using Python.

Prerequisites

An introductory statistics course, covering summary statistics, sampling, probability distributions, hypothesis testing, and linear regression, is required. Equivalent courses or experience include:

- **URP 506 Planning Methods (2024 Fall); STATS 507** – Statistics fundamentals, data wrangling, and visualization in R or Python; Required for MURP or other master's students.
- **DATASCI 101** (formerly STATS 206); **STATS 250**; Required for undergraduate students

Familiarity with a programming language for data wrangling, visualization, and debugging is also required. Equivalent courses or experience include:

- **SI 106** and **SI 206** (for UT students).
- **URP 535/UT 402 Introduction to Urban Informatics (2024 Winter)** – Data epistemologies, data infrastructure, data governance, and urban analytical methods using R
- **URP 610/UT 402 Urban Networks (2024 Fall)** – Network data wrangling and visualization using R.

Students may approach this course with either a policy (understanding and evaluating ML/AI systems' implications) or application (developing ML/AI applications in urban settings) focus. For a policy focus, **prior experience or coursework in public policy** (e.g., Housing Policy and Economics; Public Policy and Transportation, Tech Clusters and Smart Cities, etc.) is recommended. For an application focus, **experience with design, planning, or computational methods** (e.g., GIS, scenario planning, transportation modeling, urban tech studio, software development) is encouraged.

🎲 Learning Goals

⭐ **Exposure**: Grow awareness of how AI will bring opportunities, costs, and changes in urban scenarios

⭐⭐ **Competency**: Understand the process of various applications and are able to replicate examples

⭐⭐⭐ **Mastery**: Develop in-depth knowledge of AI mechanics and skills for new applications

Essential Knowledge / Skills	**Modules**	**Policy Focus**	**Application Focus**
Explain what ML/AI is, how it works, and the process to train, evaluate, and apply a model	AI Fundamentals	⭐ Describe ML/AI mechanics and examples in abstract terms ⭐⭐ Explain daily experience and constraints of GenAI tools through AI mechanics ⭐⭐ Identify key steps of building a machine learning model ⭐⭐ Use pre-trained ML/AI models to evaluate specific examples	⭐⭐ Understand the foundational mechanics of ML/AI ⭐⭐ Explain daily experience and constraints of GenAI tools through AI mechanics. ⭐⭐⭐ Train a basic ML model given a dataset ⭐⭐⭐ Apply pre-trained ML/AI models for various tasks
Understand how ML/AI can enhance planning research and practices	AI for Prototyping and Tooling; Applications	⭐ Identify opportunities for innovation in planning through AI	⭐⭐⭐ Develop simplified prototypes for advanced ML/AI applications
Articulate the social risks and costs of ML/AI systems and how to audit/evaluate them	Governance & Society	⭐⭐⭐ Audit and evaluate the social risks and costs associated with ML/AI systems through scientific methods and policy design	⭐ Recognize how ML/AI systems may introduce risks in urban applications

Reflect on AI's systematic impacts on the environment, labor, economy, and human dynamics	Governance & Society	⭐ Reflect on how AI's systematic impacts could reshape urban scenarios	⭐ Reflect on how AI's systematic impacts could reshape urban scenarios
Be aware of human-centered ML/AI paradigms for enhancing representation, fairness, and transparency	Governance & Society	⭐ Be aware of the complexity and difficulty of aligning ML/AI systems with human values and available solutions	⭐ Be aware of the importance of human-centered design in AI applications
Proficiently and critically interact with GenAI tools and fine-tune them through interface and code	AI for Prototyping and Tooling	⭐⭐ Develop strategies and basic customizations for critical interactions with GenAI tools	⭐⭐⭐ Develop strategies and implement in-depth customizations for critical interactions with GenAI tools

📖 Course Materials

Readings: There is no required textbook for the course. All the readings will have open-access links or have PDFs uploaded on Canvas.

Computer: Bringing your own computer is recommended for Thursday lecture and is required for Thursday Labs

Three-in-one: Students should have three links handy in the bookmarks: 1) the interactive Notion syllabus for course schedule, readings, and lab and assignment descriptions, 2) Canvas for work submission, reading PDFs, and lecture slides, 3) Slack for discussions and for technical help.

📆 Course Schedule

📌 Click All to see all entries. Click Lessons , Labs , and Assignments to switch to those entries separately. Click Calendar to see all due date in the calendar view. Hover over a weekly folder and click ⤢ OPEN to see topics, readings, lecture slides, and to-do lists for the week. **This schedule is subject to change. Please check periodically.**

Schedule

Aa Week	Dates	Module	Big Question	Topic
Week 1	@01/09/2025	Introduction	What is this course about?	(Lecture) Introduction to Urban AI (Lab) Python and Jupyter Notebook
Week 2	@01/16/2025	AI for Prototyping and Tooling	What is ML/AI and what can they do? How can you use ML/AI tools for prototyping ideas, analysis, and design?	(Lecture) Machine Learning and GenAI Sandbox (Lab) Exploring GenAI tools
Week 3	@01/23/2025	AI Fundamentals	What are different types of ML models? How do ML models learn from structured data and make predictions? How do you evaluate the model results?	(Lecture) Introduction to Machine Learning (Lab) Predicting Vacant Properties via Supervised Learning (Python - Scikit-learn)
Week 4	@01/30/2025	AI Fundamentals	How do ML/AI models learn from	(Lecture) Natural Language Processing (NLP),

Aa Week	Dates	Module	Big Question	Topic
			unstructured data (e.g., texts, images?)	Image Recognition, and Deep Learning (Lab) Using pre-trained models from Hugging Face for text classification and image segmentation tasks
📒 Week 5	@02/06/2025	AI Fundamentals	How can ML/AI understand contexts and generate original contents?	(Lecture) Generative AI and Large Language Model (Lab) Interacting with ChatGPT through OpenAI API
📒 Week 6	@02/13/2025	AI for Prototyping and Tooling; Application	How may ML/AI enhance planning practices and how may planning change in response to ML/AI?	(Lecture) AI-driven Applications and Customized LLMs (Guest Speaker) Catherine Brinkley @ UC-Davis (Lab) Customizing ChatGPT through web interface, prompt engineering, and

Aa Week	Dates	Module	Big Question	Topic
				in-context-learning
📒 Week 7	@02/20/2025	Governance & Society	What are the social risks and costs of AI and how to audit/mitigate them?	(Lecture) AI Ethics and Social Costs (Guest Speaker) Meixin Yuan @ Taubman PhD (Lab) Open lab time for preparing group work for presentation and demo
📒 Week 8	@02/27/2025	Application	N/A	(Lab) Open lab time for preparing group work for group project
📒 Week 9	@03/06/2025	N/A	N/A	Winter Break (No Class)
🔈 Week 10	@03/13/2025	Application	AI Application; Prototype for Final Project	(Group-led class) ML / AI Application #1 AI + GIS (Group-led class) ML / AI Application #2 AI + Built Environment
🔈 Week 11	@03/20/2025	Application	AI System Audit; Prototype for Final Project	(Group-led class) ML / AI Application #3 AI + Public Participation, Activism,

Aa Week	Dates	Module	Big Question	Topic
				Community Support (Group-led class) ML / AI Audit #4 AI + Public Service
👥 Group Project Assignment Due	@03/23/2025	Application	N/A	Group Project Assignment (Substack Publication) Due
📒 Week 12	@03/27/2025	Governance & Society	What are the roles of human in the interaction with AI?	(Lecture) Human Roles in Designing, Auditing, and Aligning AI Systems with Human Values Final Proposal Help
📒 Week 13	@04/03/2025	Governance & Society	How might AI's systematic impacts on environment, labor, economy, and human dynamics shape future urban scenarios?	(Lecture) AI's System Impact: Environment, Labor, Economics, and Human Dynamics (Guest Speaker) Heyu Huang; Partner @ Fresco Capital Final Proposal Help

Aa Week	Dates	Module	Big Question	Topic
✏️ Final Proposal Due	@04/06/2025	Synthesis	What mini-project can I do to prove the concept / practice the skills / experiment with ideas?	Final Proposal Due
📒 Week 14	@04/10/2025	Synthesis	Same as above	Final Project Help
📒 Week 15	@04/17/2025	Synthesis	Same as above	Final Project Help
📄 Final Project Due	@04/24/2025	Synthesis	Same as above	Final Project Report Due (Reflection) Final Sharing and Group Reflection

💯 Grading

Breakdown

Participation: **10 pt**
Labs:
18 pt

Weekly AI Tools Journal: **12 pt**
Group Project Assignment:
20 pt
Final Proposal:
10 pt
Final Project:
30 pt

Scale / Minimum %

A+	100	A	95
A-	90	B+	87
B	83	B-	80
C+	77	C	73

Participation

Attendance at lectures and labs is required. Students who wish to receive credits for missed classes or labs should follow the following procedures:

1. Notify the instructor at least a week ahead, or as early as possible, to request access to a Zoom-based lecture or lab on a case-by-case basis.
2. If joining a lecture through Zoom is not possible, prepare a 300-word write-up summarizing what you had learned from lecture slides. Email the write-up to the instructor before the next lecture. If joining a lab through Zoom is not possible, go through the lab materials at your own time.
3. Additionally, students are responsible for reviewing lecture slides afterward, submit lab quiz questions on time, and catch up with classmates on notes and announcements.

Beyond attendance, students are encouraged to **post in the #general channels in Slack**. These posts can be any materials that are conducive for understanding the weekly topics, such as interpretations and thoughts around the readings, useful resources for labs, and news related to the weekly topics, and so on.

Bonus Point

If you participate in a guest lecture or event (at UM or outside UM; Online or Offline) that is relevant to Urban AI outside of class time, you are welcome to submit a 200 words reflection on the event (what it is about and what you take away) and earn a 0.5 bonus point. A maximum of 2 bonus points can be given.

You are also highly encouraged to post questions and solicit helps from your peers on Slack. **Bonus participation points** will be given to students who actively participate in lectures, labs, and Slack, such as posting questions and sharing resources, interacting with the instructor (or guest lecturers), and helping your peers.

Lecture and Lab

The instructor refers to the first 1.5h on Thursday as the “lecture” time and the second 1.5h on Thursday as the “lab” time, unless indicated otherwise. **Only 6 labs in this course are graded (from Week 1 to Week 6).** Each lab worths 3 points (18 points in total). For each of the technical labs, you will receive a lab folder that contains the lab lecture slides, any necessary data, and a R html file with

examples and starter code. Lab materials will be posted on Canvas before the lab time. Note that the lab numbers correspond to the week numbers and may not be continuous integers.

During each technical lab session, the first 20 minutes will be dedicated to a brief lecture that explains the code and provides technical examples. The remaining time will be allocated for self-guided work on the lab examples and practice questions. The instructor will be present in the room to offer assistance. If you require assistance with the practice questions, do not hesitate to seek help from the instructor. Labs are designed to provide practice opportunities for learning.

Each technical lab will have **three practice questions** and **three lab quiz questions**. The lab practice questions are designed to practice what you have learned and get help if needed; they resemble the lab quiz questions which must be completed **independently by the next lab (a week from the current lab)**. To submit your lab quiz questions and your R (or ipynb) file, please go to the Canvas course page ➡️ Assignments ➡️ Labs.

The labs are designed to be completed, or at least mostly completed, within the allocated lab time. If you consistently find it difficult to finish the labs, please don't hesitate to ask for help during the lab time, either from me or from your peers.

If you finish a lab early, you are welcome to work on other tasks related to this course (such as readings and assignments) while remaining in the room.

Weekly AI Tools Journal

From Week 1 to Week 13 (excluding Week 9 for Winter Vacation), you will be required to submit a 100~300 words weekly AI tools journal with your lab quiz (if there is no lab quiz, then a stand-alone reflection submission). The goal is to consolidate how your understanding and usage of the AI tools (e.g., ChatGPT) has evolved to enhance your learning and workflow and whether you have reflections. If you did not use AI tools, please also elaborate your thinking. Each reflection worths 1 point.

I may feature some students' journals in lecture (anonymized) for the purpose of exposing students to a variety of AI tools and ways they can be used.

Final Proposal / Project

Students will complete the ✏️Final Proposal and 📄 Final Project individually or in groups of no more than two other peers (maximum two people per group). A written final proposal and final project must be submitted before the due dates. More details will be announced later.

Other Programming Languages

You may submit the labs or write your final project in other programming languages (e.g., R, Javascript, etc.).

🔎 Resources

Institutions

- **Spatial and Numeric Data Services (SAND) Lab:** The University Library's Spatial and Numeric Data Services (SAND) provides assistance with spatial data, numeric data, and statistics for the University of Michigan community. SAND also provides access to and assistance with data from the Inter-university Consortium for Political and Social Research (ICPSR), Roper Center for Public Opinion Research, Europa World Plus, Global Insight, Geolytics, the U.S. Census Bureau, the U.S. Geological Survey, and other sources.
- **UM Clark Library Digital Projects Studio:** A resource providing tutorials and support for visualization work on campus. Includes resources on data analysis and mapping using R and Python, web mapping with Leaflet, network analysis using Cytoscape, and more.
- **Michigan Institute for Data Science:** A university-wide institute which fosters work in data science and artificial intelligence, and hosts many events and other resources available to students.

Technical Materials

- Geocomputation with Python - including Python for Geospatial Analytics
- Data Science from Scratch (2nd Edition) - including Python basics, data wrangling and visualization, statistics basics, application of simple machine learning models, etc. UM library has free access.

- Python for Data Analysis (3rd Edition) - including more detailed data wrangling and visualization operations with Pandas
- Practicum AI - provides a wonderful overview for using Python, Colab, GitHub, and other tools in computation. Highly Recommended. Link to GitHub Repository.

Scholarship and Grants

- Taubman College Scholarship / Fellowship Opportunities
- Arts Engine
- UM-wide grants and fellowships for students (Toggle For Students Section)
- DOW Sustainability Fellows Program
- APA Scholarships

📎 Course Policy

Late Submissions

One late submission within 24 hours of the due time will be automatically excused. After that, late work will be deducted **5%** per twenty-four hour period that passes after the due time. No late submissions are allowed for the final project submission. Late work may be excused due to unavoidable personal or family emergencies or religious observance. In these cases, students are expected to communicate with the instructor as soon as possible to arrange accommodations. **Do not email me the late submission. Proceed to submit on Canvas (even though it may show you grade deduction at first) and attach explanatory notes.**

Plagiarism

The Rackham Graduate School policy states: “Integrity in research and scholarship is a fundamental value of the University of Michigan. It is the responsibility of all students to conduct research and scholarly activities in an ethical manner at all times.” This requires that you are honest in all your course work.

Plagiarism is the use of someone else's words, ideas, or work as one's own in writing or presentations, and failing to give full and proper credit to the original source. It is failing to properly acknowledge and cite language from another source, including paraphrased text. Plagiarism is a serious offense that will lead to grade penalties and a record filed with Taubman College. It may lead to failing a course or expulsion from the university.

These policies apply to all Taubman College students as well as non-Taubman College students who take courses within the college.

Since this course involves a significant amount of coding, it can be challenging to differentiate between peer support, online resources, and plagiarism. Recommended practices will be explained with examples in Lab 2. In general, you must provide proper credit to online posts or peers (e.g., Stack Overflow, blog posts, the names of your peers) that inform your code.

Generative AI tools

There is **no restriction of the use of generative AI tools in this class**. You can use it in any manner you want. However, you must document your use and your reflection of your use in the weekly AI tool journaling. There will be a component in the final project that asks you to explain the use of AI tools as well.

While using GenAI tools (e.g., ChatGPT) can be appealing and efficient at first, please use these tools with discretion and keep the following points in mind:

- Over-dependency on GenAI tools can weaken your fundamental programming skills (e.g., debugging, reading documentations, or even web searching for solutions), writing skills, and problem-solving skills (e.g., breaking down a task into small steps).
- GenAI tools can hallucinate, provide false facts, or even reinforce biased answers. It may also highlight certain search results (may not be the best) than others when you ask for recommendation. It is your responsibility to fact-check the responses.
- GenAI tools can provide inconsistent outputs with the same prompt, or are sensitive to prompts.
- Other URP courses typically have restrictions on the use of GenAI tools.

You are encouraged to paste in this “meta prompt” at the beginning of your interaction with ChatGPT to help shape its behaviors.

- "You are a feedback-oriented learning assistant. Your role is to guide me through my problem-solving process, offer constructive feedback, suggest resources or approaches, and ask clarifying questions when necessary. Please refrain from directly providing answers or code. If you’re unsure about something or if there are limitations in your knowledge, explicitly express your uncertainty and encourage me to fact-check or consult additional resources. Help me learn by fostering critical thinking and understanding, not by solving the problem for me.”

Writing Assistance

Students are encouraged to use the University’s resources for writing instruction and assistance. For our multilingual students, the ELI faculty offer office hours in our building. Students can seek assistance through the student services team.

The resources of the Sweetland Center for Writing are available for both undergraduate and graduate students. They offer classes, one--on--one assistance in a variety of modalities, and resource guides.

Sweetland Writing Center: http://lsa.umich.edu/sweetland

Link to resource guides (designed for undergraduates, but even grad students might find them useful):
http://www.lsa.umich.edu/sweetland/undergraduate/writingguides

Statement on Diversity, Equity, and Inclusion

Taubman College affirms the principles of diversity, equity, and inclusion as we organize resources and priorities that align with our values. We seek to have a diverse group of persons at all levels of the college - students, faculty, staff and administrators - including persons of different race and ethnicity, national origin, gender and gender expression, socioeconomic status, sexual orientation, religious commitment, age, and disability status. We strive to create a community of mutual respect and trust, a community in which all members and their respective backgrounds, identities, and views are represented without any threat of bias, harassment, intimidation, or discrimination. The College Compact is a description

of the environment we wish to create and the behaviors we hope our community members will exhibit.

Mental Health

Taubman College is committed to advancing the mental health and wellbeing of its students. Studies and surveys indicate clearly that a variety of issues, such as strained relationships, increased anxiety, alcohol/drug problems, and depression, directly impact student academic performance. If you or someone you know is feeling overwhelmed, depressed, and/or in need of support, please reach out to any of the following for assistance:

- Karen Henry is a CAPS Embedded Psychologist who offers counseling here at Taubman College (karhenry@umich.edu). Note that appointments may take place via phone call or BlueJeans when COVID-19 precautions are in place.
- Counseling and Psychological Services (CAPS) can be reached at (734) 764-8312 and https://caps.umich.edu/ during and after hours, on weekends and holidays. When precautions for COVID-19 are in place, please contact CAPS at caps-uofm@umich.edu or schedule online here: https://caps.umich.edu/article/caps-initial-consultation-request
- For medications, contact University Health Services (UHS) at (734) 764-8320 and https://www.uhs.umich.edu/mentalhealthsvcs, or for alcohol or drug concerns, see www.uhs.umich.edu/aodresources.
- For an extensive listing of mental health resources available on and off campus, visit: http://umich.edu/~mhealth/.
- To get help right away, if you or someone you know is in a crisis situation, please do one of the following: Call 911 or Call (734) 996-4747 (U-M Hospital Psychiatric Emergency).
- If you are experiencing concerns, seeking help is a courageous thing to do for yourself and those who care about you. If the source of your stressors is academic, please contact me so that we can find solutions together. For personal concerns, U-M offers many resources, some of which are listed at Resources for Student Well-being.

Disability Support

In compliance with the University of Michigan Rackham Graduate School policy, I am available to discuss appropriate academic accommodations that may be required for students with disabilities. Requests for academic accommodations should be made during the first three weeks of the semester, except for unusual circumstances, so arrangements can be made. Some aspects of this course, the assignments, the in-class activities, and the way the course is usually taught may be modified to facilitate your participation and progress. As soon as you make me aware of your needs, we can work with the Services for Students with Disabilities (SSD) office to help us determine appropriate academic accommodations. SSD (734-763-3000; http://ssd.umich.edu) typically recommends accommodations through a Verified Individualized Services and Accommodations (VISA) form. Any information you provide is private and confidential and will be treated as such.

Accommodations for Religious Holidays and Observances

The guidance on this issue issued by the Office of the Provost is as follows: “Although the University of Michigan, as an institution, does not observe religious holidays, it has long been the University's policy that every reasonable effort should be made to help students avoid negative academic consequences when their religious obligations conflict with academic requirements. Absence from classes or examinations for religious reasons does not relieve students from responsibility for any part of the course work required during the period of absence. Students who expect to miss classes, examinations, or other assignments as a consequence of their religious observance shall be provided with a reasonable alternative opportunity to complete such academic responsibilities. It is the obligation of students to provide faculty with reasonable notice of the dates of religious holidays on which they will be absent. Such notice must be given by the drop/add deadline of the given term. Students who are absent on days of examinations or class assignments shall be offered an opportunity to make up the work, without penalty, unless it can be demonstrated that a make-up opportunity would interfere unreasonably with the delivery of the course. Should disagreement arise over any aspect of this policy, the parties involved should contact the Department Chair, the Dean of the School, or the Ombudsperson. Final appeals will be resolved by the Provost.”

Audio and Video Recordings and Protecting Privacy

The pandemic crisis may require that synchronous class activities be recorded and posted for students who are unable to participate in-person. But recording lectures, discussions, and other similar course-related activities raises important privacy concerns. Instructors must balance the need to include all class members against the need to protect privacy concerns. Recording may stifle discussion and interfere with the free exchange of ideas, particularly when discussing sensitive subjects. Instructors may choose to have some sessions not recorded in order to encourage the free exchange of ideas, or they may choose to pause recording when discussion of sensitive subjects begins. Instructors will share recordings only with members of the class through a platform that is only accessible by members, such as Canvas, to ensure that only members of the class in which the recording was made can access the recording. Faculty should take steps, such as preventing downloading capability, in order to protect the privacy of the members. Recordings and chat sessions are private and cannot be shared outside the classroom. Sharing recordings or chat sessions with anyone outside of the class will be considered academic misconduct. Course activities may be audio or video recorded and made available to other students in this course. As part of your participation in this course, you may be recorded. If you do not wish to be recorded, please contact the instructor the first week of class, or as soon as you enroll in the course, to discuss alternative arrangements. The university provides additional resources on recordings and privacy concerns.

📚 Appendix: Week by Week Reading (See Optional Readings in Weekly Folder)

Week 1: Introduction to Urban AI

- (SKIM) Sanchez, T. (2023). Planning with Artificial Intelligence. American Planning Association (APA). https://www.planning.org/publications/report/9270237/ (PDF available on Canvas)
- (TO-DO) UM-ChatGPT. https://umgpt.umich.edu/ (Can access GPT-4o model; Llama 3; and DALL.E 3)
- (TO-DO) UM-Maizey. https://its.umich.edu/computing/ai/maizey-in-depth (Customizable version of UM-ChatGPT)

- (TO-DO) OpenAI ChatGPT. https://chatgpt.com/ (Register a free account; Pro is recommended — $20/month — but not required)
- (TO-DO; OPTIONAL) Apply for Github education benefit here: https://education.github.com/discount_requests/application?type=student
- (TO-DO; OPTIONAL) Download Visual Studio Code https://code.visualstudio.com/

Week 2: Machine Learning and GenAI Sandbox

- (EXPLORE) Teachable Machine. https://teachablemachine.withgoogle.com/
- (EXPLORE) Teachable Machine Tutorial: Bananameter https://medium.com/@warronbebster/teachable-machine-tutorial-bananameter-4bfffa765866
- (EXPLORE) OpenAI ChatGPT. https://chatgpt.com/ (Register a free account; Pro is recommended — $20/month — but not required)
- (EXPLORE) Adobe Firefly Login using UM account: https://teamdynamix.umich.edu/TDClient/30/Portal/KB/ArticleDet?ID=11877
- (OPTIONAL) UM-ChatGPT. https://umgpt.umich.edu/ (Can access GPT-4o model; Llama 3; and DALL.E 3)
- (OPTIONAL) UM-Maizey. https://its.umich.edu/computing/ai/maizey-in-depth (Customizable version of UM-ChatGPT)
- (OPTIONAL) Github Copilot. GitHub Copilot is an AI pair programmer that translates natural human language into programming code. It is free for students (application can take up to 9 days to process). It can be installed in VScode. https://education.github.com/discount_requests/application?type=student
- (OPTIONAL) Prompt engineering in coding assistance with GitHub Copilot: https://docs.github.com/en/copilot/using-github-copilot/prompt-engineering-for-github-copilot
- (TECHNICAL RESOURCE) A Quick Guide for Using GenAI for Scientific Research (2024). Michigan Institute for Data & AI in Society.

https://midas.umich.edu/research/research-resources/generative-ai-hub/users-guide/

- (TECHNICAL RESOURCE) Generative AI Tutorials (2024). Michigan Institute for Data & AI in Society (Slides and Recording Available). https://midas.umich.edu/research/research-resources/generative-ai-hub/generative-ai-tutorials/

Week 3: Introduction to Machine Learning

- (EXPLORE) A visual introduction to machine learning. r2d3us. http://www.r2d3.us/visual-intro-to-machine-learning-part-1/
- (EXPLORE) Model Tuning and the Bias-Variance Tradeoff. r2d3us. http://www.r2d3.us/visual-intro-to-machine-learning-part-2/
- (TECHNICAL RESOURCES) Sklearn. https://scikit-learn.org/stable/

Week 4: Natural Language Processing, Neural Networks, Deep Learning

- (SKIM) Cai, M. (2021). Natural language processing for urban research: A systematic review. *Heliyon*, *7*(3). https://www.cell.com/heliyon/pdf/S2405-8440(21)00427-8.pdf (PDF available on Canvas)
- (SKIM) Fu, X. (2024). Natural language processing in urban planning: A research agenda. *Journal of Planning Literature*, 08854122241229571. https://journals.sagepub.com/doi/epub/10.1177/08854122241229571 (PDF available on Canvas)
- (TO-DO) Create an account on Hugging Face https://huggingface.co/welcome and create API token for lab
- (TECHNICAL RESOURCE) Hugging Face Models. https://huggingface.co/models; Create an account on Hugging Face https://huggingface.co/welcome and create API token for lab
- (TECHNICAL RESOURCE) Hugging Face Guide: https://huggingface.co/docs/hub/index

Week 5: Generative AI and Large Language Model

- (EXPLORE) Murgia, M. & Visual Storytelling Team. (2023). Generative AI exists because of the transformer. Financial Times. https://ig.ft.com/generative-ai/
- (SKIM) Vaswani, A. (2017). Attention is all you need. *Advances in Neural Information Processing Systems*. https://arxiv.org/abs/1706.03762

Week 6: Planning as Code and Customized LLMs

- (SKIM) Brinkley, C., & Stahmer, C. (2024). What is in a plan? Using natural language processing to read 461 California city general plans. *Journal of Planning Education and Research*, *44*(2), 632-648. https://journals.sagepub.com/doi/epub/10.1177/0739456X21995890 (PDF available on Canvas)
- (SKIM) Poirier, L., Antonio, D., Dettmann, M., Eng, T., Ganata, J., Ghosh, S., ... & Brinkley, C. (2024). Making plans findable, accessible, interoperable, and reusable with data infrastructure: A search engine for constructing, analyzing, and visualizing planning documents. *Environment and Planning B: Urban Analytics and City Science*, 23998083241227471. https://journals.sagepub.com/doi/full/10.1177/23998083241227471 (open access; PDF available on Canvas). Link to the plan search tool they developed: https://plansearch.caes.ucdavis.edu/
- (SKIM) Fu, X., Li, C., & Zhai, W. (2023). Using natural Language Processing to read plans: a study of 78 resilience plans from the 100 resilient cities network. *Journal of the American Planning Association*, *89*(1), 107-119. https://www.tandfonline.com/doi/full/10.1080/01944363.2022.2038659 (PDF available on Canvas)
- Silver, A. (2024). How Governments Are Using AI and GIS to Fast-Track Permits. https://www.govtech.com/artificial-intelligence/how-governments-are-using-ai-and-gis-to-fast-track-permits
- (SKIM) Hammon, M. (2024). AI Traffic Management Comes to Dallas-Fort Worth. Planetizen. https://www.planetizen.com/news/2024/04/128598-ai-traffic-management-comes-dallas-fort-worth
- (SKIM) Partida, D. (2024). Using Machine Learning to Optimize Utility Management. https://www.planetizen.com/blogs/129620-using-machine-learning-optimize-utility-management

- Hammon, M. (2024). San Jose Is Training AI to Identify Homeless Camps. https://www.planetizen.com/news/2024/04/128168-san-jose-training-ai-identify-homeless-camps
- Descant, S. (2024). Cities Using AI for Transparency, Resident Engagement. https://www.govtech.com/artificial-intelligence/cities-using-ai-for-transparency-resident-engagement
- Teale, C. (2022). AI-powered cameras to enforce bus lanes https://www.route-fifty.com/infrastructure/2022/08/ai-powered-cameras-enforce-bus-lanes/375728/
- (TECHNICAL RESOURCE) Cacic, M. (2023). Pre-training vs Fine-Tuning vs In-Context Learning of Large Language Models. https://www.entrypointai.com/blog/pre-training-vs-fine-tuning-vs-in-context-learning-of-large-language-models/
- (TECHNICAL RESOURCE) Lau, J. (2024): How to create a custom GPT: A beginner's guide. https://zapier.com/blog/custom-chatgpt/

Week 7: AI Ethics and Social Costs

- (SKIM) T. W. Sanchez, M. Brenman, and X. Ye, "The Ethical Concerns of Artificial Intelligence in Urban Planning," *Journal of the American Planning Association*, vol. 0, no. 0, pp. 1–14, doi: 10.1080/01944363.2024.2355305 (PDF available on Canvas)
- (SKIM) So, W. (2023). Which information matters? Measuring landlord assessment of tenant screening reports. *Housing Policy Debate*, *33*(6), 1484-1510. (PDF available on Canvas)
- (SKIM) Liu, E. J., So, W., Hosoi, P., & D'Ignazio, C. (2024, October). Racial Steering by Large Language Models: A Prospective Audit of GPT-4 on Housing Recommendations. In *Proceedings of the 4th ACM Conference on Equity and Access in Algorithms, Mechanisms, and Optimization* (pp. 1-13).

Week 12: Human Roles in Designing, Auditing, and Aligning AI Systems with Human Values

- (SKIM) Green, B. (2022). The flaws of policies requiring human oversight of government algorithms. *Computer Law & Security Review*, *45*, 105681.

https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3921216

- (SKIM) London Office of Innovation and Technology: Humans in the Loop: What should the role of officers be in AI-powered public services? https://loti.london/blog/hil-how-can-and-should-officers-intervene-in-ai-powered-public-services/
- (SKIM) Christian, B. The Alignment Problem: Machine Learning and Human Values. P.17-81 (Chapter 1) New York: WW Norton & Company.
- (SKIM) Liang, X., Brainerd, B., Hicks, T., & Andris, C. (2024). Lessons from a human-in-the-loop machine learning approach for identifying vacant, abandoned, and deteriorated properties in Savannah, Georgia. *Journal of Planning Education and Research*, 0739456X241273945. https://www.xiaofanliang.com/publication/savannah/savannah.pdf
- (TECHNICAL RESOURCE) Human-in-the-Loop Machine Learning: Active Learning and Human-Centered AI. https://www.manning.com/books/human-in-the-loop-machine-learning
- (TECHNICAL RESOURCE) Interpretable Machine Learning: A Guide for Making Black Box Models Explainable https://christophm.github.io/interpretable-ml-book/

Week 13: AI's Systematic Impact: Environment, Labor, Economics, and Human Dynamics

- (SKIM) Crawford, K. (2021). *The Atlas of AI: Power, Politics, and the Planetary Costs of Artificial Intelligence*. Yale University Press.
- (SKIM) Saenko, K. (2023). A Computer Scientist Breaks Down Generative AI's Hefty Carbon Footprint. Scientific American. https://www.scientificamerican.com/article/a-computer-scientist-breaks-down-generative-ais-hefty-carbon-footprint/
- (SKIM) Chen, S. (2025). How much energy will AI really consume? The good, the bad and the unknown. https://www.nature.com/articles/d41586-025-00616-z
- (SKIM) Fluet, J. (2021). Data Centers Evolved: A Primer for Planners. American Association of Planning.

https://www.planning.org/planning/2021/summer/data-centers-evolved-a-primer-for-planners/

- (SKIM) Muro, M., Methkupally, S., Kinder, M. (2025). The geography of generative AI's workforce impacts will likely differ from those of previous technologies. https://www.brookings.edu/articles/the-geography-of-generative-ais-workforce-impacts-will-likely-differ-from-those-of-previous-technologies/