MUSA 5080/CPLN 5920: Public Policy Analytics

Fall 2025

Course Information

Time: Mondays, 10:15 AM – 1:14 PM
Location: Fagin 214
Instructor: Dr. Elizabeth Delmelle
Email: delmelle@design.upenn.edu
Office Hours: Mondays 1:30–3:00 PM/ Tuesdays 9:30-10:30am or by appointment *Use Link To Sign Up*
TA Office Hours:

- Jiayue Ma (majiayue@design.upenn.edu): Thursdays 10-11am
- Zhanchao Yang (zhanchao@design.upenn.edu): Tuesdays 1-2pm

Course Description

This course teaches advanced spatial analysis and introduces data science and machine learning tools within the context of urban planning and public policy. Unlike private-sector data science focused solely on optimization, our approach emphasizes public goods, governance, and equity. We'll cover topics including transportation, housing, public health, and criminal justice, using both spatial tools and predictive modeling to help guide resource allocation and policy design.

Key Focus: Understanding concepts deeply rather than just completing code. We emphasize fairness, transparency, and understanding the implications of our models.

Learning Outcomes

By the end of the semester, students will be able to:

- Build and evaluate predictive models for public policy questions
- Critically assess model generalizability, effectiveness, and bias
- Navigate the full data science workflow: wrangling, exploration, modeling, and communication
- Integrate spatial and temporal variables into policy-oriented models
- Communicate uncertainty, limitations, and equity impacts to decision-makers
- Create professional data science portfolios using Quarto

Course Materials

Required Texts (All Free Online)

- Ken Steif, *Public Policy Analytics*
- Hadley Wickham et al., *R for Data Science*
- Robin Lovelace et al., *Geocomputation with R*
- Kyle Walker, *Analyzing US Census Data*

Supplemental Material

- Selected chapters from *Visualization for Social Data Science*
- Additional readings provided weekly via Canvas

Assessment Structure

Component	Weight	Description
Weekly In-Class Quizzes	35%	Concept-focused assessments (10 quizzes, lowest score dropped)
Lab Assignments (5 total)	20%	Implementation + feedback response graded on 3-point scale
Midterm: House Prediction Competition	15%	Team-based modeling competition with lightning presentations
Final Modeling Challenge	25%	Real-world policy problem requiring model selection and justification
Participation & Weekly Notes	5%	Attendance, engagement, and weekly learning documentation

Lab Assignment Structure

Philosophy: Lab assignments assess coding implementation, documentation, and professional response to feedback. Knowledge of underlying concepts is evaluated through weekly quizzes. Ultimately, the labs will form your final portfolio for this course so the amount of effort you put into each assignment is for your own benefit.

Lab Assignment Structure:

Labs 1, 2, 4, and 5 are individual assignments. **Lab 3 (House Prediction)** is completed in teams of 3-4 students.

Assignment Sequence:

1. **Census Data Exploration** (Individual)
2. **Neighborhood Indicators** (Individual)
3. **House Price Prediction Competition** (Team-based) - *Serves as Midterm*
4. **Parole Reform Analysis** - Logistic Regression (Individual)
5. **Bike Share Rebalancing** - Space-Time Modeling (Individual)

Final Modeling Challenge: Teams work on a real-world policy problem and choose the most appropriate modeling approach from the semester (linear regression, count models, logistic regression, or space-time modeling). The challenge emphasizes problem framing, methodology justification, and complete workflow implementation.

GitHub-Based Feedback Response: Each assignment (after the first) must include a `feedback-response.md` file addressing:

- How you incorporated previous TA feedback
- Specific improvements made to visual clarity of figures, documentation, writeups
- Challenges encountered and solutions attempted
- Questions or areas needing clarification

Weekly Notes Requirement: Students maintain a `weekly-notes/` folder in their GitHub repo with files named `week-XX-notes.md`. Notes should include:

- Key concepts from lecture and readings
- Coding techniques learned and challenges faced
- Questions or confusion points
- Connections to previous weeks or policy applications
- Personal reflections on the material

Notes are checked weekly for completion and effort (not accuracy) and serve as quiz preparation aids.

Lab Grading Scale:

- **2 points:** Complete implementation + feedback incorporation + clear documentation.
- **1 point:** Somewhat complete, poor feedback integration or unclear work
- **0 points:** Not submitted, incomplete, or no evidence of engaging with feedback

Weekly Quiz: AI advancements have changed how I view assessment. I am no longer concerned about students ability to complete coding-based assignments. AI, while certainly not perfect, will generally produce a solution to assignment prompts. My major concern now is how well students are able to really comprehend the concepts and fundamentals of what is being done in order to be appropriate critics of what AI produces.

Therefore, each class period will begin with an in-person, written quiz on material from the prior week or the prior lab assignment. There will be a total of 10 quizzes, but I will drop the lowest one.

Course Format

Structure: Each 3-hour session combines conceptual lectures with hands-on labs

Expectations:

- Bring charged laptops for live coding and group work
- Maintain weekly Quarto-based portfolio with reflections and notes (*ideally* students will take written notes and then transfer these to quarto after class for optimal retainment.)
- Revise past work based on TA feedback for portfolio improvement
- Engage actively in discussions and collaborative problem-solving
- Attend class!

Technology: All work will be completed in R using Quarto for reproducible, professional documentation.

GitHub Classroom: We will use GitHub Classroom for assignment distribution and submission. Each assignment creates a personal repository containing starter materials and instructions. Students customize, complete, and push their work to GitHub. This workflow builds professional version control skills while enabling efficient feedback and collaboration.

Weekly Schedule

Week	Date	Topic	Assessment	Lab Assignment	GitHub Deliverables
1	Sep 8	Course Intro • Quarto & GitHub Setup • R Review	—	Setup & Portfolio Init	Initial repo + Week 1 notes
2	Sep 15	Census Data + Wrangling • Basic Visualization	Q1	**Lab 1 Start:** Census Exploration	Week 2 notes + Lab 1 progress
3	Sep 22	EDA • Visual Design Foundations	Q2	Lab 1 continued	Week 3 notes + Lab 1 progress
4	Sep 29	Spatial Operations • Neighborhood Indicators	Q3	**Lab 1 Due** + **Lab 2 Start**	Week 4 notes + Lab 1 final + Lab 2 start
5	Oct 6	Linear Regression I • Making Predictions	Q4	Lab 2 continued	Week 5 notes + Lab 2 progress
6	Oct 13	Linear Regression II • Model Evaluation	Q5	**Lab 2 Due** + **Lab 3 Start** (Teams)	Week 6 notes + Lab 2 final + Lab 3 start
7	Oct 20	Spatial Auto-correlation • Intro to Spatial ML	Q5	**Lab 3 Continue** (Teams)	Week 7 notes + Lab 2 final + Lab 3 start

Week	Date	Topic	Assessment	Lab Assignment	GitHub Deliverables
8	Oct 27	**House Prediction Presentations** + Count Models- Predictive Policing	**Competition Presentations**	**Lab 3 Due**	Week 8 notes + Lab 3 final + presentations
9	Nov 3	Logistic Regression I • Geographic Cross-Validation	Q6		Week 9 notes
10	Nov 10	Logistic Regression II • Recidivism Case Study	Q7	**Lab 4 Start:** Parole Reform Analysis	Week 10 notes + Lab 4 start
11	Nov 17	Space-Time Modeling • Temporal Analysis	Q8	**Lab 4 Due** + **Lab 5 Start:** Bike Share	Week 11 notes + Lab 4 final + Lab 5 start
12	Nov 24	Text Analysis + *k*-means clustering. Final Challenge Introduced in Class	Q9	Lab 5 continued	Week 12 notes + Lab 5 start
13	Dec 1	**Final Challenge Continued - Teams work in class.**	Q10	Lab 5 Due	Lab 5 final
14	Dec 8	**Final Challenge Presentations**			Final Challenge Deliverables Due in 1 week.

Academic Integrity & AI Policy

Core Principle

All written work must be in your own words and demonstrate your understanding of concepts.

AI Tool Guidelines

- **Permitted:** Using AI for debugging code, understanding error messages, understanding or decoding samples.
- **Not Permitted:** Copying/pasting AI-generated text for assignments, having AI complete entire problems. Using AI to interpret your results or do your data analysis. Providing responses suggested by AI that you do not fully understand.
- **Quiz Preparation:** Use AI to help understand concepts, but ensure you can explain ideas without assistance

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Additional FAQ Information

Late Assignments: Please turn in your assignments on time. I do very much understand that you have many other courses and I've done by best to make the required work reasonable. However, the concepts in this course build on each other and therefore assignments need to be turn in on time.

Revising & Resubmitting Assignments: I've minimized the grading of assignments for reasons outlined above. You'll receive general feedback on how to improve in future work, but as long as you complete the assignment and continue to improve, you'll 'pass' the assignment. Therefore, there is no option to revise and resubmit for a higher grade.

Academic Integrity: *Please see the university policy on academic integrity.* Cases of academic dishonesty on assignments will result in a score of 0 on the assignment.

Policy: 24-hour response time goal. For coding issues, please share your repository link or create a GitHub Issue for technical problems.

This syllabus may be modified during the semester. Check Canvas for the most current version.