11.524: Spatial Statistics Workshop

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Lab: Tu, 4-7pm, 9-554 | Lecture: Th, 5-6:30pm, 9-450A

Description

The broad availability of spatial data on and in cities means that planners can paint pictures of both “what is where” and “what was where, when” with an unprecedented level of detail. However, “where” questions often produce more questions than answers. Maps are evocative, but they are unable to answer questions that are crucially important to planners: how are phenomena interrelated, clustered, and interdependent? Spatial statistics offer one analytical approach for getting at these complex questions that are often key to understanding urban environments.

Even as these methods enhance the analytical repertoire of urban planners, we must remember that methods don’t come from nowhere; they cannot be fully divorced from the conditions of their emergence. Even methods are placed; they come from somewhere. As such, we will be digging into the history of spatial statistics methods and approaches, producing biographies of our methods.

What Will We be Learning?

Students will develop the technical skills necessary to ask spatial questions, statistically. We will be covering spatial autocorrelation (including local indicators), interpolation and kernel density methods, and spatial regression. Students will also learn to investigate the history of spatial methods, arriving collectively at a richer picture of what planners inherit when these methods become part of our palette.
As such, students should emerge from the class able to perform sophisticated spatial statistical analyses and able to contextualize specific methods.

**How Will We be Learning?**

This is a quantitative class in which our methods will be empirical and statistical; our tools will be computational. As such, much of our time will be spent in the weeds, learning how to build models that take space into account, and ask spatial questions, statistically. However: my hope is that no one will be intimidated because they’re not “data scientists.” To the extent that it is possible, I will be seeking to make these methods approachable and accessible.
We will be using freely accessible software. We will be using entirely free and open source software. QGIS 3.4 will be our GIS of choice. Our spatial statistics work will be carried out in the R statistical computing environment. These tools will be sufficient to carry out almost any spatial analysis task… for free!

Are There Prerequisites?

Again, accessibility is a priority. However, it is best to proceed with a baseline of shared knowledge. MCP students hoping to enroll in this course must have taken or tested out of 11.205: Introduction to Spatial Analysis and 11.220: Quantitative Reasoning and Statistical Methods for Planning (or its equivalent). We will assume a familiarity with GIS fundamentals (projections, overlay operations), spatial analysis, basic inferential statistics, and linear modeling. For most undergraduates, general MIT requirements will prove sufficient. Students from other institutions hoping to cross-register should have experience with GIS, quantitative methods, and will find past exposure to the R statistical computing environment beneficial.

Am I Required to Buy the Texts?

No! All readings are uploaded to the course Stellar 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…

Also, I recognize that the preponderance of these readings are by men; this is, of course, a problem. To cite two of my colleagues, Carrie Mott and Daniel Cockayne: “the choices we make about whom to cite—and who is then left out of the conversation—directly impact the cultivation of a rich and diverse discipline, and the reproduction of geographical knowledge itself. To cite narrowly… does a disservice not only to researchers and writers who are othered by white heteromasculinism, but also to the prevailing impression of geography upon those who may be less familiar with the discipline, most notably, our students” (Mott and Cockayne 2017, 955). In future iterations of this class, I would like my primary texts to do more to intervene in the field and to challenge dominant representations of “GIScience” and its practitioners… for now, mea culpa, and as I locate other resources I will do my best to call your attention to them.

Assessment and Assignments

Assessment
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<td>Weekly Exercises</td>
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<td>History of a Method</td>
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**Weekly Exercises**

- Due: Weekly on Thursday at 8:00am.

These are straightforward exercises intended to keep you caught up with the material. They should not take you more than an hour to complete and will be tightly coupled to each week’s readings.

**Histories of Methods**

- Due: Tuesday of chosen week at 8:00am.
- Revisions: Thursday of chosen week at 8:00am.
- Presentation: Thursday of chosen week, start of lecture.

We are inclined to forget that quantitative methods—numerical, statistical, and computational approaches by which we come to answer questions about processes that unfold in the world—have histories. They come from somewhere. They were built by someone. They were not always accepted as sound. One of your assignments this semester will be to remind us of this by producing a short (5 page) history of one of the methods covered in the course of the semester, revise it based on feedback, and present it to the class at the beginning of lab.

**Demystification Guides**

- Due: Tuesday of chosen week at 8:00am.
- Revisions: Thursday of chosen week at 8:00am.
- Presentation: Thursday of chosen week, start of lecture.

Statistics have a nasty way of making things less lucid even as they are intended to produce clear understandings of the world. This is partially due to the opaque,
mathematical language generally used to describe methods and results, and to ensure their rigor. The cynic might also say that statisticians and data scientists—who command high salaries due to their mastery of an arcane tongue—are not incentivized to make their approaches transparent. Your challenge, should you choose to accept it, is to take one of the methods we cover this semester and make it as radically accessible as possible. You will then revise this demystification guide and distribute it to your classmates. One of these demystification guides will be presented to the class at the beginning of each lecture.

**Attendance**

For a very long time, I was against taking attendance. But here’s the thing… this course will be a collective effort, and the quality of our work together might be seriously taxed by mid-semester apathy. So: feel free to take one unexcused absences. Beyond that, each unexcused absence will result in a stepwise reduction in your final grade (e.g., A becomes A-). Please note, though, that an absence does not imply that I must provide you with a walkthrough of the happenings of the day!

**Office Hours**

Office hours will be set together in the first week of class.

I find it very helpful if you book sessions in advance through the DUSP office hours portal\(^1\), though this is not absolutely mandatory. No time slot can possibly please everyone. As such, If this time does not work for you, we can make arrangements to meet at another time. However, please be conscientious! I set this time aside each week for office hours and I really do try to manage my time.

**Email**

I reserve the right to take up to 24 hours to respond to your emails during the week. I will respond to emails sent after 5pm the following day. I do not respond to emails on Saturday and do so on Sunday only at my discretion. 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.

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\(^{1}\)https://dusp.mit.edu/oh
Lateness 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.

On Exceptions...

There will of course be situations where I am willing to bend these rules. These are regulatory ideals, not absolutes. I am a human being; you are human beings. The contingencies and exigencies that condition your life are real. I will strive to respect them if you similarly strive to not take advantage of my inclination to respect them. We're all in this weird boat together—let's be good to each other.

A Note on Graduate School and 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. I went to graduate school. In fact, I went to graduate school twice. I also went to college. Without dwelling on the issue, I will say that I am intimately familiar with the toll that institutions of higher education can exact on our mental health and wellbeing.

I have two points here: 1) MIT offers a range of counseling and mental health resources\(^2\) for students. I would really encourage you to be proactive about taking advantage of them; and 2) do not hesitate to let me know if you're struggling. It is not my intention to mine for the details of your private lives! It is only to let you know that I am sensitive to the distinctive difficulties of the environment we inhabit and that help is available.

\(^2\)https://medical.mit.edu/services/mental-health-counseling
Schedule

W01: What is Special about Spatial?

Readings


Assignments

- Weekly Exercise 1: Thursday, 9 April at 8:00am.

W02: Global Spatial Autocorrelation

No lecture this week—Passover.

Deadlines

- Weekly Exercise 1: Thursday, 9 April at 8:00am.

Readings


Assignments

- Weekly Exercise 2: Thursday, 16 April at 8:00am.

W03: Local Spatial Autocorrelation

Deadlines

- Weekly Exercise 2: Thursday, 16 April at 8:00am.
Readings


Assignments

• Weekly Exercise 3: Thursday, 23 April at 8:00am.

W04: Describing Fields

Deadlines

• Weekly Exercise 3: Thursday, 23 April at 8:00am.

Readings


Assignments

• Weekly Exercise 4: Thursday, 30 April at 8:00am.

W05: Spatial Regression I

Deadlines

• Weekly Exercise 4: Thursday, 30 April at 8:00am.

Readings


Assignments

• Weekly Exercise 5: Thursday, 7 May at 8:00am.
W06: Spatial Regression II

**Deadlines**

- Weekly Exercise 5: Thursday, 7 May at 8:00am.

**Readings**


**Assignments**

- Weekly Exercise 6: Thursday, 14 May at 8:00am.

W07: Fin.

**Deadlines**

**Readings**

**Assignments**