GEOG 4/597: Advanced Spatial Quantitative Analysis

Winter 2021

Course Description

This course is an application of statistical methods for geographers and other social, earth and environmental scientists that use geospatial data (e.g., climatology, criminology, demography, ecology, health studies, hydrology, urban planning, etc.). It is intended to teach how to use spatial statistics in understanding and solving various geospatial problems. Topics include inferential statistics for spatial data (hypothesis testing), spatial regression, point pattern analysis, spatial autocorrelation, geographically weighted regression, and spatial machine learning. The emphasis will be on developing analytical skills with practical applications. Topics covered in this class will be supplemented with lab exercises, which will use the R programming language to perform graphical and numerical analysis of geospatial data.

A Note on R

R - the statistical programming environment and language - will be used for all work in this course. One of the main goals of this course is to learn the process of spatial data analysis in R.

Classes

Tuesdays and Thursdays, noon - 1:50pm

Zoom meeting links will be posted on the course Slack page before each meeting.

I don't care if you turn your camera on or off for lectures - it is entirely up to you. Personally, I prefer keeping my camera off (why should you get all dressed up just to sit there and listen to somebody?). I would like to see you during one-on-ones and presentations *if you are open to it*, as I'm very visual and like putting faces to names. Again, this is up to you and will have no impact on your grade/ participation.

Course Communication

All course communication will be done through **Slack**. Slack is a team communication platform gaining popularity. Within it, we can have private direct messages, group conversations, file sharing, and even private group projects. This will allow you to ask the entire class questions on issues that you are having with assignments, labs, or projects. It is accessible via a web browser or mobile App (iOS and Android).

To join our Slack group, follow the link provided (requires an @pdx.edu email).

Weekly Assignments

In place of reading assignments (and thus required texts), students will completely weekly R courses on DataCamp.com (http://datacamp.com). I have arranged for **free access for students** enrolled in this course. All students will have the choice of which R coursework they take, with recommendations provided. One 'course' or 'module' is to be complete each week by Monday morning.For students already proficient in R, this presents an opportunity to take advanced R, SQL, or Python coursework. There are also opportunities to earn credit for weekly assignments by filling a peer mentor roll and helping your fellow classmates with R questions. Please discuss this with the instructor first, however, so we can have some clear guidelines on how it will impact your grade.You will receive and invitation to our course's DataCamp page within the first week of school.

Weekly Labs

Submitted through Slack direct message
There will be several lab assignments throughout the term which allow you to practice the concepts covered during the lectures. These labs will require the R and R Studio software packages.

This software is proved in CH 469 and the PSU Virtual Lab, but is also entirely free and can be run on any operating system. I recommend you install it on your own computer!

Late Assignments and Labs

Life is unpredictable - if you need to complete some DataCamp lessons or other coursework late (or feel as if you shouldn't have to take it at all), please discuss it with me **before** it is due. I will happily entertain any requests, though will have the final say in whether it is justified or not.

Term Project

The term project will be up to you - either choose a research project related to your thesis/dissertation, something that interests you, or a pre-made project that I have made for you.

The requirements are:

* We agree on an acceptable project before you begin
* working on it You demonstrate tools/concepts learned in this course
* You use R for the analysis
* You use R to create the
* presentation You presentation is online

Grading

20% Weekly Assignments (DataCamp)	
10% Participation	
20% Labs	
50% Term Project (you'll receive 0/50 if you do not present or clear the project with me first)	

Tentative Schedule

We may spend more or less time on a subject depending on interest!

Week	Date	Topic	Lab ("due" following Thursday)
1	1/04 - 1/08	Introduction: Spatial Analysis	
2	1/11 - 1/15	Hypothesis testing for spatial data, spatial sampling	Lab 1: Point Pattern Analysis
3	1/18 - 1/22	Point pattern analysis	Lab 2: Spatial Autocorrelation
4	1/25 - 1/29	Spatial autocorrelation	Lab 3: Local Spatial Autocorrelation
5	2/01 - 2/05	Spatial autocorrelation/regression	Lab 4: Spatial Regression
6	2/08 - 2/12	Spatial regression	Lab 5: Geographically Weighted Regression (GWR)
7	2/15 - 2/19	Geographically weighted regression	Lab 6: Machine Learning
8	2/22 - 2/26	Machine Learning	Work on Term Project
9	3/01 - 3/05	Machine Learning	
10	3/08 - 3/12	Term project presentations	Final Models submitted by Friday 5pm
11	3/15 - 3/19	Finals Week (no class, no exam, unless you need to present)	

Academic Integrity

You are responsible for the content and integrity of the academic work you submit. The guiding principle of academic integrity shall be that your submitted work, examinations, and projects must be your own work. Note that cutting and pasting sources from the internet is considered plagiarism, but can *sometimes* be acceptable in analytics. If you need help determining what is or is not plagiarism, please talk to the instructor - I am very open and non-judgmental.

Access and Inclusion for Students with Disabilities PSU values diversity and inclusion; we are committed to fostering mutual respect and full participation for all students. My goal is to create a learning environment that is equitable, usable, inclusive, and welcoming. If any aspects of instruction or course design result in barriers to your inclusion or learning, please notify me. The Disability Resource Center (DRC) provides reasonable accommodations for students who encounter barriers in the learning environment.

If you have, or think you may have, a disability that may affect your work in this class and feel you need accommodations, contact the Disability Resource Center to schedule an appointment and initiate a conversation about reasonable accommodations. The DRC is located in 116 Smith Memorial Student Union, 503-725-4150, drc@pdx.edu (mailto:drc@pdx.edu), http://www.pdx.edu/drc (http://www.pdx.edu/drc). - If you already have accommodations, please contact me to make sure that I have received a faculty notification letter and to discuss your accommodations. - Students who need accommodations for tests and quizzes are expected to schedule their tests to overlap with the time the class is taking the test. - Please be aware that the accessible tables or chairs in the room should remain available for students who find that standard classroom seating is not usable.

Title IX / Non-discrimination Statement

As an instructor, one of my responsibilities is to help create a safe learning environment for my students and for the campus as a whole. We expect a culture of professionalism and mutual respect in our department and class. You may report any incident of discrimination or discriminatory harassment, including sexual harassment, to either the Office of Equity and Compliance (http://www.pdx.edu/diversity/office-of-equity-compliance (http://www.pdx.edu/diversity/office-of-equity-compliance)), or to the Office of the Dean of Student Life (http://www.pdx.edu/dos/student-conduct-at-psu (http://www.pdx.edu/dos/student-conduct-at-psu)). Please be aware that, as a faculty member, I have a responsibility to report any instances of sexual harassment, sexual violence, and/or other forms of prohibited discrimination. If you would rather share information about sexual harassment or sexual violence to a confidential employee who does not have this reporting responsibility, you can find a list of such individuals at (http://www.pdx.edu/sexual-assault/get-help (http://www.pdx.edu/sexual-assault/get-help)