Geography 385 Spatial Data Analysis

Spring 2024

Class Meetings

Meeting	Location	Time
Lecture	GMCS 307	Tue & Thu 2:00 - 3:15pm

Teaching Team

Name	Office hours	Location
Sergio Rey	Tue 9:00 - 10:00 (by appointment)	PSFA 361G
Jin Huang	Fri 10:30am (virtual)	PSFA 361F

Introduction

Welcome to 385: Spatial Data Analysis!

The purpose of this course is to introduce you to methods of spatial data analysis. The focus is on both the conceptual and applied aspects of spatial statistical methods. We will place particular emphasis on the computational aspects of Exploratory Spatial Data Analysis (ESDA) methods for different types of spatial data including point processes, lattice data, geostatistical data, network data, and spatial interaction. Throughout the course you will gain valuable hands-on experience with several specialized software packages for spatial data analysis. The overriding goal of the course is for you to acquire familiarity with the fundamental methodological and operational issues in the statistical analysis of geographic information and the ability to extend these methods in your own research.

The course takes an explicitly computational thinking approach to its pedagogy. Students are introduced to computational concepts and tools that are increasingly important to research

that engages with geospatial data. By adopting these tools, students acquire a deeper engagement with, and mastery of, the substantive concepts. Put differently, students will *learn to code*. But this is a means to the end goal: students will *code to learn* spatial data analysis.

In the scope of a 15-week semester course we can only introduce a handful of the key concepts and methods relevant to the field of spatial data analysis. As such, the course is not intended as an exhaustive treatment. Instead, the goal is that students will acquire an understanding of the more common and useful methods and practices, and use the course as an entry point for further engagement with the field.

Prerequisites

- GEOG 101 or GEOG 102
- STAT 250 or comparable course in statistics.

All students are required to complete the prerequisite assessment quiz before 2024-01-30 2:00pm.

Computational Learning

We will be using open source geospatial software throughout the course together with Jupyter Notebooks, and Python as our scripting language.

All software for the course will be made available through a web-based framework. Students wishing to install these materials on their own machines will be given instructions to do so, **but this is not required**.

Readings

All required readings are available through the links listed below. Assigned readings should be completed before the date listed in the schedule (see below). Readings are a critical part of the discussions we will hold in class, and therefore being prepared for class means having completed the readings and thought about the content. It will be difficult to do well in this course without having completed the readings.

Abbreviation	Source
GDA	Tenkanen, H., V. Heikinheimo, D. Whipp (2023) Python for Geographic Data Analysis. CRC Press.
GDS	Rey, S.J., D. Arribas-Bel, L.J. Wolf (2023) Geographic Data Science with Python. CRC Press.

Schedule (Planned)

Week	Dates	Topic	Reading	Due
1	Jan-18	Course Introduction		
2	Jan-23	Computational Environment I		
	Jan-25	Computational Environment II		
3	Jan-30	Python: Introduction	GDA 1 GDS 2	Quiz 1
	Feb-01	Python: Programming Concepts	GDA 2	
4	Feb-06	Python: Scripting	GDA 2	Quiz 2
	Feb-08	Python: Functions	GDA 2	
5	Feb-13	Exericse 1 Collaboration		Exercise 1
	Feb-15	Python: Data Analysis/Visualization	GDA 3,4	Quiz 3
6	Feb-20	Geopandas	GDA 5	Quiz 4
	Feb-22	Geoprocessing	GDA 6	
7	Feb-27	Research: Intersectional Urban Dynamics	Rey 2023	
	Feb-29	PySAL	GDS 3	Quiz 5
8	Mar-05	GeoVisualization	GDS 5	Quiz 6
	Mar-07	Spatial Weights	GDS 4	
9	Mar-12	Spatial Dependence	GDS 6	Quiz 7
	Mar-14	Global Autocorrelation	GDS 6	Exercise 2
10	Mar-19	Global Autocorrelation Tests	GDS 6	Quiz 8
	Mar-21	Local Autocorrelation	GDS 7	
11	Mar-26	Local Autocorrelation Tests	GDS 7	Quiz 9
	Mar-28	Point Pattern Data	GDS 8	Exercise 3
	Apr-02	Spring Break		
	Apr-04	Spring Break		
12	Apr-09	Centrography	GDS 8	Quiz 10
	Apr-11	Point Processes	GDS 8	
13	Apr-16	Quadrat Statistics	GDS 8	Quiz 11
	Apr-18	Nearest Neighbor Statistics	GDS 8	
14	Apr-23	Distance Based Statistics	GDS 8	Quiz 12
	Apr-25	Geostatistical Data	DS 6.1-6.5	
15	Apr-30	Spatial Interpolation	DS 6.5	Quiz 13
	May-02	Kriging	DS 6.7	Exercise 4
16	May-07	*Final Exam (1-3pm)*		

Grading

GEOG385 uses specification grading in evaluating student work and in determining your final course grade. Your course grade will be based on the quality and quantity of the work that

you submit that is evaluated to be of an acceptable level of quality. The acceptable level of quality demonstrates competency in the concepts and methods covered in the course.

There is a two-step process for determination of your final course grade at the end of the quarter:

1. Using your quizzes and exercises, your **base grade** is determined.
2. Using your final exam results, determine if your base grade includes a "plus", "minus", or level drop to form the course grade.

For Step 1, the base grade is determined using the following specification:

Level	Hurdles
A	Pass at least 12 of 14 quizzes and earn "Demonstrates Competency" on 4 of 4 exercises,
B	Pass at least 10 of 14 quizzes and earn "Demonstrates Competency" on 3 of 4 exercises
C	Pass at least 8 of 14 quizzes and earn "Demonstrates Competency" on 2 of 4 exercises
D	Pass at least 6 of 14 quizzes and earn "Demonstrates Competency" on 1 of 4 exercises
F	Fail to clear D-level hurdles

For Step 2, your final course grade is determined as follows:

- If you earn at least 85% on the final exam, you will obtain a "+" for your grade. So a B base grade would become a B+ course grade, and so on (**Note: SDSU does not record A+ grades**).
- If you score between 70-85% on the final exam, your base grade becomes your course grade.
- If you score between 50% and 69% on the final exam, you will obtain a "-" for your grade. So an A base grade becomes an A- course grade, a B base grade becomes a B- course grade, and so on.
- If you score less than 50% on the final exam, your course grade will drop one level: An A base grade becomes a final B course grade.

Quizzes

Starting in week three, there will be a quiz given during the first five minutes of the class meeting. The quiz will cover the assigned reading that is required before our work in class. Quizzes are graded on a pass/fail basis.

Exercises

Four exercises will be introduced in class and are to be completed outside of class meetings.

Each exercise is graded using a **CRN** rubric that classifies work with marks of **C** ("Demonstrates Competence"), **R** ("Needs Revision"), or **N** ("Not assessable"):

Of each exercise the following questions will be asked: Does the work demonstrate that the student understands the concepts? Does the work demonstrate competence and meet the expectations outlined in the exercise?

If the answer is "yes" to both of the questions, a student passes the hurdle for that exercise.

If the initial submission does not clear the hurdle, then a second question is asked: Is there evidence of partial understanding of the concepts? If the answer to this question is "Yes" the student can exchange one token to attempt a revision of their work. If the answer is "No", the student does not clear the hurdle for this exercise and will not have the opportunity to revise their work.

Final Exam

A closed book, closed note, timed final exam will be given on **May 7 (13:00-15:00)**. The exam will be based on a blend of previous quiz questions and additional questions that pertain to material covered in class.

Tokens

Each student is provided with three tokens at the beginning of the semester.

Using Tokens

1. One token can be used for a one-day extension for an exercise.
2. One token can be used to revise an exercise that was submitted on-time but evaluated as "Needing Revision".
3. Two tokens can be used to request a make-up date for the final exam. (**Requests required by 2024-04-15 17:00.**)

Remaining Tokens

Each token that remains unused after **2024-05-02** will be counted as a passed quiz. *Tokens cannot be exchanged with other students.*

Policies

Accommodations

If you are a student with a disability and are in need of accommodations for this class, please contact Student Ability Success Center at (619) 594-6473 as soon as possible. Please know accommodations are not retroactive, and I cannot provide accommodations based upon disability until I have received an accommodation letter from Student Ability Success Center.

Privacy and Intellectual Property

Student Privacy and Intellectual Property: The Family Educational Rights and Privacy Act (FERPA) mandates the protection of student information, including contact information, grades, and graded assignments. I will use Canvas to communicate with you, and I will not post grades or leave graded assignments in public places. Students will be notified at the time of an assignment if copies of student work will be retained beyond the end of the semester or used as examples for future students or the wider public. Students maintain intellectual property rights to work products they create as part of this course unless they are formally notified otherwise.

Academic Integrity

The SDSU student academic integrity policy lists violations in detail. These violations fall into eight broad areas that include but are not limited to: cheating, fabrication, plagiarism, facilitating academic misconduct, unauthorized collaboration, interference or sabotage, noncompliance with research regulations and retaliation. For more information about the SDSU student academic integrity policy, please see the following: https://sacd.sdsu.edu/student-rights/academic-dishonesty.

Code of Conduct

As course instructor, I am dedicated to providing a harassment-free learning experience for all students, regardless of gender, sexual orientation, disability, physical appearance, body size, race, religion, or choice of operating system. All course participants are expected to show respect and courtesy to other students throughout the semester. As a learning community we do not tolerate harassment of participants in any form.

- All communication should be appropriate for a professional audience including people of many different backgrounds. Sexual language and imagery are not appropriate in this course.

- Be kind to others. Do not insult or put down other students. Behave professionally. Remember that harassment and sexist, racist, or exclusionary jokes are not appropriate for this course.
- Students violating these rules may be asked to leave the course, and their violations will be reported to the SDSU administration.

This code of conduct is an adaptation of the SciPy 2018 Code of Conduct.