Geography 385 Spatial Data Analysis

Spring 2025

Class Meetings

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

Instructor

Name	Office hours	Location
Sergio Rey	Mon 3:00 - 4:00pm (by appointment)	PSFA 361G

Introduction

Welcome to GEOG 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 with a particular focus on point processes and lattice (areal unit) data. 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 2025-01-23 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 JupyterHub, 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.

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

Schedule (Planned)

Week	Date	Topic	Readings	Exercise	Quiz
1	01-21	Introduction			
	01-23	Computational Resources	RAW 2, JL		Prerequisite
2	01-28	Exploratory Spatial Data Analysis	RAW 1	One out	1
	01-30	Spatial Data Models	RAW 3		
3	02-04	Coordinate Reference Systems	THW 5.3		2
	02-06	Distances	CA21		
4	02-11	PySAL Geoprocessing	RAW 4		3
	02-13	PySAL Spatial Graphs	RAW 4		4
5	02-18	Visualization	VIZ	One due	5
	02-20	Geovisualization	BOKGV	Two out	
6	02-25	Classification Schemes	RAW 5		6
	02-27	Choropleth Mapping	RAW 5		
7	03-04	Point Pattern Visualization	DABVPP		7
	03-06	Kernel Density Estimation	DABVPP		8
8	03-11	Review		Two due	
	03-13	*Exam 1*			
9	03-18	Global Autocorrelation	RAW 6	Three out	9
	03-20	Global Autocorrelation Tests	RAW 6		
10	03-25	Local Autocorrelation	RAW 7		10

Week	Date	Topic	Readings	Exercise	Quiz
	03-27	Local Autocorrelation Tests	RAW 7		
Spring Break	03-31				
11	04-08	Nearest Neighbor Relations	RAW 8		11
	04-10	Nearest Neighbor Tests	RAW 8		
12	04-15	Nearest Neighbor Distances	RAW 8	Three due	12
	04-17	Distance Based Tests	RAW 8	Four out	
13	04-22	Clustering Point Patterns	DABPC		13
	04-24	Regionalization	RAW 10		
14	04-29	Interpolation Point Based	DS6.6	13	14
	05-01	Kriging	DS6.7		
15	05-06	Interpolation Area Based	DS4.2		15
	05-08	Review		Four due	
	05-13	*Exam 2 (1pm)*			

Grading

GEOG 385 uses specification grading in evaluating student work and in determining your final course grade. The quality and quantity of your work will determine your course grade. 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 scores on quizzes and exercises, your **base grade** is determined.
2. Using your exam results, determine if your base grade includes a ”plus”, ”minus”, or level drop to form the course grade.

Base Grade

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

Thresholds for base grade:

Item\Base	A	B	C	D
Quizzes	12	10	8	6
Exercises	4	3	2	1

You must pass the both thresholds to obtain the base grade.

Final Grade

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

- Exam average 90 or above, "+" added to base grade
- Exam average 75-89, no adjustment
- Exam average 60-74, "-" added to base grade
- Exam average <60, one grade below base grade

Examples of Final Grade Determination:

Exam\Base	A	B	C	D
90+	A	B+	C+	D+
75-89	A	B	C	D
60-74	A-	B-	C-	D-
<60	B	C	D	F

> **Note**
>
> Note that SDSU grading policy does not allow A+ grades. However, if you have a base grade of A and score 90+ on your exam average, you are eligible for a letter of recommendation from the professor.

Quizzes

Starting in week two there will be a quiz due before a session that pertains to the background reading that is required before our work in class. Quizzes are graded on a pass/fail basis.

Exercises

Four exercises are assigned on the dates listed in the syllabus. These exercises are evaluated based on whether they demonstrate a sufficient understanding of the covered content. When an assignment is deemed satisfactory, it indicates that the student has effectively showcased their comprehension of the subject matter.

Tokens

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

Using Tokens

1. Credit for a reading quiz that was failed (1 token).
2. Obtaining a one-day extension for an exercise prior to due date (1 token).
3. Revising an exercise that was submitted on-time but evaluated as unsatisfactory (2 tokens).
4. Requesting a make-up date for an exam (3 tokens scheduled at least 2 weeks before exam date)

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, non-compliance 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.