

# **GTECH 33100**

## **Spatial Data Science I**

Spring 2025, Monday 2:30 – 5:15 PM

Location: HN 1090B-2

**Instructor:** Shipeng Sun

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**Office Hours:** Monday 12 – 2 pm & By Appt.

**Zoom ID:** 735 204 6101

### **Course Description and Objectives**

This practical hands-on course introduces programming concepts and coding techniques relevant to the computational methods in spatial data science. The objective of this class is to master the programming concepts, tools, and skills that are instrumental to process, visualize, and analyze geospatial data.

We will learn a wide variety of topics that serve as the basis for more in-depth treatment and practical applications in subsequent courses. We will start with the basics of programming and algorithms, and work through examples for some general, mathematical, and spatial operations. We will then dive into the nuts and bolts of Python as a first language and learn how to translate basic operations into running code, in the context of representing and processing geospatial data. The class will also review some of the most used open-source and proprietary Python libraries for general and spatial data processing, visualization, and analysis. Eight programming assignments will cover various topics. A final project is required to focus on a particular area of interest.

### **Learning Outcomes**

At the end of the semester, students should be able to

- describe generally applicable programming concepts and methods;
- config and apply programming tools and methods, particular to analyzing geospatial data;
- manage the mainstream programming environment for geocomputation;
- write and debug code in a major programming language (Python) for spatial data analysis;
- develop basic algorithmic solutions for spatial data processing problems.

### **Pre-requisite**

GTECH 20100: Introduction to GIS

### **Course Materials**

*Recommended Resources and Books:*

- Sweigart, Al (2019). *Automate the Boring Stuff with Python: Practical Programming for Total Beginners* (2nd Edition). No Starch Press. Free at <https://automatetheboringstuff.com>
- Matthes, Eric (2022). *Python Crash Course: A Hands-On, Project-Based Introduction to Programming* (3rd Edition), No Starch Press.
- Michael Dorman, Anita Graser, Jakub Nowosad, Robin Lovelace (2024). *Geocomputation with Python*. Open-Source book at <https://py.geocompx.org/>
- Lawhead, Joel (2019). *Learning Geospatial Analysis with Python* (3rd Edition). Packt Publishing.

**Free resources** on learning Python are available extensively online. Here are a few examples.

- The official Python tutorial, <https://docs.python.org/3/tutorial/index.html>
- A Python book written with R bookdown based on markdown. Read the book free at <https://f0nzie.github.io/yongks-python-rmarkdown-book/index.html>. Check out the GitHub site to examine how R and Python work together in RStudio
- Free books at PythonBooks, <https://pythonbooks.org/free-books/>
- A catalog of free Python books, <https://github.com/pamoroso/free-python-books>
- Another catalog at <https://github.com/ewertoncodes/python-books>
- A well-organized list, <https://docs.python-guide.org/intro/learning/>

## Course Calendar & Content

Week	Session	Date	Topic	Lab Exercise
1	1	01/27/25	Introduction: Spatial Data Science and Python Ecosystem	Software setting-ups, Conda, Python, Jupyter
2	2	02/03/25	Python 1: Variables and data types	Lab 0 (optional)
3	3	02/10/25	Python 2: Flow control and basic data structures	Lab 1 Due
4		02/17/25	<i>College Closed</i>	
4	4	02/18/25	Python 3: Functions and modules	Lab 2 Due
5	5	02/24/25	Python 4: Objects and debugging	Lab 3 Due
6	6	03/03/25	Data visualization and charting	Lab 4 Due
7	7	03/10/25	Geometry and Spatial Data	Lab 5 Due
8	8	03/17/25	ArcPy and Python Notebooks	Lab 6 Due
9	9	03/24/25	Pandas and GeoPandas	Lab 7 Due
10		03/31/25	<i>No Class Scheduled</i>	
11	10	04/07/25	Raster with Python	Project proposal Due
12		04/14/25	<i>Spring Recess</i>	
13	11	04/21/25	Networks and NetworkX	Lab 8 Due
14	12	04/28/25	Simple GUI development	Project development
15	13	05/05/25	Machine learning & GeoAI	Project Progress
16	14	05/12/25	Project Presentation	Project Discussion
17	15	05/19/25	Final Report	Final Project Report Due

## Syllabus Change Policy

Except for changes that substantially affect implementation of the evaluation (grading) statement, this syllabus is a guide for the course and is subject to change with advance notice. Changes will be announced in class and on Blackboard, which students are expected to check regularly during the semester.

## Software

- Miniforge, or Miniconda (or the full Anaconda) for Python environments, versions, packages, and dependency management.
- Python 3.X and relevant packages. 3.10 or above is recommended.
- A Python IDE (Integrated Development Environment) such as Microsoft Visual Studio Code®, PyCharm, or Spyder. This class will primarily use Visual Studio (VS) Code.
- ArcGIS Pro® with a Hunter College/CUNY associated ArcGIS.com account.

## Grading Method & Scale

Evaluation of academic performance is based on the following components and breakdowns.

Components	GTECH 33100
Lab exercises	60%
Participation	15%
Project Proposal	5%
Project Presentation	10%
Project Report	10%

Numeric scores will be used throughout the semester. The course letter grade will be determined only at the end of the semester. There are no "extra-credit" assignments. If you need more time for a specific assignment, please request a possible extension at least 48 hours before the deadline.

### *Incomplete and Credit*

The instructor will not give the final grade of IN (incomplete) unless students discuss with the instructor and present formal/official/authoritative evidence. Graduate students are not eligible for Credit/No Credit as a final grade.

## Policies

### Communication

[Professionalism](#) and "[netiquette](#)" are expected in the communication through emails. If your emails are not replied to in a timely fashion, please consider rewriting your emails in a better way.

### General Lab Policies

*Lab policies* are described in detail in

<http://www.geo.hunter.cuny.edu/techsupport/rules.html>.

## Preferred Names and Pronouns

All people have the right to be addressed and referred to in accordance with their personal identity. In this class, we will have the chance to indicate the name that we prefer to be called and, if we choose, to identify pronouns with which we would like to be addressed. The instructors will do their best to address and refer to all students accordingly and support classmates in doing so as well.

## Hunter College Policy on Academic Integrity

Hunter College regards acts of academic dishonesty (e.g., plagiarism, cheating on examinations, obtaining unfair advantage, and falsification of records and official documents) as serious offenses against the values of intellectual honesty. The College is committed to enforcing the CUNY Policy on Academic Integrity and will pursue cases of academic dishonesty according to the Hunter College Academic Integrity Procedures.

## ADA Policy

In compliance with the American Disability Act of 1990 (ADA) and with Section 504 of the Rehabilitation Act of 1973, Hunter College is committed to ensuring educational parity and accommodations for all students with documented disabilities and/or medical conditions. It is recommended that all students with documented disabilities (Emotional, Medical, Physical, and/or Learning) consult the Office of AccessABILITY, located in Room E1214B, to secure necessary academic accommodations. For further information and assistance, please call: (212) 772-4857 or (212) 650-3230.

## Hunter College Policy on Sexual Misconduct

In compliance with the CUNY Policy on Sexual Misconduct, Hunter College reaffirms the prohibition of any sexual misconduct, which includes sexual violence, sexual harassment, and gender-based harassment retaliation against students, employees, or visitors, as well as certain intimate relationships. Students who have experienced any form of sexual violence on or off campus (including CUNY-sponsored trips and events) are entitled to the rights outlined in the Bill of Rights for Hunter College.

a. Sexual Violence: Students are strongly encouraged to immediately report the incident by calling 911, contacting NYPD Special Victims Division Hotline (646-610-7272) or their local police precinct, or contacting the College's Public Safety Office (212-772-4444).

b. All Other Forms of Sexual Misconduct: Students are also encouraged to contact the College's Title IX Campus Coordinator, Dean John Rose (jtrose@hunter.cuny.edu or 212-650-3262) or Colleen Barry (colleen.barry@hunter.cuny.edu or 212-772-4534) and seek complimentary services through the Counseling and Wellness Services Office, Hunter East 1123.

CUNY Policy on Sexual Misconduct Link:

<https://hunter.cuny.edu/public-safety/policies/sexual-assault-and-misconduct/>