

Fall 2018
GTECH 73100 – GeoComputation I
Thursday, 5:35 – 9:15 pm
Room 1090B-1 Hunter North

Instructor

Gordon M. Green, PhD

ggree@hunter.cuny.edu

When you communicate with me via mail, please use GTECH 73100 in your subject line and sign your full name.

Prerequisite: GTECH 710 or equivalent

Required textbook:

Xiao, Ningchuan, *GIS Algorithms*, SAGE Publications Ltd., 2016.

<https://hunter.textbookx.com/institutional/index.php?action=browse#books/1737386/>

ISBN-10: 1446274330; ISBN-13: 978-1446274330.

Recommended:

Matthes, Eric, *Python Crash Course: A Hands-On, Project-Based Introduction to Programming*, No Starch Press, 2015. ISBN-10: 1593276036, ISBN-13: 978-1593276034. This is a good introductory book, but there are many similar books available, and similar resources are available online for free.

Lawhead, Joel, *Learning Geospatial Analysis with Python - Second Edition*, Packt Publishing, 2015. ISBN-10: 1783552425, ISBN-13: 978-1783552429. This is a good tour of GIS programming tools, and has many code snippets that are very useful.

Course Description

This practical hands-on course will introduce you to some of the main programming concepts and techniques relevant to computational methods in geography. We will introduce a wide variety of topics that will serve as the basis for more in-depth treatment in subsequent courses.

Before diving into the details of a particular programming language, we will start with the basics algorithmic thinking, and work through examples of reading and writing pseudocode 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 some basic operations into running code, in the context of representing and processing geospatial data.

After this introduction, we will spend a large portion of the class with some of the spatial algorithms covered in the textbook. These will help you not only understand some of the operations at the heart of GIS, but also give you practice thinking algorithmically and translating ideas to and from code. The third segment will review some of the most commonly-used open- and closed-source Python libraries for GIS programming.

Frequent small programming assignments will give you the opportunity to get some practice with the various topics covered, which we will cover only briefly. To help you learn the topics with more breadth and depth, you will be required to summarize and briefly present to the class a spatial algorithm,

to be scheduled as the semester progresses. A small final project will allow you to focus on a particular area of interest for the last portion of the class.

Course Objective

The objective of this class is to teach you the programming concepts and skills needed to expand your ability to process, analyze and visualize geospatial data beyond what is readily available using off-the-shelf software, using popular programming tools and methods.

Expected Learning Outcomes

In this class, you will learn generally-applicable programming concepts and methods, as well as tools and methods particular to processing and analyzing geospatial data. The goal is to develop an intuition about how to structure algorithmic solutions to spatial data processing problems. An understanding of spatial data, and basic ways of representing and processing it, will provide the basis for more advanced geographic problem solving in GTECH 73300, for which this course is a pre-requisite

Course Calendar and Content

Week	Lecture Topic	Homework/Lab Topic
Part 1 - Pseudocode and the Python language		
8/30	Introduction; thinking algorithmically 1	Pseudocode for a mathematical formula
9/6	Thinking algorithmically 2	Pseudocode for a spatial algorithm
9/13	Python syntax and basic data structures	Processing textual data
9/20	Functions and modules	Function design and implementation
9/27	Objects	Creating spatial objects
Part 2 - GIS algorithms		
10/4	Geometry	Data structures for spatial data
10/11	Some geometric algorithms	Geometric algorithm implementation
10/18	Spatial indexing	Using a tree index
10/25	Interpolation	Implementing an interpolation algorithm
11/1	Networks and NetworkX	Recursion and network traversal
11/8	Raster operations with Numpy	Spatial prediction
Part 3 - Python Libraries		
11/15	ArcPy	Project proposal due
11/22	No class – Holiday	
11/29	GDAL and OGR	
12/6	Pandas and GeoPandas	
12/13	No class – Reading day	
12/20		Final project presentations

Please refer to the Hunter College registrar’s site for important dates and deadlines.

Grading

Grades will be based on the take-home programming assignments (60%), the algorithm presentation (15%), and the final project (25%), all of which are expected to reflect individual problem solving. Each homework that includes code should be submitted in a runnable form (if there are dependencies, please include them in a zip file when submitting), and should include explanatory comments.

Essential Policy Information:

- There is absolutely no eating or drinking in the computer laboratory, either during class or when working independently. You run the risk of having your departmental computer account suspended if you are caught eating or drinking in HN 1090B.
- You are expected to arrive on time. Please send me an email if possible when a class will be missed or if you will be more than 15 minutes late.
- Assignments will be due either in class on the due date, or prior to class the following week. Late assignments will be marked down a letter grade. All assignments and presentations must be completed by the last class session to receive credit.
- I will post class materials on Blackboard, and will make announcements through the system.

Hunter College Policy on Sexual Misconduct

In compliance with the CUNY Policy on Sexual Misconduct, Hunter College affirms 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 relationship. 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.

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, on contacting the College's Public Safety Office (212-772-4444)

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) of 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: <http://www.cuny.edu/about/administration/offices/la/Policy-onSexual-Misconduct-12-1-14-with-links.pdf>

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 Accessibility, located in Room E1214B, to secure necessary academic accommodations. For further information and assistance, please call: (212) 772- 4857 or (212) 650-3230.

Syllabus Change Policy

This syllabus is a guide for the course and is subject to change with advance notice by email and/or class announcement.