Spring 2021
GTECH 73100 – GeoComputation I

Date/time: Thursday, 5:35 – 9:15 pm Room 1090B-1 Hunter North

Instructor

Sean C. Ahearn, sahearn@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 709 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.

We will start with the basics of algorithms, 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. We will spend a large portion of the class with 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 class will also 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
2/4	Introduction	Setup and pseudocode
2/11	Variables and data types	Spatial algorithm
2/18	Loops and basic data structures	Processing textual data
2/25	ArcPy	Writing geoprocessing scripts
3/4	Functions and modules	Function design and implementation
3/11	Objects	Data structures for spatial data
3/18	Geometry	Spatial objects
3/25	Some geometric algorithms	Geometric algorithm
4/8	Spatial indexing	Trees and indexes
4/15	Raster with GDAL and numpy	Band math

4/22	Pandas and GeoPandas	Spatial prediction
4/29	Networks and NetworkX	Project proposal due
5/6	Spatial data science topics 1	
5/13	Spatial data science topics 2	
5/20		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. 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 that system.