Fall 2017
GTECH 73100 – GeoComputation I
Thursday, 5:35 – 9:25 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 as it appears in CUNYfirst.

Department
Department of Geography, 695 Park Avenue, Rm 1006 HN, Phone: 212-772-5265, Email: geog@hunter.cuny.edu

Prerequisites: GTECH 710 or equivalent

Required texts:
Python Crash Course: A Hands-On, Project-Based Introduction to Programming, by Eric Matthes, published by No Starch Press, 2015. ISBN-10: 1593276036, ISBN-13: 978-1593276034.

Learning Geospatial Analysis with Python - Second Edition by Joel Lawhead, published by Packt Publishing, 2015. ISBN-10: 1783552425, ISBN-13: 978-1783552429.

Optional texts:
Python Scripting for ArcGIS- Alternate edition by Paul A. Zandbergen, published by ESRI Press, 2015. ISBN-10: 1589482824, ISBN-13: 978-1589482821.

PostGIS in Action, 2nd Edition by Regina O. Obe and Leo S. Hsu, published by Manning Publications, 2015. ISBN-10:1617291390, ISBN-13: 978-1617291395.

Additional supplemental readings from publicly-available or Hunter College library resources will be provided as needed.

Course Description
This practical hands-on course will introduce you to GIS programming concepts and techniques using the Python programming language. We will start with the basics of Python as a first language, and look at some basic spatial operations. We will then look at interacting with GIS systems programmatically with a variety of libraries that are commonly used to work with vector data. The third segment of the class will cover processing remote sensing and elevation data programmatically. Finally, we will look at miscellaneous approaches not covered in the first three sections.

This class will briefly cover many topics, and frequent assignments will give you an introductory level of with familiarity with each. A small final project, devised in consultation with the instructor, will provide the opportunity for you to explore a class topic of your choice in more depth.

Preliminary Course Calendar and Content

Week	Topic	Reading	Lab/Assignment
8/31	Introduction, variables and data types	Matthes Chapters 1-2 Lawhead Chapter 1 – Geospatial fundamentals	Set up Python environment
9/7	List, sets, and tuples	Matthes Chapters 3-4	Plotting random data
9/14	Dictionaries	Matthes Chapters 5-7	Polygon centroids
9/19 (Tuesday)	Functions and classes	Matthes Chapters 8-9 Lawhead Chapter 5 part 1only	Calculating distance
9/28	Working with text data	Matthes Chapters 15-17	Nearest neighbors
10/5	Spatial data formats and indexes	Lawhead Chapter 2-3 – Data formats and spatial libraries overview	Tree data structure
10/12	Vector data in GDAL/OGR	Lawhead Chapters 4-5 – Geospatial Python Toolbox and Python in Geographic Information Systems	Reading/writing vector data with open-source tools
10/19	Vector data in ArcPy	Supplemental reading on ArcPy	Querying vector data with ArcPy cursors
10/26	Vector data in PostGIS	Supplemental reading on spatial databases	Querying vector data with SQL
11/2	Working with remote sensing data with GDAL	Lawhead Chapter 6 – Python and remote sensing	Image histogram
11/9	Working with elevation data	Lawhead Chapter 7 – Python and elevation data	Contours and segmentation
11/16	Multidimensional arrays	Supplemental reading on NumPy and array databases Skim Lawhead Chapter 8-10	Band math with NumPy and project proposal
11/23 (No class)			
11/30	Spatial prediction	Supplemental reading on data mining in GIS	Raster classification
12/7	Networks	Network data representation and routing	Weighted shortest path with NetworkX
12/14	**Final project presentations**	N/A	N/A

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

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

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 practical algorithmic solutions to spatial problems. An understanding of spatial data and basic ways of representing and processing it programmatically will help prepare you for more advanced geographic problem-solving in your future work.

Grading

80% of the final grade will be based on the programming assignments and 20% on the final project. Students are expected to complete all of the assignments, which will be graded based on how completely and accurately they solve each given problem. The final project will be graded based on the completeness and clarity of the code and the difficulty and complexity of the project.

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.
- Attendance/lateness policy – students are expected to arrive on time and to email me when classes will be missed.
- Late work– programming assignments will be due prior to class on the due date. Late assignments will be marked down a letter grade.
- Policy on the use of instructional technologies (e.g, Blackboard) – I will post class materials on Blackboard, and will make class announcements through the Blackboard announcement system.

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.

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.

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, on 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) 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-on-Sexual-Misconduct-12-1-14-with-links.pdf

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.