Geog 378: Introduction to Geocomputing

Lectures (360 Science Hall): Tuesday & Thursday 9:30 AM-10:45 AM
Instructor: Prof. Song Gao
Office Hours: Tuesday 1:00-2:00 PM, Thursday 1:00-2:00 PM, or by appointment (421 Science Hall)
Email: song.gao@wisc.edu

Labs (380 Science Hall):
Section 301: Wed 8:50 AM - 10:50 AM
Section 302: Wed 11:00 AM - 1:00 PM
Teaching Assistant: Yuying Chen
TA Office Hours: Tuesday 6-8PM or by appointment (M376 Science Hall, the Student Lab Room)
Email: chen449@wisc.edu

Overview

Geography 378 (GEOG378) will introduce students to the scripting and programming tools and skills commonly employed in GIS and spatial analysis using Python. The skills learned in this course are equally applicable in scientific research, the public sector, and private industry. This course helps satisfy the programming requirements of the Cartography/GIS undergraduate/graduate major and provides foundational knowledge for the Online Professional Master's in GIS & Web Map Programming as well as for the GIS certificate program students. No programming background is assumed for this course.

Course Learning Objectives

Upon completion of the course modules, the student is expected to:

- Be able to write shell commands to accomplish common (batch)geoprocessing tasks using popular open-source utility programs, and they will learn when these utilities are preferred over mainstream GIS software.
- Have basic skills in the Python programming language, and they will have acquired programming concepts necessary for advanced GIS courses that require programming.
- Know how to use Python with open-source GIS libraries regardless of the Integrated Development Environment (IDE). The students will also learn how Python can extend the capabilities of ArcGIS to solve problems difficult or impossible to address otherwise.
- Be familiar with major geospatial vector and raster file formats and specifications for spatial reference coordinate systems.
- Have used and be comfortable with online resources that support geocomputing and programming in the GIS profession.
- Learn newly developed GIS computation tools/libraries and platforms.

Course Materials

Textbook: *Think Python: How to Think Like a Computer Scientist* by Allen Downey et al., 2014, O'Reilly.

Recommended Readings:

- *Python Scripting for ArcGIS, by P.A. Zandbergen. ESRI Press, 2014, 358 pp.*
- *Introduction to GIS Programming and Fundamentals with Python and ArcGIS* By Chaowei Yang et al., 2017, CRC Press.

All lecture slides and notes are available on the *Canvas*.

Grading

70% Lab Assignments + 30% Quizzes

Course grades will be based on 2 in-class quizzes (30% of total grade) and 8 laboratory assignments (70% of total grade). Quizzes will be given in the class and will cover the material presented in the course lectures and notes with an emphasis on concepts and vocabulary. Lab assignments will require original programming based on lecture material. Lab assignments are not scheduled weekly, but there will be weekly lab time scheduled (consult your lab section for times) and you can use this time to work on your assignments or work through course material. There is no final exam or other summary activity for this course.

Grading Scale:

Score	Grade	Grade Points Per Credit
> or = 90	A (Excellent)	4
86 ~ 89.99	AB (Intermediate grade)	3.5
80 ~ 85.99	B (Good)	3
76 ~ 79.99	BC (Intermediate grade)	2.5
70 ~ 75.99	C (Fair)	2
60 ~ 69.99	D (Poor)	1
< 60	F (Failure)	0

More information: https://registrar.wisc.edu/grades_and_gpa.htm

Course Outline (2017 Fall)

The following is a tentative schedule. Please check the Canvas website for updates.

Modules	Lectures & Date	Labs
Module 1: Introduction and Python Fundamentals	Lesson 1: Understanding geospatial data formats and file organization (9/7)	
	Lesson 2: Programming basics & Python core concepts (9/12, 9/14)	Lab 1: Introduction to Python (9/13)
	Lesson 3: Functions (9/19, 9/21)	
	Lesson 4: Flow control (9/26, 9/28)	Lab 2: Functions and containers (9/27)
Module 2: Python Advanced Concepts	Lesson 5: Containers (10/3, 10/5)	
	Lesson 6: Copies, reading and writing files (10/10)	Lab 3: File I/O and system access (10/11)
	Lesson 7: Python system access (10/12)	
	Lesson 8: Classes and objects (10/17, 10/19)	
	Lesson 9: Plotting with Python (10/24)	Lab 4: Python classes and plotting (10/25)
	Lesson 10: Command line & scripting (10/26)	
Module 3: Python for GIS	Lesson 11: Raster Processing with GDAL (10/31, 11/2)	Lab 5: GDAL and Python (11/8)
	Lesson 12: Vector Processing with OGR (11/14, 11/16)	Lab 6: OGR and Python (11/15)
	Lesson 13: Geoprocessing with ArcPy (11/21, 11/28)	Lab 7: Arcpy (11/22)
	Lesson 14: ArcGIS API for Python (11/30)	Lab 8: Jupyter Notebook (12/6)
	Lesson 15: IPython for Interactive Mapping (12/5)	
In-Class Quizzes	Quiz 1 (11/7)	
	Quiz 2 (12/12)	

Attendance (Required)

You must attend all lectures & lab sessions and complete all course assignments and quizzes on time. You should appropriately comment all code you submit for a grade. Please seek assistance when you have a question or problem through office hours and/or your peers.

Communication & Accommodation

The University of Wisconsin-Madison supports the right of all enrolled students to a full and equal educational opportunity. The Americans with Disabilities Act (ADA), Wisconsin State Statute (36.12), and UW-Madison policy (Faculty Document 1071) require that students with disabilities

be reasonably accommodated in instruction and campus life. Reasonable accommodations for students with disabilities is a shared faculty and student responsibility. Students are expected to inform faculty of their need for instructional accommodations by the end of the third week of the semester, or as soon as possible after a disability has been incurred or recognized. Faculty will work either directly with the student or in coordination with the McBurney Center to identify and provide reasonable instructional accommodations. Disability information, including instructional accommodations as part of a student's educational record, is confidential and protected under FERPA. If you face any personal or professional difficulties or require accommodation or a disability, please feel free to contact me as soon as possible.

Academic Integrity

Academic Integrity is critical to the mission of the University of Wisconsin-Madison, a research institution with high academic standards and rigor. All members of the University community play a role in fostering an environment in which student learning is achieved in a fair, just, and honest way. Plagiarism is prohibited in lab assignments and quizzes. Any offense results in a zero for the grade and disclosure of the impropriety to the Department and University.