

GEOG 5590 – Advanced GIS Programming

Spring 2022

Dr. Pinliang Dong

Professor, Department of Geography and the Environment

University of North Texas

Phone: (940) 565-2091

E-mail: Pinliang.Dong@unt.edu URL: <http://geography.unt.edu/~pdong>

Office hours: ENV 310B, Mon & Wed 5 - 6 pm, or by appointment.



Prerequisite

GEOG 4560/5560: Introduction to Python Programming (or consent of department)

Objectives

This course includes lectures, demos, hands-on exercises, homework assignments, and a programming project. It is for those who work with ESRI's ArcGIS on a technical level and have knowledge in programming with Python. Based on the knowledge of Python, students will learn advanced labeling and field calculation with Python, ArcPy classes and functions, ArcPy mapping, data access, and spatial analysis modules, Python tools, toolboxes, add-ins, and raster processing in moving windows (neighborhoods). Students will develop skills to improve GIS productivity, implement customized GIS applications, and create new GIS tools using the Python programming language. Upon successful completion of this course, students will be able to: (1) conduct advanced labeling and field calculation using Python; (2) manipulate ArcGIS map documents, data frames, and layers using ArcPy/Python; (3) query and update attributes of feature classes; (4) create tools, toolboxes, and toolbars using Python/ArcPy; (5) conduct basic raster data processing using NumPy; and (6) design and implement new tools, toolboxes, and toolbars for real applications.

Reference

ArcPy Documentation: <https://desktop.arcgis.com/en/arcmap/10.7/analyze/arcpy/what-is-arcpy-.htm>

Software: ArcGIS Desktop 10.7.1 and PyCharm.

Labs and Homework

Labs (20%) and homework (40%) should be submitted to Canvas. Late labs and homework will be marked down 10% each day.

Project

Two programming project (30%) will be distributed in class. Project files should be submitted to Canvas.

Extra Credit

The Department of Geography and the Environment does not allow extra credit assignments (work not specified on a course syllabus).

Grading Structure

| | |
|---|-------------|
| Attendance | 10% |
| Labs | 20% |
| Five Homework Assignments (8% each) | 40% |
| Programming Project 1 | 20% |
| Programming Project 2 | 10% |
| Total | 100% |
| 90-100: A; 80-89: B; 70-79: C; 60-69: D; 0-59: F. A minimum grade of "B" is required for the GIS Certificate. | |

Schedule

| Module | Dates | Topic |
|--------|-------|---|
| 1 | 1/19 | Module 1: Python Review (1) <i>Demos and Lab 1</i> |
| 2 | 1/26 | Module 2: Python Review (2) <i>Demos and Lab 2</i> |
| 3 | 2/2 | Module 3: Advanced Labeling and Field Calculation with Python <i>Demos and Lab 3. Homework 1 (Due Feb 23)</i> |
| 4 | 2/9 | Module 4: ArcPy Classes and Functions <i>Demos and Lab 4</i> |
| 5 | 2/16 | Module 5: ArcPy Mapping Module (1) <i>Demos and Lab 5</i> |
| 6 | 2/23 | Module 6: ArcPy Mapping Module (2) <i>Demos and Lab 6. Homework 2 (Due Mar 9)</i> |
| 7 | 3/2 | Module 7: ArcPy Data Access Module (1) <i>Demos and Lab 7</i> |
| 8 | 3/9 | Module 8: ArcPy Data Access Module (2) <i>Demos and Lab 8. Homework 3 (Due Apr 6)</i> |
| 9 | 3/16 | Spring break (no class) |
| 10 | 3/23 | Module 9: Using Tools and Toolboxes in Python (1) <i>Demos and Lab 9. Homework 4 (Due Apr 20)</i> |
| 11 | 3/30 | Module 10: Using Tools and Toolboxes in Python (2) <i>Demos and Lab 10</i> |
| 12 | 4/6 | Module 11: Developing Python Add-ins for ArcGIS Desktop (1) <i>Demos and Lab 11. Programming Projects 1&2 (Due May 13)</i> |
| 13 | 4/13 | Module 12: Developing Python Add-ins for ArcGIS Desktop (2) <i>Demos and Lab 12</i> |
| 14 | 4/20 | Module 13: ArcPy Spatial Analyst Module <i>Demos and Lab 13. Homework 5 (Due May 11)</i> |
| 15 | 4/27 | Module 14: Application and Code Samples <i>Work on your projects</i> |
| 16 | 5/4 | Pre-final (work on your projects) |
| 17 | 5/11 | Final Week. Programming Projects Due on 5/13 |

Academic Dishonesty

Students caught cheating or plagiarizing will receive a "0" for that particular assignment or exam. Additionally, the incident will be reported to the Office of Student Rights and Responsibilities for further penalty. According to the UNT catalog, the term "cheating" includes, but is not limited to:

- a. Use of any unauthorized assistance in taking quizzes, tests, or examinations;
- b. Dependence upon the aid of sources beyond those authorized by the instructor in writing papers, preparing reports, solving problems, or carrying out other assignments;
- c. The acquisition, without permission, of tests or other academic material belonging to a faculty or staff member of the university;
- d. Dual submission of a paper or project, or resubmission of a paper or project to a different class without express permission from the instructor(s); or
- e. Any other act designed to give a student an unfair advantage.

The term "plagiarism" includes, but is not limited to:

- a. The knowing or negligent use by paraphrase or direct quotation of the published or unpublished work of another person without full and clear acknowledgment; and
- b. The knowing or negligent unacknowledged use of materials prepared by another person or agency engaged in the selling of term papers or other academic materials.

Face Coverings

UNT encourages everyone to wear a face covering when indoors, regardless of vaccination status, to protect yourself and others from COVID infection, as recommended by current CDC guidelines. Face covering guidelines could change based on community health conditions.

Course Materials for Remote Instruction

Remote instruction may be necessary if community health conditions change or you need to self-isolate or quarantine due to COVID-19. Students will need access to a webcam and microphone to participate in fully remote portions of the class. Information on how to be successful in a remote learning environment can be found at <https://online.unt.edu/learn>

Class Attendance

Attendance will be taken every class session. Excused attendance requires documentation.

Students are expected to attend class meetings regularly and to abide by the attendance policy established for the course. It is important that you communicate with the professor and the instructional team prior to being absent, so you, the professor, and the instructional team can discuss and mitigate the impact of the absence on your attainment of course learning goals. Please inform the professor and instructional team if you are unable to attend class meetings because you are ill, in mindfulness of the health and safety of everyone in our community.

If you are experiencing any symptoms of COVID-19 (<https://www.cdc.gov/coronavirus/2019-ncov/symptoms-testing/symptoms.html>) please seek medical attention from the Student Health and Wellness Center (940-565-2333 or askSHWC@unt.edu) or your health care provider PRIOR to coming to campus. UNT also requires you to contact the UNT COVID Team at COVID@unt.edu for guidance on actions to take due to symptoms, pending or positive test results, or potential exposure.

Rules of Engagement

Rules of engagement refer to the way students are expected to interact with each other and with their instructors. Here are some general guidelines:

- While the freedom to express yourself is a fundamental human right, any communication that utilizes cruel and derogatory language on the basis of race, color, national origin, religion, sex, sexual orientation, gender identity, gender expression, age, disability, genetic information, veteran status, or any other characteristic protected under applicable federal or state law will not be tolerated.
- Treat your instructor and classmates with respect in any communication online or face-to-face, even when their opinion differs from your own.
- Ask for and use the correct name and pronouns for your instructor and classmates.
- Speak from personal experiences. Use “I” statements to share thoughts and feelings. Try not to speak on behalf of groups or other individual’s experiences.
- Use your critical thinking skills to challenge other people’s ideas, instead of attacking individuals.
- Avoid using all caps while communicating digitally. This may be interpreted as “YELLING!”
- Be cautious when using humor or sarcasm in emails or discussion posts as tone can be difficult to interpret digitally.
- Avoid using “text-talk” unless explicitly permitted by your instructor.
- Proofread and fact-check your sources.
- Keep in mind that online posts can be permanent, so think first before you type.

See these [Engagement Guidelines](https://clear.unt.edu/online-communication-tips) (https://clear.unt.edu/online-communication-tips) for more information.

Accommodations

The University of North Texas makes reasonable academic accommodation for students with disabilities. Students seeking accommodation must first register with the Office of Disability Accommodation (ODA) to verify their eligibility. If a disability is verified, the ODA will provide you with an accommodation letter to be delivered to faculty to begin a private discussion regarding your specific needs in a course. You may request accommodations at any time, however, ODA notices of accommodation should be provided as early as possible in the semester to avoid any delay in implementation. Note that students must obtain a new letter of accommodation for every semester and must meet with each faculty member prior to implementation in each class. For additional information see the Office of Disability Accommodation website at <http://www.unt.edu/oda>. You may also contact them by phone at 940.565.4323.

Classroom Courtesy

Please follow these guidelines to avoid disrupting the class:

- (1) Turn off cell phones before arriving.
- (2) Do not arrive late or leave early (except for a bathroom break or emergency).
- (3) Do not sleep or eat during class.
- (4) Do not work on other assignments during class.
- (5) Do not talk when the instructor is lecturing, unless prompted for feedback by the instructor.

Course Evaluation

You will receive an email with a link to the UNT Student Perceptions of Teaching (SPOT) Course Evaluation by the end of the semester.
