Cutting Edge Survival Skills for Computation, Data Handling and Analysis
HWRS499/599 Fall 2020

This class is scheduled to be taught in the LIVE ONLINE modality, Tu/Th 8:00-9:15

1. General Information

Description of Course

This course will provide a hands-on introduction to major software tools and methods used across research and industry for hydrology and atmospheric science. We will take a project-based approach, learning software packages and best practices while building our own analysis for a real world problem. Major topics covered will include: Python for scientific computing, GitHub workflows and collaborative open source development, the basics of parallel and cloud computing, major data repositories and how to interact with them, and the basics of visualization. No prior coding experience is required.

Course Prerequisites or Co-requisites

None

Meeting Times

Tu/Th 8:00 – 9:15 via Zoom

Instructor and Contact Information

Dr. Laura Condon
lecondon@arizona.edu
Office: Harsbarger 324e
Virtual Office Hours: Listed on D2L or by request

2. Class format, participation and attendance

Course Format

This class is scheduled to be taught in the LIVE ONLINE modality. The class will meet Tuesdays and Thursdays at 8:00-9:15 via Zoom. In our synchronous meetings I will present new material, students will present their work and we will have group discussions and code walkthroughs.

This course will consist of a mixture of lectures, discussion and interactive coding activities. This is a very interactive course and students are expected to participate in discussions and come prepared to share their work and help others.

Course Communication

- Course communications will take place using your official UA email address.
- I will attempt to reply to all email inquiries in a timely manner but please be advised that if your question will take more than 5 minutes to reply to, I will request that you come to virtual office hours or schedule an appointment. For coding questions related to homework or projects, I prefer that you come to office hours or make an appointment as debugging can be difficult over email.
- Emails will generally be handed in normal business hours so do not expect to get a response if you send your question out late the night before an assignment is due.
- Course announcements and grades will be posted through D2L
- All other course materials will be shared through GitHub

Attendance & COVID-19

Attendance at our live sessions is expected for your participation grade in class. That said, I understand that this is likely to be a challenging semester and I will make every effort to make the course accessible for everyone. If you are sick or need other accommodations, please contact me in advance so that your absences can be excused, and we can work around your needs. Also as a general reminder:

- If you feel sick, or may have been in contact with someone who is infectious, stay home. Except for seeking medical care, avoid contact with others and do not travel.
- Notify your instructors if you will be missing an in person or online course.
- Campus Health is testing for COVID-19. Please call (520) 621-9202 before you visit in person.
- Visit the UArizona COVID-19 page for regular updates.

Class recordings

Live class sessions will be recorded as needed throughout the semester. For lecture recordings, which are used at the discretion of the instructor, students must access content in D2L only. Students may not modify content or re-use content for any purpose other than personal educational reasons. All recordings are subject to government and university regulations. Therefore, students accessing unauthorized recordings or using them in a manner inconsistent with UArizona values and educational policies are subject to suspension or civil action.

Required Texts or Readings

There is no required textbook for this course. How to guides and resources for all of the material covered will be shared through our GitHub site.

Equipment and Software Requirements

All of the work for this class will be done on personal computers using free software packages. You will need daily access to a laptop or other web-enabled device with a webcam and microphone, regular access to reliable internet signal; ability to download and free software including python. Mac or PC computers are both fine for this course.

Makeup Policy for Students Who Register Late

Students may register late with the instructor's permission but will be expected to make up all assignments that they missed within one week of their registration.

3. Learning Objectives, Outcomes and Assessment

Course Objectives

The course will use open source software with a focus on teaching students how to (1) interact with existing data repositories and computational systems already developed for earth and atmospheric sciences, and (2) develop and contribute to their own projects in Findable, Accessible, Interoperable and Reusable (FAIR) ways.

Expected Learning Outcomes

1. You will be able to access code from GitHub repositories and build your own repository.
2. You will be able to write python scripts to download, visualize and analyze common data types in the earth sciences such as point observations and gridded datasets.
3. You will be familiar with best coding practices and documentation for FAIR research practices.
4. You be able to access and use UArizona High Performance Computing and you will understand the basics of parallel computing.

5. You will understand the difference between scripting and coding languages and the basics of how to get started with new languages.

Assignments:

- **Class participation (25%):** Active participation in our live sessions expected and is critical to the success of the course. For full credit you should be on time, actively participate in discussions and come prepared to share your work. Excused absences will not affect your participation grade as long as they are (1) excused in advance if possible and (2) you complete whatever makeup requirements are agreed upon between you and the instructor.
- **Weekly forecast submissions (45%, 15 submissions, 3 points each):** Every week you will be writing a script for our forecast competition. This consists of three parts (1) your forecast values, (2) the script you used to generate your forecasts and short written report explaining your approach and what you forecasted. Details on the requirements for each of these are provided on GitHub. You will not be graded for the accuracy of your forecast but for completion. For full credit you must submit all three parts on time according to the assignment instructions for that week. No credit will be given for late assignments.
- **Two code reviews (8%):** We will conduct two code reviews in the semester. Students will be expected to review other students' scripts and provide specific comments through GitHub on things they can change to improve readability, efficiency, accuracy. Each student will review one other students' repo.
- **Two graded scripts (12%):** Two scripts will be graded for quality over the course of the semester. These will be submitted after the code review and it is expected that you have commits demonstrating your response to the suggestions from your peers.
- **Forecast Evaluator (10%):** Every student will serve as the forecast evaluator once per semester. The details of this job are provided on GitHub. Students will be graded on the analysis they complete, the functionality they add to the repo and their presentation and discussion.

Late work policy:

The forecast competition will be scored weekly and each our assignments will build on the last therefore no late assignments will be accepted without prior approval! Late assignments will receive a zero.

Policy on teamwork and collaboration:

All of the assignments in this course will be submitted and graded individually. It is expected that you will write all of your own scripts and will come up with your own forecasts. However, teamwork is still highly encouraged. You are welcome to share your work with others, consult classmates for help debugging and follow their examples for how to approach a problem. You will only be penalized if it is clear that you are copying others work without also doing your own.

Final Exam:

This course will not include a final exam and will be completed on the last day of regular classes.

Grading Scale and Policies:

This course will be graded using the regular university grading system (http://catalog.arizona.edu/policy/grades-and-grading-system) with the A-E scale. G

Grades will be assigned as follows:

A >= 90%

B >= 80%

C >= 70%

D >= 60%

E < 60%

This weighting for the course assignments is provided above. The grade weighting for 400 & 500 level students is the same but the 500 level students will be required to complete additional two additional code reviews.

Incomplete or Withdrawal:

Requests for incomplete (I) or withdrawal (W) must be made in accordance with University policies, which are available at http://catalog.arizona.edu/policy/grades-and-grading-system#incomplete and http://catalog.arizona.edu/policy/grades-and-grading-system#Withdrawal respectively.

4. Scheduled Topics and Activities

The schedule for the course is provided below. This schedule is subject to change and will be updated throughout the course. Please refer to D2L and our course GitHub for the most up to date course schedule information.

Section 1: The basics of GitHub and Python

- Week 1: Course intro and getting started with GitHub
- Week 2: Getting started with Python and Terminal – installation, IDEs, environment and modules
- Week 3: Intro to Python – Language structure, data structures, NumPy
- Week 4: Data structures - Lists, Dictionaries, NumPy arrays and Pandas
- Week 5: Control flow and basic plotting – conditionals and loops and plotting
- Week 6: Writing nice scripts – Designing workflows, making functions, documentation, pep8 standards, Jupyter Notebooks

Section 2: Intermediate data analysis with Python

- Week 7: Timeseries data and more advanced plotting – intro to Matplotlib and Plotly
- Week 8: Working gridded and Hierarchical data – xarray, rasters, NetCDFs
- Week 9: Working with vector data and making maps
- Week 10: Working with remote sensing data
- Week 11: Machine learning with Python
- Week 12: Additional special topics in Python – TBD

Section 3: Beyond Python

- Week 13: Parallel computing – How does it work and how do you use it
- Week 14*: Dockers and cloud computing (short week for Thanksgiving)
- Week 15: Other languages - When you should and shouldn't use python.
- Week 16: Course wrap up final forecast evaluation and presentations

5. University Resources and Policies

University-wide Policies links

Links to the following policies are provided here, https://academicaffairs.arizona.edu/syllabus-policies:

- Absence and Class Participation Policies
- Threatening Behavior Policy

- Accessibility and Accommodations Policy
- Code of Academic Integrity
- Nondiscrimination and Anti-Harassment Policy
- Subject to Change Statement

Academic advising

If you have questions about your academic progress this semester, or your chosen degree program, please note that advisors at the Advising Resource Center can guide you toward university resources to help you succeed.

Life Challenges

If you are experiencing unexpected barriers to your success in your courses, please note the Dean of Students Office is a central support resource for all students and may be helpful. The Dean of Students Office can be reached at 520-621-2057 or DOS-deanofstudents@email.arizona.edu

Physical and Mental Health Challenges

If you are facing physical or mental health challenges this semester, please note that Campus Health provides quality medical and mental health care. For medical appointments, call (520-621-9202. For After Hours care, call (520) 570-7898. For the Counseling & Psych Services (CAPS) 24/7 hotline, call (520) 621-3334.

Additional Resources for Students

UA Academic policies and procedures are available at http://catalog.arizona.edu/policies

Student Assistance and Advocacy information is available at http://deanofstudents.arizona.edu/student-assistance/students/student-assistance

Confidentiality of Student Records

http://www.registrar.arizona.edu/personal-information/family-educational-rights-and-privacy-act-1974-ferpa?topic=ferpa