Syllabus for GEOS F436/636

Beyond the Mouse: Computer Programming and Automation for Geoscientists

Instructor: Dr. Christine (Chris) Waigl

UAF Department of Geology and Geophysics

University of Alaska Fairbanks

Fall 2018

Figure 1: Not this kind of mouse. (Image credit: Dr. Melanie Chang)

1 Course information

Title: Beyond the Mouse: Computer Programming and Automation for Geoscientists
Number: GEOS F436 & 636
CRNs: 73655 (GEOS F436) / 73666 (GEOS F636)
Credits: 2 (pass/fail)
Meeting times: Tuesday & Thursday 3:40 – 5:40 pm
Course website: https://beyondthemouse.community.uaf.edu/

2 Learning outcomes

Students will become confident in:

- programming in MATLAB for science applications
- reading MATLAB code
- making informed choices about scripting languages (Python, R, shell scripting ...)
- setting up and managing project folders
- thinking computationally to solve scientific problems
- using the Unix/Linux command line
- generating production-ready reproducible figures and maps
- reading and writing shell scripts

3 Instructor information

3.1 Instructor

My name is Christine Waigl. I hold a PhD in Geophysics (Remote Sensing) and specialize in satellite and aerial remote sensing of wildfire in Alaska and the circum-polar North. I am particularly interested in using machine learning methods to develop products for the detection and characterization of wildfires as well as modeling the distribution of fire emissions.

You can call me Dr. Waigl or Chris, according to your preference. More information about me:

email: cwaigl@alaska.edu
office: Reichardt 324 and IARC 334
office hours: Thursdays 2-3:30 pm, Reichardt office (or by appointment)
pronouns: she, her, hers

3.2 TA

Andrew Johnson is a PhD grad student in the Glaciers Group at the GI. He is studying surface melting on the Antarctic Peninsula, both quantifying snow melt through remote sensing and also studying how snow melt impacts glacier and ice shelf dynamics.

email: acjohnson16@alaska.edu
office hours: Tuesday, 10am-noon
TA office location: Reichardt 305, desk 6

Note: Andrew also has an office in Elvey. If you need to talk to him outside of class or office hours, please email him. He may or may not be able to meet in Elvey because his office is shared by other busy grad students.

pronouns: he, him, his

4 Grading policy

You need to attain 65% to pass the course. Each lab is due at the date of the following lab meeting (typically, the next week). Points will be deducted for late labs.

4.1 GEOS F436 (undergraduates)

- 30%: attendance and participation
- 70%: 12 graded labs + project (counts as 1 lab)

4.2 GEOS F436 (graduate students)

- 30%: project presentation and execution
- 70%: 12 graded labs

5 Course policies

- Students will be expected to attend class. Especially for beginners, we have found that in-class practice is essential.
- Lecture notes and lab assignments for each week will be posted each Wednesday (after the lecture part, before the lab part) via the course website at https://beyondthemouse.community.uaf.edu/
- Please let the instructor (for Tuesdays) or TA (for Thursdays) know as early as possible if you cannot attend a lab. It is your responsibility to ensure you hand in each lab assignment in time, or obtain an (exceptional! justified!) extension beforehand.
- The computer lab room, Reichardt 316, is at your disposal for practice.
- You can also use your own computer. MATLAB is available as a site-wide license for students to install. You will need to create an account at Mathworks (the publisher of MATLAB). See the OIT site for details: https://www.alaska.edu/oit/software/authenticate/files/student/
- We will use a variety of assigned readings (some required, some optional) to deepen your understanding.
- The recommended reference work is

6 Course schedule

The course will proceed by weekly topics. Tuesdays will be focussed on direct instruction and workshop-style learning, Thursdays will be reserved for lab led by your TA. the following course schedule is preliminary.

Week	Dates	Teaching & practice	Guided lab
1	Aug 28 / 30	What is computer programming? MATLAB interface basics. Variables & operators	Structuring a program. Variables & operators
2	Sep 4 / 6	MATLAB functions & computational thinking. Code organization.	Vector operations. Structs. Write a function
3	Sep 11 / 13	MATLAB control: conditionals & booleans	if / elseif / else / end. Boolean operators
4	Sep 18 / 20	MATLAB control structures: loops	for loops, while loops. Data processing in loops
5	Sep 25 / 27	Project organization & version control	Git/Github
6	Oct 2 / 4	MATLAB I/O	Reading/writing files. file formats
7	Oct 9 / 11	Plotting & mapping 1 (MATLAB)	Plot design. Plotting geopatial data.
8	Oct 16 / 18	Editor skills & mark-up languages	Github-markdow, HTML
9	Oct 23 / 25	Unix command line 1	Make your own virtual machine! shell scripting basics
10	Oct 30 / Nov 1	Unix command line 2	Scripting for reproducible project organization
11	Nov 6 / 8	Debugging strategies	Using a debugger. Practice
12	Nov 13 / 15	Plotting and mapping 2	Making publication-ready maps with various tools
13	Nov 20	Plotting and mapping 3	NO LAB (Thanksgiving)
14	Nov 27 / 29	Open lab: project help	Open lab: project help
15	Dec 4 / 6	Presentations	Presentations

7   Readings

Some students will learn better by practicing hands-on and using the built-in online help system, some students prefer sitting down with a book. For this reason, readings will be optional, and will be drawn from resources that are available to you free of charge, either on the internet or via the UAF library system. **However, even if the reading is only recommended, not assigned, it is your responsibility to use it if you feel you need to clarify the taught material.**

MATLAB reference works are:

- **Attaway, Stormy: "Matlab : A Practical Introduction to Programming and Problem Solving".**
  This is, as the title implies, a very practical book, with many screen shots and step-by-step instruction. If you're struggling with MATLAB syntax, this is the place to start. Available for UAF students via https://ebookcentral-proquest-com.proxy.library.uaf.

`edu/lib/uaf/detail.action?docID=739037#`

- **Hahn**, Brian & **Valentine**, David T.: "**Essential MATLAB for Scientists and Engineers**"
This book is our main text of reference for MATLAB. It goes more deeply than Attaway into designing programs. Both the 5th and the 6th edition are available as electronic resources in the UAF library. Try these links: `https://ebookcentral-proquest-com.proxy.library.uaf.edu/lib/uaf/detail.action?docID=1110712#` and `http://proquest.safaribooksonline.com.proxy.library.uaf.edu/book/programming/9780128052716`.

The links will require login with your UA ID.

There will be also weekly recommended links to online texts in your lecture notes.

8 Disability services

Students with any type of disabilities who may need classroom accommodations are encouraged to visit the Disabilities website at `http://www.uaf.edu/chc/disability.html` and make an appointment with the Office of Disability Services (474-5655). Please meet with the instructor so that the appropriate accommodations and supports to assist in meeting the goals of the course can be made in collaboration with the Office of Disability Services.

9 Title IX

University of Alaska Board of Regents have clearly stated in BOR Policy that discrimination, harassment and violence will not be tolerated on any campus of the University of Alaska. If you believe you are experiencing discrimination or any form of harassment including sexual harassment/misconduct/assault, you are encouraged to report that behavior. If you report to a faculty member or most university employees, including your instructors, they must notify the UAF Title IX Coordinator about the basic facts of the incident. However, you are not obliged to provide any details you do not wish to.

You can find resources for reporting at the UAF Title IX Office. There are a number of options for reporting confidentially.

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