GISC 425 Emerging Topics in GIScience: Geographical Computing

Recent years have seen the (re)emergence of programmatic approaches to geographical information science and the de-emphasis of established desktop 'GIS' packages, both in research settings and in the commercial world. This class introduces the Python programming language and the Python geospatial ecosystem to prepare students for conducting research in this new context.

Important dates

Item	Dates
Trimester	4 March to 29 June 2019
Teaching period	4 March to 7 June 2019
Mid-trimester break	15 April to 29 April 2019
Last assessment item due	14 June 2019
Study period	NA
Examination period	NA
Withdrawal dates	See Course additions and withdrawals

If you cannot complete an assignment or sit a test or examination, refer to Aegrotats

Lecture and lab schedule

Lectures are in Cotton 110 at 10AM on Thursdays and will be followed immediately by related lab sessions in the same location. The combined session will last up to three hours, finishing up before 1PM.

Contact details

Lecturer/coordinator

Prof. David O'Sullivan
Office CO227 **Extn.** 6492 **Office hours by appointment** click here

GIS Technician

Andrew Rae
Office CO502 **Office hours** TBD

Lab and lecture timetable

Here's the trimester schedule we will aim to follow. **Bolded labs** have an associated assignment that must be submitted and contributes the indicated percentage of the course credit. Relevant materials (lecture slides, lab scripts and datasets) are linked below, when available.

Week#	Date	Lecture topic	Lab topic	Notes
1	7 Mar	Course overview; why python	Introduction to code and setting up the GISC 425 environment	
2	14 Mar	Programming 1: variables and operators	`geopandas`**: working with spatial data using code** (5%)	due 20 Mar
3	21 Mar	Programming 2: functions builtin and user-defined; logic and flow control	**Repetive processing tasks** (10%)	due 27 Mar
4	28 Mar	Programming 3: objects, modules and APIs	**Reclassify complex landuse data programmatically** (15%)	due 10 Apr
5	4 Apr	Programming 4: thinking computationally	Thought experiment exercise	
6	11 Apr	Digression into web maps	**Generate and customize a web map from multiple data layers** (15%)	due 1 May
	Trimester break			
7	2 May	APIs: Controlling QGIS and Arc with	**Automate processing tasks in a**	due 14

		python	**desktop GIS** (25%)	Jun
8	9 May	Beyond notebooks: virtual environments, IDEs and version control	Hands on with `conda`, `git`, and an IDE	
9	16 May	A look at other languages: same only different	`R` `javascript` `java` `netlogo`	
10	23 May	Web scraping	`scrapy`	
11	30 May	PostGreSQL and PostGIS	Support on final lab	
12	6 Jun	Course review	**In class test** (30%)	

Lectures

Lectures will generally consist of up to an hour of presented material, and up to 30 minutes of more open-ended discussion and Q&A based on the materials and on reading which students will have been expected to do ahead of class. After that we will dive into the associated lab materials.

Readings

A really great introduction to Python is provided by this freely available PDF book (also available to purchase), from which readings will be assigned, especially in the first half of trimester.

- Downey A. 2015. *Think Python: How to think like a Computer Scientist* 2nd edn. Green Tea Press, Needham, MA.

Other useful resources are found online and will be called out in lectures as we proceed. There will probably be readings set from

- Crickard P, E van Rees and S Toms. 2018. *Mastering Geospatial Analysis with Python*. Packt Publishing.

- Westra E. 2016. *Python geospatial development* 3rd edn. Packt Publishing.

These are both accessible via a university subscription through the library, and PDFs are purchasable for only US$5.

Labs

Lab sessions follow the lecture sessions and will cover related practical topics. General directions for the labs are found here. Five sessions have an associated assessed assignment, but you should attend all labs and particpate fully to broaden your knowledge of GIScience methods and tools as any of the approaches covered may prove useful for you in other parts of the program. (Note also that a portion of the course credit is for participation in all aspects of the course.)

The final assignment may be organised in pairs or small groups, depending on differing student interests and skillsets.

Software

Most of the lab work will be completed in Jupyter Notebook or similar Jupyter Lab environments. These are good for incrementally becoming accustomed to code, then writing small amounts of code, building up to writing more extensive blocks of code.

When we come to the final assignment it will be more effective to work in an *Integrated Development Environment* (IDE) such as PyCharm and use a version control tool such as git.

All these tools are freely available for all platforms (although there are a few wrinkles and variations between platforms). If you wish to replicate the lab set up on a personal machine, you can use this requirements file along with these instructions to install the conda virtual environments management tool, and to create an environment from a file.

Course learning objectives (CLOs)

1. manage, analyse, visualize and present spatial data using a range of programming tools
2. configure and manage a computing environment suitable for geographical information analysis
   3.automate geographic information analysis workflows
3. setup and manage version control for geographical analysis projects
4. Specify an appropriate combination of tools and languages suitable for the conduct of any well-defined geographical data management and analysis project

Assessment

This course is 100% internally assessed. Assessment is based on four lab assignments worth 12.5% of overall course credit each, and a final assignment worth 50% of course credit due in the exam period.

Assessment item	Credit	Due date	CLOs
`geopandas` : working with spatial data using code	5%	20 March	1 2 3
Repetive processing tasks	10%	27 March	2 3
Reclassify complex landuse data programmatically	15%	10 April	1 3
Generate and customize a web map from multiple data layers	15%	31 May	2 4
Automate processing tasks in a desktop GIS	25%	31 May	1 2 3 4
In class test	30%	6 June	5

Assessments are submitted electronically via dropbox on Blackboard. I will aim to return coursework within 3 weeks. Extensions should be requested from the SGEES administration office. If you anticipate problems come and talk to me.

Late submission penalties

All assignments must be handed in by their due dates. Non-submission by the required date will result in a 5% penalty off your grade for that assignment for each day or part thereof that the coursework is late. No submissions will be accepted more than 5 days after the due date.

Computer crash or similar excuses are not acceptable. Save your material and make sure you have something to submit by the due date.

Non-assessed lab work

Note that there are also non-assessed lab sessions. These will be important for your ability to complete the final assignment effectively and to your all-around training in GIScience, so it is vital that you take them seriously as part of the course.

Additional information

The primary mode of communication for the course will be via Blackboard, so please ensure that your contact details there are up to date and are regularly checked (note that Blackboard defaults to your myvuw email address).

Class representatives

Since this is a relatively small graduate class, I expect that it will not be a problem to raise any issues or concerns directly with me, or with the GIS technician.

Other useful resources

- Academic Integrity and Plagiarism
- Aegrotats
- Academic Progress (including restrictions and non-engagement)
- Dates and deadlines
- Grades
- Resolving academic issues
- Special passes
- Statutes and policies including the Student Conduct Statute
- Student support
- Students with disabilities
- Student Charter
- Student Contract
- Turnitin
- University structure
- VUWSA