Course Syllabus

Course Number: DS 422

Course Title: Geocomputation

Department Name: Data Science, Analytics and Visualization

College/School/Division Name: Natural Sciences and Mathematics

Term: Fall 2025

Course Credits: 3

Class Meeting Days: Tuesdays & Thursdays

Class Meeting Hours: 2:30 - 3:50 PM

Class Location: Remote, Online

Instructor Name: Connor Flynn, M.S

Email: connor.flynn@chaminade.edu

Office Location: Data Science Center (Upstairs)

Office Hours: Thursdays 3:50 - 4:30 PM or by appointment

Instructor Website: https://connorflynn.github.io/

1. University Course Catalog Description

This course introduces the principles and practices of geocomputation, focusing on how computational methods are applied to geographic data to produce insight and support decision-making. Students will work with contemporary open-source tools, including R, sf, terra, and mapgl, to process, transform, and model geographic information across vector and raster domains. Topics include data acquisition, cleaning, coordinate transformations, geoprocessing operations, raster computation, and reproducible workflows. Through a combination of technical training and real-world case studies—from tsunami evacuation modeling to business and defense applications—the course prepares students to design efficient, ethical, and reproducible computational pipelines that extend beyond visualization into robust geographic computation.

2. Course Overview

DS422 is a practice-oriented exploration of geocomputation within the broader context of geographic information science. Students will learn to manipulate and compute geographic data through a blend of technical exercises, live demonstrations, and applied projects. Emphasis is placed on developing fluency with computational geospatial workflows, including vector operations (sf, rmapshaper, osmdata), raster processing (terra, stars), and API integration (tidycensus, environmental and transportation APIs). Students will also gain experience building reproducible projects in Quarto, automating routine tasks, and critically evaluating the assumptions and limitations of computational methods.

3. Program Learning Outcomes

Upon completion of the undergraduate B.S. program in Data Science, Analytics & Visualization, students will be able to:

1. Source, describe, and curate large, multimodal data sets (‘Big Data’);
2. Apply foundational mathematical and statistical concepts and operations, including the application of up-to-date tools, that underlie data sourcing, management, analysis, and interpretation;
3. Develop and implement approaches for effective data translation, dissemination, and communication between domains, stakeholders, and the public;
4. Apply basic data modeling, predictive models, and visualizations to support decision-making, independently or in teams;
5. Integrate an awareness of ethical issues and collective standards to positively influence the application of data science to service, justice and peace in working towards solutions for societal problems;

General Education Learning Outcomes Critical Thinking: Students will evaluate and articulate the social, environmental and ethical dimensions of service, justice, and peace in the context of their particular course and field or discipline of study.

4. Course Learning Outcomes and Linkage to Program Learning Outcomes

Students who successfully complete this course will be able to:

Course Learning Outcomes (CLOs)	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	GELO
Import, clean, and transform geographic datasets in R (sf, terra)	X	X				
Perform geocomputation operations (buffer, overlay, raster math, API queries)	X	X		X		
Compute derived indicators (e.g., population exposure, housing affordability) from census/environmental data	X	X		X		
Build reproducible geospatial workflows with Quarto and GitHub	X	X	X			X
Deploy interactive computational maps (mapgl) for stakeholder engagement			X			X

5. Course Prerequisites

DS 420, DS 421

6. Required Learning Materials

All materials will be provided on the course website
https://github.com/NSF-ALL-SPICE-Alliance/DS422-Geocomputation

7. Course Website:

All assignments will be turned in via Github.

8. Technical Assistance for Canvas Users:

We will thoroughly cover how to turn in assignments via Github. For any assistance, please visit office hours or setup an appointment with me via email: connor.flynn@chaminade.edu

Week	Date	Lesson	Activities
1	08/25–08/29	**Setup & Orientation**	Install R, RStudio, GitHub Desktop; connect to GitHub; intro to `sf`, `terra`, `mapgl`

2	09/01–09/05	**Working with Geographic Data in R**	Vector & raster basics (`sf`, `terra`); CRS and transformations; reading/writing SHP, GPKG, GeoJSON
3	09/08–09/12	**Tsunami Evacuation Zones**	Hawai‘i tsunami zone shapefiles; overlay with census tracts; compute population exposure with `tidycensus`
4	09/15–09/19	**Case Study: Evacuation & Infrastructure**	Integrate evacuation zones with schools/hospitals; compute service gaps; Assignment 1 due
5	09/22–09/26	**Traffic & Network Data**	Intro to `osmdata`, `sfnetworks`; map Hawai‘i road network; traffic dataset integration
6	09/29–10/03	**Case Study: Tsunami Evacuation Traffic Bottlenecks**	Analyze traffic flow before/during tsunami evacuation; identify bottlenecks; visualize alternatives
7	10/06–10/10	**Raster Computation with terra**	Map algebra, raster math, zonal statistics; link rasters with census polygons
8	10/13–10/17	**Case Study: O‘ahu ACS Computation**	Use `tidycensus` to compute derived indicators (housing affordability, industry reliance); Assignment 2 due
9	10/20–10/24	**Spatial Business Analytics**	Point-in-polygon analysis; buffers; service area calculations; competitor mapping
10	10/27–10/31	**Case Study: Business Location Modeling**	Coffee shops, surf schools, or healthcare; build location-allocation models; Assignment 3 due
11	11/03–11/07	**Defense & DoD Applications**	DoD installations on O‘ahu; overlay with environmental data (noise, PFAS, air quality)
12	11/10–11/14	**Case Study: Environmental Exposure Near Installations**	Clip census + environmental layers to buffers; compute exposure; ethical implications
13	11/17–11/21	**Reproducible Workflows**	Quarto + GitHub for reproducible geocomputation projects; publish interactive maps with `mapgl`
14	11/24–11/28	**Final Project Development**	Workshop project ideas; independent data acquisition + pipeline building

15	12/01–12/05	**Final Project Work Week**	In-class workshopping; peer feedback
16	12/08–12/11	**Final Project Presentations**	Student presentations of full geocomputation workflows

9. Assessment.

Assessments	Points
Participation and Communication	36
Assignments (4x)	44
Final Project & Presentation	20
Total	**100**

10. Grading Scale

Letter grades are given in all courses except those conducted on a credit/no credit basis. They are interpreted as follows:

A 90-100% 90 points or more: Outstanding scholarship and an unusual degree of intellectual initiative

B 80-90% 80-89 points: Superior work done in a consistent and intellectual manner

C 70-80% 70-79 points: Average grade indicating a competent grasp of subject matter

D 60-70% 60-69 points: Inferior work of the lowest passing grade, not satisfactory for fulfillment of prerequisite course work.

F <60% 59 points or less: Failed to grasp the minimum subject matter; no credit given

Feedback and grades on course deliverables (e.g., assignments, projects, quizzes, etc.) will be provided via Github. Response time will take place up to 7 days.

11. Course Schedule

Credit Hour Policy:
This is a three-credit course requiring a minimum of 135 clock hours of student engagement, per the official CUH Credit Hour Policy. Students enrolled in this course are anticipated to spend 37.50 hours in class and 24 hours on the final project. There will be an additional 74.50 hours of work required beyond what is listed here (course readings, assignments, etc.), averaging ~4.66 hours each week.

Course changes:
The instructor reserves the right to change the course instruction, schedule, deadlines, course requirements, and grading throughout the semester. Changes will be announced through email and outlined on the course website

12. Alignment of Natural Sciences Courses with Marianist and Hawaiian values of the University.

The Natural Sciences Division provides an *integral, quality education:* sophisticated integrative course content taught by experienced, dedicated, and well-educated instructors.

- We *educate in family spirit* – every classroom is an *Ohana* and you can expect to be respected yet challenged in an environment that is supportive, inclusively by instructors who take the time to personally get to know and care for you.
- We *educate for service, justice and peace*, since many of the most pressing global issues (climate change, health inequity, poverty, justice) are those which science and technology investigate, establish ethical parameters for, and offer solutions to.
- We *educate for adaptation and change*. In science and technology, the only constant is change. Data, techniques, technologies, questions, interpretations and ethical landscapes are constantly evolving, and we teach students to thrive on this dynamic uncertainty.

The study of science and technology can be formative, exploring human creativity and potential in the development of technologies and scientific solutions, the opportunity to engage in the stewardship of the natural world, and the opportunity to promote social justice. We provide opportunities to engage with the problems that face Hawai‘i and the Pacific region through the Natural Sciences curriculum, in particular, those centered around severe challenges in health, poverty, environmental resilience, and erosion of traditional culture. The Marianist Educational Values relate to Native Hawaiian ideas of *mana, na'auao, ohana*, *aloha* and *aina*. We intend for our Natural Sciences programs to be culturally-sustaining, rooted in our Hawaiian place, and centered on core values of *Maiau,* be neat, prepared, careful in all we do; *Makawalu*, demonstrate foresight and planning; *`Ai,* sustain mind and body; *Pa`a Na`au*, learn deeply.

13. Additional departmental and university policies

13.1. Late Work Policy

Requests for extensions due to extenuating circumstances (medical problems, for example) will be considered, but work received after the deadline will not be graded, unless stated otherwise. Computer problems are not an excuse for late work.

13.2. Grades of "Incomplete"

Students and instructors may negotiate an incomplete grade when there are specific justifying circumstances. An Incomplete Contract (available form the Divisional Secretary and the Portal) must be completed. When submitting a grade the "I" will be accompanied by the alternative grade that will automatically be assigned after 90 days. These include IB, IC, ID, and IF. If only an "I" is submitted the default grade is F. The completion of the work, evaluation, and reporting of the final grade is due within 90 days after the end of the semester or term. This limit may not be extended.

13.3. Writing Policy

Paper requirements and formatting will be discussed during the course when the assignment is given.

13.4. Instructor and Student Communication

Questions for this course can be emailed to the instructor at [rylan.chong@chaminade.edu]. Online, in-person and phone conferences can be arranged. Response time will take place up to 3 days.

The University provides a Chaminade email address for all students. Official Chaminade communications will be sent to the students' Chaminade email address and instructors will use only this email to communicate with students. It is the responsibility of the student to check their email frequently. Report email-related problems to the Helpdesk at 808-735-4855 or helpdesk@chaminade.edu

13.5. Cell phones, tablets, and laptops

Music Devices and Cellular Phones: Unless specifically permitted by your instructor, use of music devices and cell phones is prohibited during all Natural Science and Mathematics classes, as it is discourteous and may lead to suspicion of academic misconduct. Students unable to comply will be asked to leave class. Out of consideration for your classmates, please set your cell phone to silent mode during class. Students are encouraged to bring laptops or tablets to class as the instructor will assign online activities and readings that will require the use of a laptop or tablet. Laptops and tablets should not be misused, such as checking distracting websites. Use your best judgment and respect your classmates and instructor.

13.6. Disability Access

If you need individual accommodations to meet course outcomes because of a documented disability, please speak with me to discuss your needs as soon as possible so that we can ensure your full participation in class and fair assessment of your work. Students with special needs who meet criteria for the Americans with Disabilities Act (ADA) provisions must provide written documentation of the need for accommodations from the Counseling Center by the end of week three of the class, in order for instructors to plan accordingly. If a student would like to determine if they meet the criteria for accommodations, they should contact the Counseling Center at (808) 735-4845 for further information (counselingcenter@chaminade.edu).

13.7. Title IX Compliance

Chaminade University of Honolulu recognizes the inherent dignity of all individuals and promotes respect for all people. Sexual misconduct, physical and/or psychological abuse will NOT be tolerated at CUH. If you have been the victim of sexual misconduct, physical and/or psychological abuse, we encourage you to report this matter promptly. As a faculty member, I am interested in promoting a safe and healthy environment, and should I learn of any sexual misconduct, physical and/or psychological abuse, I must report the matter to the Title IX Coordinator. If you or someone you know has been harassed or assaulted, you can find the appropriate resources by visiting Campus Ministry, the Dean of Students Office, the Counseling Center, or the Office for Compliance and Personnel Services.

13.8. Attendance Policy

The following attendance policy is from the 2024-2025 Academic Catalog: Students are expected to attend regularly all courses for which they are registered. Student should notify their instructors when illness or other extenuating circumstances prevents them from attending class and make arrangements to complete missed assignments. Notification may be done by emailing the instructor's Chaminade email address, calling the instructor's campus extension, or by leaving a message with the instructor's school office (Natural Science and Math 1 (808) 440-4204). It is the instructor's prerogative to modify deadlines of course requirements accordingly. Any student who stops attending a course without officially **withdrawing** may receive a failing grade.

Unexcused absences equivalent to more than a week of classes may lead to a grade reduction for the course. Any unexcused absence of two consecutive weeks or more may result in being **withdrawn** from the course by the instructor, although the instructor is not required to **withdraw** students in that scenario. Repeated absences put students at risk of failing grades.

Students with disabilities who have obtained accommodations from the Chaminade University of Honolulu ADA Coordinator may be considered for an exception when the accommodation does not materially alter the attainment of the learning outcomes. Federal regulations require continued attendance for continuing payment of financial aid. When illness or personal reasons necessitate continued absence, the student should communicate first with the instructor to review the options. Anyone who stops attending a course without official withdrawal may receive a failing grade or be withdrawn by the instructor at the instructor's discretion.

13.9. Academic Conduct Policy

See the current Undergraduate Academic Catalog and the Student Handbook available from Student Affairs.