

GEOG 5963/6960: Geographic Data Science

Professor: Alexander Hohl
Class time: Th / 02:00PM-04:20PM
Class location: GC 2140

Contact information: alexander.hohl@geog.utah.edu, GC 4841
Office Hours: Th / 10:00AM-12:00PM

Evaluation:

Paper presentation	25%
Project proposal	05%
Project presentation	20%
Project report	50%

Course Description

It is widely acknowledged that the emergence of “Big Data” is having a profound and often controversial impact on the production of knowledge. In this context, Data Science has developed as an interdisciplinary approach that turns such “Big Data” into information. Geography can have a positive influence on Data Science when studying spatially explicit problems; and inversely, there is much that Geography and Geographical Analysis could learn from Data Science. In this class, we take a deeper look on an ambitious research agenda, including systems engineering, new methodological developments, and work toward addressing some acute challenges around epistemology.

Course goals

The overall aim is to provide an overview of the discipline, its (albeit short) history and current research frontiers. Students completing the course will have:

- Investigated the building blocks of Geographic Data Science
- Experience of coding these approaches in an open source language
- Undertaken the steps to parameterize and test geographic models
- Discussed examples from a variety of application domains

Class schedule

The tentative schedule of the course and associated reading assignments are listed in the table below. Classes will generally consist of paper presentations, followed by discussions. Please note that this is a draft schedule, and is subject to change as the semester progresses.

Date	Subject	Readings/presenter	Deadlines
8/22	Introductions		Research Presentation

8/29	Data Science	[1], [2], [3], [4], [5]	
9/5	Geographic Data Science	[6], [7]	
9/12	Data Acquisition, Preparation - APIs, Web scraping, geocoding, VGI, GPS	[8]*, [9]*	
9/19	Data Analysis - Statistics	[10]*, [11]*	
9/26	Data Analysis - Data Mining	[12]*, [13]*	
10/3	Data Analysis - Machine Learning	[14]*, [15]*	Project Proposal
10/10		Fall Break	
10/17	Data Analysis - Deep Learning/AI	[16]*, [17]*	
10/24	Data Processing - HPC	[18]*, [19]*	
10/31	Data Processing - HPC Spatiotemporal Domain Decomposition	[20], [21]	
11/7	Data Processing - Cloud Computing	[22]*, [23]*	
11/14	Data Visualization	[24]*, [25]*	
11/21	Data Visualization	[26]*, [27]*	
11/28		Thanksgiving Break	
12/5			Project Presentations, Reports
12/12		Final Exam Day	

* TBD

Literature

- [1] Donoho, D. (2017). 50 years of data science. *Journal of Computational and Graphical Statistics*, 26(4), 745-766.
- [2] Press, G. (2013). Data Science: What's The Half-Life Of A Buzzword? *Forbes*.
- [3] Darrow, B. (2015). Data science is still white hot, but nothing lasts forever. *Fortune*.
- [4] Miller, S. (2014). Collaborative approaches needed to close the big data skills gap. *Journal of Organization design*, 3(1), 26-30.
- [5] Wladawsky-Berger, I. (2014). Why Do We Need Data Science When We've Had Statistics for Centuries? *CIO Journal*, *Wall Street Journal*.
- [6] Singleton, A., & Arribas-Bel, D. (2019). Geographic Data Science. *Geographical Analysis*.
- [7] Marc P. Armstrong, Shaowen Wang & Zhe Zhang (2019) The Internet of Things and fast data streams: prospects for geospatial data science in emerging information ecosystems, *Cartography and Geographic Information Science*, 46:1, 39-56, DOI: 10.1080/15230406.2018.1503973
- [8]
- [9]
- [10] Tao, R., & Thill, J. C. (2019). Flow Cross K-function: a bivariate flow analytical method. *International Journal of Geographical Information Science*, 1-17.
- [11]
- [12] Tao, R., & Thill, J. C. (2016). Spatial cluster detection in spatial flow data. *Geographical analysis*, 48(4), 355-372.
- [13]
- [14]
- [15]
- [16]
- [17]
- [18]
- [19]
- [20] Ding, Y., & Densham, P. J. (1996). Spatial strategies for parallel spatial modelling. *International journal of geographical information systems*, 10(6), 669-698.
- [21] Hohl, A., Delmelle, E. M., & Tang, W. (2015). SPATIOTEMPORAL DOMAIN DECOMPOSITION FOR MASSIVE PARALLEL COMPUTATION OF SPACE-TIME KERNEL DENSITY. *ISPRS Annals of Photogrammetry, Remote Sensing & Spatial Information Sciences*, 2(4).
- [22]
- [23]
- [24]
- [25]
- [26]
- [27]

Class policies

- Individual extra credit will not be assigned
- Any assignment turned in after the due date will only be worth half the earned points
- Canvas will be used for the submission of assignments
- Materials turned in must be typed
- Collaboration between students is encouraged, but final products must show evidence of individual effort. If not, no credit will be given.

Grading

Letter grades will be assigned following the scheme provided below, using .5 as the break point:

A	95+	C+	70~74
A-	90~94	C	65~69
B+	85~89	C-	60~64
B	80~84	D	50~59
B-	75~79	E	~49

Paper presentations

Each student is required to find, present and lead discussion on papers that fall within the topic of the class. The presentations should discuss the aims and results of the study, and focus on the benefits/limitations of methodology. These presentations should be 20-25 minutes, and will be followed by a discussion. Students should use powerpoint (or similar) slides to illustrate the main points of the talk and any relevant figures. A computer will be provided for the slides. The presentations will take place throughout the semester, and the schedule will be assigned during the second week of class. There will be a limit of two student presentations for any given class.

Project

Students are also required to carry out a project based on their research interests but relevant to Geographic Data Science. The project will require students to a) identify a topic relevant to their interests; b) identify and obtain dataset(s), c) perform data wrangling, c) perform analysis; and d) write and present a report detailing the work carried out.

Evaluation of the project will be based on (1) a one page proposal of the project, (2) an in-class presentation, and (3) a project report.

The *proposal* will include:

- Description of the problem you attempt to solve
- Tentative list of data sets to be used in the project
- Tentative workflow, including methods to be used
- Preliminary or expected results

The *project report* (use the [template](#)) will include the following elements: Title, Name, Affiliation, Abstract, Introduction, Related works, Data and Methods, Results, Discussion and Conclusions, References (not included in page limit).

Your *in-class presentation* will be a 15-minute talk, and should be based on a condensed version of the project report. Use of powerpoint presentation or like is strongly recommended.

Disability Statement

The University of Utah seeks to provide equal access to its programs, services and activities for people with disabilities. If you will need accommodations in this class, reasonable prior notice needs to be given to the instructor and to the Center for Disability Services, 162 Olpin Union Building, 581-5020 (V/TDD) to make arrangements for accommodations. All written information in this course can be made available in alternative format with prior notification to the Center for Disability Services.

Academic Misconduct Statement

- Academic misconduct will not be tolerated. Penalties may include failure of an assignment, the entire course, and/or the filing of formal charges with appropriate university authorities.
- Academic misconduct includes, but is not limited to, cheating, misrepresenting one's work, and plagiarism:
 - Cheating involves the unauthorized possession or use of information in an academic exercise, including unauthorized communication with another person during an exercise such as an examination.
 - Misrepresenting one's work includes, but is not limited to, representing material prepared by another as one's own work or submitting the same work in more than one course without prior permission of all instructors.
 - Plagiarism means the intentional unacknowledged use or incorporation of any other person's work in one's own work offered for academic consideration or public presentation.

Safety & Wellness Statement

Your safety is our top priority. In an emergency, dial 911 or seek a nearby emergency phone (throughout campus). Report any crimes or suspicious people to 801-585-COPS; this number will get you to a dispatch officer at the University of Utah Department of Public Safety (DPS; dps.utah.edu). If at any time, you would like to be escorted by a security officer to or from areas on campus, DPS will help — just give a call.

The University of Utah seeks to provide a safe and healthy experience for students, employees, and others who make use of campus facilities. In support of this goal, the University has established confidential resources and support services to assist students who may have been affected by harassment, abusive relationships, or sexual misconduct. A detailed listing of University Resources for campus safety can be found at <https://registrar.utah.edu/handbook/campussafety.php>

Your well-being is key to your personal safety. If you are in crisis, call 801-587-3000; help is close.

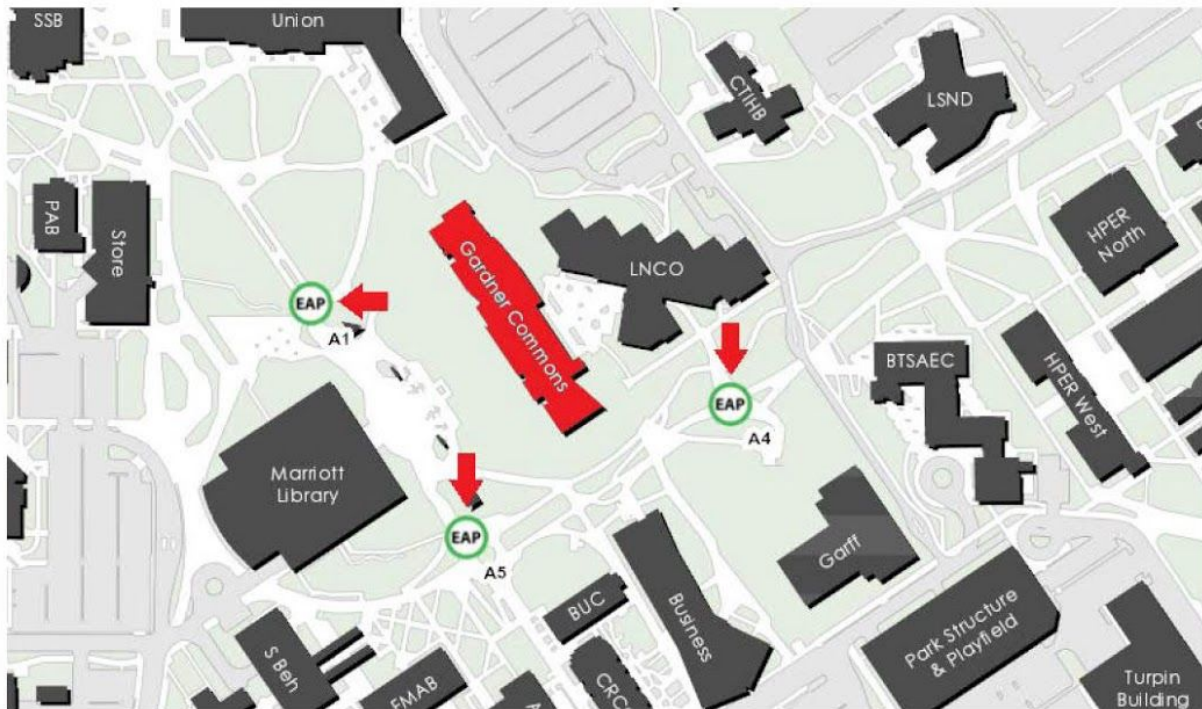
The university has additional excellent resources to promote emotional and physical wellness, including the Counseling Center (<https://counselingcenter.utah.edu>), the Wellness Center (<https://wellness.utah.edu>), and the Women's Resource Center (<https://womenscenter.utah.edu>). Counselors and advocates in these centers can help guide you to other resources to address a range of issues, including substance abuse and addiction.

The University of Utah values the safety of all campus community members. To report suspicious activity or to request a courtesy escort, call campus police at 801-585-COPS (801-585-2677). You will receive important emergency alerts and safety messages regarding campus safety via text message. For more information regarding safety and to view available training resources, including helpful videos, visit safeu.utah.edu.

Undocumented Student Support Statement

Immigration is a complex phenomenon with broad impact—those who are directly affected by it, as well as those who are indirectly affected by their relationships with family members, friends, and loved ones. If your immigration status presents obstacles to engaging in specific activities or fulfilling specific course criteria, confidential arrangements may be requested from the Dream Center. Arrangements with the Dream Center will not jeopardize your student status, your financial aid, or any other part of your residence. The Dream Center offers a wide range of resources to support undocumented students (with and without DACA) as well as students from mixed-status families. To learn more, please contact the Dream Center at 801.213.3697 or visit dream.utah.edu.

CSBS EMERGENCY ACTION PLAN



BUILDING EVACUATION

EAP (Emergency Assembly Point) – When you receive a notification to evacuate the building either by campus text alert system or by building fire alarm, please follow your instructor in an orderly fashion to the EAP marked on the map below. Once everyone is at the EAP, you will receive further instructions from Emergency Management personnel. You can also look up the EAP for any building you may be in on campus at <http://emergencymanagement.utah.edu/eap>.



CAMPUS RESOURCES

U Heads Up App: There's an app for that. Download the app on your smartphone at alert.utah.edu/headsup to access the following resources:

- **Emergency Response Guide:** Provides instructions on how to handle any type of emergency, such as earthquake, utility failure, fire, active shooter, etc. Flip charts with this information are also available around campus.
- **See Something, Say Something:** Report unsafe or hazardous conditions on campus. If you see a life threatening or emergency situation, please call 911!

Safety Escorts: For students who are on campus at night or past business hours and would like an escort to your car, please call 801-585-2677. You can call 24/7 and a security officer will be sent to walk with you or give you a ride to your desired on-campus location.