Syllabus
Geography 5150/6150 – Geospatial Big Data
Fall 2020

Instructor: Dr. Alexander Hohl, alexander.hohl@geog.utah.edu
Office Hours: MoWe, 10:30AM – 11:30AM, book a 20-minute slot here.
Lecture: Online
Lab: Mo 3:05PM – 5:00PM, GC 1855
Lab TA: Wenqu Chen, wenq.chen@.utah.edu, office hours by appointment.

Prerequisites: Prerequisites: "C" or better in GEOG 4140 or GEOG 6140

Credit Hours: GEOG 5150/6150 is a four-credit hour course. At the University of Utah, it is assumed that there is at least one hour in class and two hours outside of class per week or the equivalent combination connected to every credit hour.

Course Overview: This course teaches three essential skills for solving geographic problems using big data and modern computing infrastructure: 1) managing geospatial data (database), 2) leveraging the web (web GIS), and 3) using cloud-based computing services (cloud computing). Scientists, governments and businesses collect spatial data at increasing volume, velocity, and variety due to technological developments such as GPS, mobile devices and remote sensing. However, spatial data involves complex objects and relationships that cannot be accommodated easily by standard database management systems. This course teaches the fundamentals of database design and data management to support GIS and other spatial applications. With the internet being the main source of information and communication for many people, the demand for accessing information via maps is increasing at a rapid pace. GIS are quickly moving towards a web-based environment where everyone can access GIS data/functionality regardless of location and GIS skill level. This course provides an overview of web GIS and associated techniques to leverage web technologies for spatial analysis. Cloud computing is a fundamental component of modern IT infrastructure and application design. Students learn about design and implementation of cloud computing environments and apply the concepts in a lab environment.

Course Objectives and Scope:

1. Database
    a. Understand the relational database design process and spatial object definition to design a spatial database;
    b. Be able to write and execute traditional and spatial queries using SQL;
2. WebGIS
    a. Explain the difference between Desktop, Distributed, Web, and other forms of GIS.
    b. Develop a basic webpage using HTML 5, CSS 3, and JavaScript.
    c. Develop a basic Web GIS application to meet an academic or industry need.
3. Cloud Computing
    a. Explain the difference between desktop, grid, and cloud computing

b. Be able to implement a simple cloud computing workflow for analyzing spatial data

Recommended Texts and Resources (not required):

1. Database
    a. Worboys and Duckham. (2004) GIS: A Computing Perspective (2nd ed). CRC Press.
    b. Shekhar, S. and Chawla, S. (2003) Spatial Databases: A Tour. Pearson.
    c. Zeiler, M., Murphy, J. (2010) Modeling Our World: The ESRI Guide to Geodatabase Concepts.
2. WebGIS
    a. Haverbeke, Marijn. 2007. Eloquent JavaScript A Modern Guide to Programming. Online book. Available at: http://eloquentjavascript.net/
    b. W3C Schools Online Web Tutorials. Supplemental Examples, Lessons, and Code Snippets. Online Resource. Available at: http://www.w3schools.com/default.asp
    c. ArcGIS for Developers. A complete mapping and analytics platform for developers. Available at: https://developers.arcgis.com
3. Cloud Computing:
    a. Yang, C., & Huang, Q. (2013). Spatial cloud computing: a practical approach. CRC Press.

Additional readings and supplementary material may also be made available via CANVAS throughout the semester.

Course Policies:

- Participation: All students enrolled in this course are expected to complete all required course activities: 1) watch the lectures, 2) readings, 3) turn in graded exercises and 4) labs, 5) complete exams, and 6) the final project. You are strongly encouraged to 1) log on to the CANVAS course page daily to stay up-to-date and to ensure a productive and professional learning environment and to 2) attend all lab meetings. Completing the required course activities is especially important to your success as the lectures are given online, as well as the rapid pace of the course and the advanced topics that will be covered.
- Deadlines: Let your instructor know as soon as possible if you anticipate missing a deadline. If you end up missing a deadline without notifying your instructor first, you will be deducted 10% of the total possible assignment score per day missed (i.e. there are no points left for you to score after 10 days of delay).
- Official Course Communication: All relevant course materials including lab instructions, slides, readings, and will be disseminated on CANVAS (recommended books are an exception and it is up to students to obtain them). Exams will be taken on CANVAS as well. Students use UMail only for course-related communication to the instructor and TA. Emails from other providers (i.e. your personal Gmail account) will be ignored to ensure privacy. Students will be expected to check their Umail and CANVAS regularly for

course related updates and important information. Students that fail to check these communication channels regularly will not be given leniency for missed communications.

Academic Integrity: The University of Utah is committed to nurturing academic excellence, truth, honesty, and personal integrity. The faculty expects all students to maintain high ethical standards. Academic misconduct will not be tolerated. Penalties will include failure of an assignment, or possibly the entire course, and 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.

Faculty and Student Responsibilities: The class will follow accepted University of Utah policies and procedures. Please refer to the University of Utah Faculty Handbook (http://academic- affairs.utah.edu/faculty-handbook/) and Student Code (http://www.admin.utah.edu/ppmanual/8/8-10.html). Specifically: All students are expected to maintain professional behavior in the classroom setting, according to the Student Code, spelled out in the Student Handbook. Students have specific rights in the classroom as detailed in the Code. The Code also specifies proscribed conduct that involves cheating on tests, plagiarism, and/or collusion, as well as fraud, theft, etc. Students should read the Code carefully and know they are responsible for the content. According to Faculty Rules and Regulations, it is the faculty's responsibility to enforce responsible classroom behaviors, beginning with verbal warnings and progressing to dismissal from class and a failing grade. Students have the right to appeal such action to the Student Behavior Committee.

Disability Accommodation: 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 the class, reasonable prior notice needs to be given to the Center for Disability Services, 162 Olpin Union Building, 581-5020 (V/TDD). CDS will work with you and the instructor 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.

Note: The syllabus is not a binding legal contract. It may be modified by the instructor when the student is given reasonable notice of the modification, particularly when the modification is done to rectify an error that would disadvantage the student.

Course Grading and Assessments:
This course is a hunt for a maximum of 1000 possible points, which are distributed as follows:

Graded item	**Points**	**Quantity**	**Total Points**
Exams	50	2	100
Labs	50	11	550
Exercises	25	6	150
Final Project	Proposal	1	50
	Final Report	1	50
	Final Presentation	1	50
	Project Code	1	50
Course Total			1000

Grade Scale	Points
A	940-1000
A-	900-930
B+	870-890
B	840-860
B-	800-830
C+	770-790
C	740-760
C-	700-730
D+	670-690
D	640-660
D-	600-630
E	<600

Lab Assignments: The lab assignments constitute the applied portion of this course and are intended to provide students with the skills necessary to draw insights from Geospatial Big Data. Lab assignments are due as indicated in the instructions and will be submitted on CANVAS. Completing lab assignments by the original deadline is essential for student success because the skills covered in a single assignment are often required in subsequent assignments. The instructor will attempt to align the applied assignments with the lecture portion of the course but makes NO guarantee that labs will correspond directly with the theoretical topics during any given class meeting.

Midterm: There is one midterm examination that and will cover a combination of theoretical and applied material from the lecture and laboratory portions of the course respectively. The exam date is listed in the tentative course schedule and is administered on CANVAS. Exams may include multiple choice, short answer and essay questions. No “make-up” exams will be given; notify the instructor at least two weeks in advance of a scheduled exam date if an alternative date is necessary.

Final project: The last two to three weeks of the course will be dedicated to working on the final project, a research/development experience where students develop an application to

showcase their Geospatial Big Data skills. All final project deliverables are submitted on CANVAS, including:

- Project proposal (1-2 pages). Includes Project Title, Student Name, Introduction, Problem Statement, Data and Methods, Preliminary Results (if applicable), current and anticipated challenges and References.
- Final report (10-15 pages). Includes Project Title, Student Name, Introduction, Problem Statement, Data and Methods, Results, Discussion, Conclusions and References.
- Final presentation (10 minutes). Students submit a voice-over Power Point presentation (either as PPT or video file). Instructions to produce a voice-over Power Point presentation can be found here. It is required that each team member contributes to the presentation.
- Project Codes. All codes involved in the project need to be submitted on CANVAS.

Important dates:
Last day to add classes without a permission code: Friday, August 28, 2020
Last day to add, drop (delete), elect CR/NC, or audit classes: Friday, September 4, 2020
Last day to withdraw from classes: Friday, October 16, 2020

W	Lec/Lab	Topics
W1 8/24 – 8/30	Lec	· Syllabus · Introduction to Geospatial Big Data Spatial Databases, WebGIS, and Cloud Computing Intro to GIS lecture: · What is GIS · GIS Functionality · Data and Databases · Hardware Support
	Lab	· Lab 1: Geodatabases in ArcGIS
W2 8/31 – 9/6	Lec	· Relational Databases · Database Development · Object-Orientation · Designing OR Databases · Recap: Relational Database Fundamentals · From ER-diagram to physical implementation
	Lab	· Lab 2: Entity-Relationship Diagrams, Relational Model Diagram, Class Diagram
W3 9/7 – 9/13	Lec	· Recap: From ER to physical implementation · Normalization
	Lab	No Lab (Labor Day)
W4 9/14 – 9/20	Lec	· Introduce SQL · SQL
	Lab	Lab 3: SQL Part 1 (physical implementation in DBMS)
W5 9/21	Lec	· SQL Recap · Fundamental Spatial Concepts

–		· Introduce spatial SQL
9/27	Lab	Lab 4: SQL Part 2 (physical implementation in DBMS)
W6	Lec	· Spatial SQL
9/28	Lab	Lab 5: Spatial SQL Open Source
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10/4		
W7	Lec	· Midterm Exam review · Midterm Exam · Project Proposals due
10/5		
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10/11	Lab	No lab
W8	Lec	· Introduce WebGIS: Internet, Client/Server Architecture, HTML
10/12		
–	Lab	Lab 6: GDB Implementation in ArcGIS Pro Part 1
10/18		
W9	Lec	· Deepen WebGIS: Internet, Client/Server Architecture, HTML
10/19		
–	Lab	Lab 7: GDB Implementation in ArcGIS Pro Part 2
10/25		
W10	Lec	· Recap WebGIS · Introduce JavaScript
10/26		
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11/1	Lab	Lab 8: Sharing WMS with ArcGIS Pro
W11	Lec	· Recap JavaScript · Deepen JavaScript
11/2		
–	Lab	Lab 9: WebGIS 1 & 2
11/8		
W12	Lec	HPC
11/9	Lab	Lab 10: High-Performance Computing
–		
11/15		
W13	Lec	Cloud Computing
11/16	Lab	Lab 11: Cloud Computing
–		
11/22		
W14	Lec	Final Exam Review
11/23	Lab	No lab
–		
11/29		
W15	Lec	Final Exam
11/30	Lab	No Lab – Work on projects
–		
12/6		
W16		Projects due (report & presentation & codes)
12/7		
–		
12/13		

Addressing Sexual Misconduct: Title IX makes it clear that violence and harassment based on sex and gender (which Includes sexual orientation and gender identity/expression) is a civil rights offense subject to the same kinds of accountability and the same kinds of support applied to offenses against other protected categories such as race, national origin, color, religion, age, status as a person with a disability, veteran's status or genetic information. If you or someone you know has been harassed or assaulted, you are encouraged to report it to the Title IX Coordinator in the Office of Equal Opportunity and Affirmative Action, 135 Park Building, 801-581-8365, or the Office of the Dean of Students, 270 Union Building, 801-581-7066. For support and confidential consultation, contact the Center for Student Wellness, SSB 328, 801-581-7776. To report to the police, contact the Department of Public Safety, 801-585-2677(COPS).

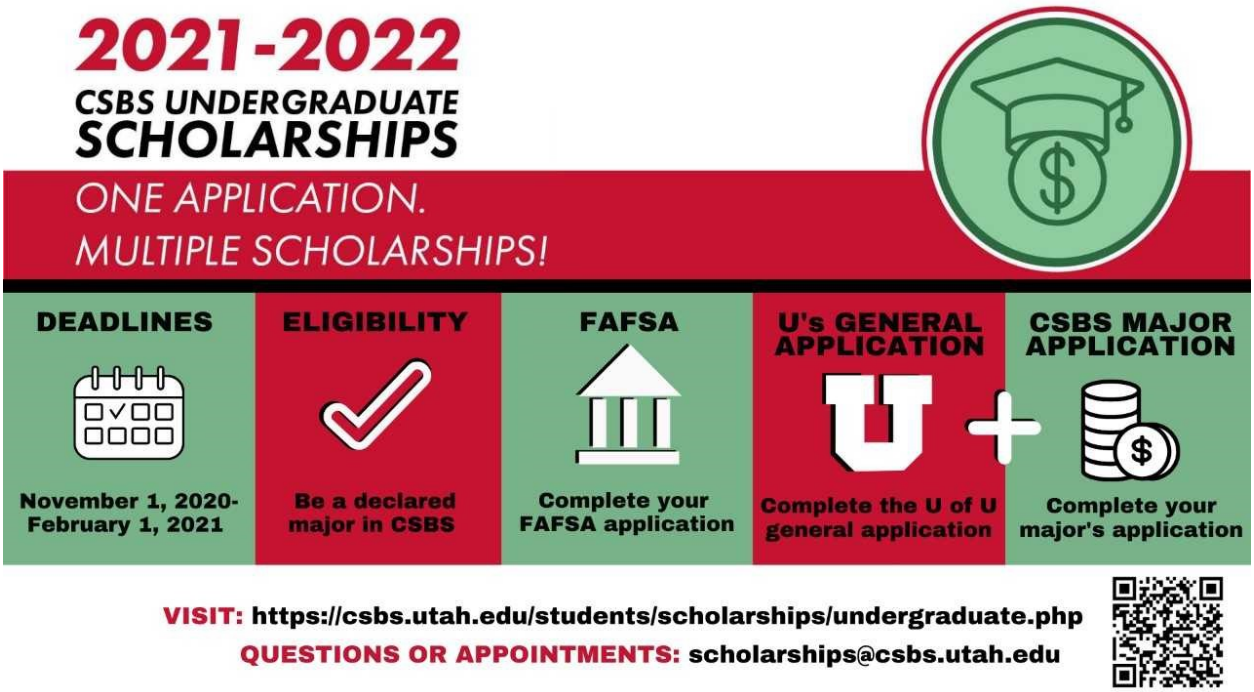
Diversity and Inclusivity: It is my intent that students from all diverse backgrounds and perspectives be well served by this course, that students' learning needs be addressed both in and out of class, and that the diversity that students bring to this class be viewed as a resource, strength and benefit. It is my intent to present materials and activities that are respectful of diversity: gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture. Your suggestions are encouraged and appreciated. Please let me know ways to improve the effectiveness of the course for you personally or for other students or student groups. In addition, if any of our class meetings conflict with your religious events, please let me know so that we can make arrangements for you.

Preferred Names and Pronouns: Class rosters are provided to the instructor with the student's legal name as well as "Preferred first name" (if previously entered by you in the Student Profile section of your CIS account, which managed can be managed at any time). While CIS refers to this as merely a preference, I will honor you by referring to you with the name and pronoun that feels best for you in class or on assignments. Please advise me of any name or pronoun changes so I can help create a learning environment in which you, your name, and your pronoun are respected. If you need any assistance or support, please reach out to the LGBT Resource Center. https://lgbt.utah.edu/campus/faculty_resources.php (Links to an external site.)

Undocumented Student Support: 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 Scholarships: Complete one application and apply for multiple scholarships! Undergraduate scholarship applications for the 2021-2022 academic year open on November 1, 2020 and close on February 1, 2021. Students must provide a well-written essay, gather two

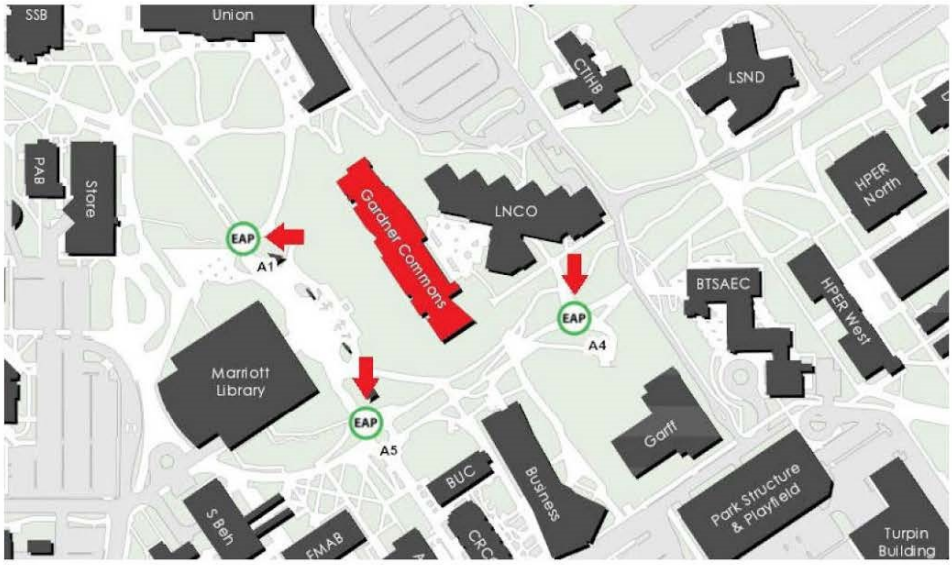
letters of recommendation, and be a declared major in the College of Social and Behavioral Science. We have scholarships for every type of student—nontraditional, minority, merit, experience-based, and all GPA's. Typical scholarships range from $1,000-$5,000. Visit https://csbs.utah.edu/students/scholarships/undergraduate.php for instructions. You can also email scholarships@csbs.utah.edu with questions, or to set up a scholarship appointment.



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 (Links to an external site.). 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 (Links to an external site.)), the Wellness Center (https://wellness.utah.edu (Links to an external site.)), and the Women's Resource Center (https://womenscenter.utah.edu (Links to an external site.)). 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 (Links to an external site.).

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.

College of Social and Behavioral Science
THE UNIVERSITY OF UTAH