UNIVERSITY OF WYOMING

GIST 5220: Spatial Modeling & Data Analysis (3 Credits)

Hybrid – In-person & Asynchronous Online

Spring 2026

January 20 – May 15

Tuesday and Thursday 9:35 AM – 10:50 AM -- ENGR 2109, UW Main Campus (or online)

Instructor: Dr. Jake Hawes

- Email: jhawes@uwyo.edu

Office Hours: Monday 1:30-2:30pm and Wednesday 10-11am via Zoom: https://uwyo.zoom.us/j/96346771908?from=addon

- *I am always available asynchronously via email. I am also available for synchronous chats via phone, audio, or video most days by prior arrangement via email. I will aim to reply to email and Teams within 8 working hours (i.e., 24 hours except weekends and holidays), though my response times to Teams especially are typically quicker than this.*

Course Description: Using raster modeling, hybrid vector/raster approaches, and geo-computational techniques, this course will explore a variety of modeling concepts and related issues. This course will examine a variety of both practical and theoretical issues, with special emphasis on understanding spatial questions that are not readily addressed by basic GIS. We will also consider issues related to error, resolution, scale, and a variety of other factors.

Course Format & Meetings: The in-person version of this course meets twice weekly in ENGR 2109 from 9:30 to 10:50 on Tuesdays and Thursdays. Asynchronous students are welcome to attend if they prefer in-person lectures to recorded ones.

This is a so-called "HyFlex" course, so there is a parallel asynchronous online version of this course in which many of you are enrolled. All work for this section of the course will be completed asynchronously online with no required meeting times. This course is scheduled to meet for the entire semester, and work will be due each week just as if you had in-person lectures. Anticipate 10-12 hours of engagement with learning materials each week.

Course prerequisites corequisites: none

There are no mandatory prerequisites for this course, but students are strongly encouraged to have a strong background in GIS, and many will have taken GIST 5050 Basics of Spatial Data Science prior to GIST 5220. If you are concerned about your level of experience in GIS, please reach out to Jake to discuss.

Related and Follow-up GIST Courses: GIST 5050 Basics of Spatial Data Science, GIST 5150 Applied Geospatial Analytics GIST 5200 Geographic Visualization

GIST Program Learning Outcomes: GIST courses address broad learning outcomes derived from and refined based on specific objectives outlined in the UCGIS GIS&T Body of KnowledgeLinks to an external site.. Achievement of these outcomes will prepare students to use scientific thinking and geospatial information science and technology across disciplines and in their careers. This course and other GIST courses address the following general goals: 1) applying the process of science, 2) using quantitative reasoning, 3) using modeling and simulation, 4) tapping into the interdisciplinary nature of science, 5) communicating and collaborating with other disciplines, and 6) understanding the relationships between science and society.

More specifically, experience shows that students trained in 1) positioning and data acquisition, 2) analysis and modeling, and 3) software and application development will be competitive nationally and internationally. Successful students learn to balance these objectives with knowledge of underlying theory and problem-solving capability in the context of specific disciplines.

Course Learning Outcomes: By the end of the course, successful students will be able to:

- Explain how complex spatial models can be used to help solve and understand environmental and social problems and management challenges.
- Plan, design, and implement a spatial analysis project demonstrating the ability to select, apply and critically interpret appropriate methods for the analysis of geographical information.
- Assess the validity, uncertainty, and sensitivity of model results, both in the research literature and in your own work.
- Outline the geographic concepts of distance, adjacency, interaction, and neighborhood and discuss how these are fundamental in performing spatial analysis.

Required materials: This course utilizes Open Access (OA) and Open Educational Resources (OER). No textbook or material purchases are required.

Optional Reading: Seeing with Fresh Eyes: Meaning, Space, Data, Truth (2020) by Edward R. Tufte, Graphics Press, LLC, ISBN 10: 0961392193 ISBN 13: 9780961392192

The *Visualization Toolkit: An Object-Oriented Approach to 3D Graphics, 4th Edition,* https://vtk.org/vtk-textbook/

Online Documentation: Voxon VX2 Developer SDK & Documentation (from Voxon Photonics) *Official materials on programming for the VX2, file support, and APIs.*

Assignments and Projects: This course utilizes four types of evaluation, which together comprise your final grade: in-class assignments, discussions, labs, and course project.

1. Labs (35% - 6 labs): Assignments will be developed based on the required reading and the lab exercises. Some assignments may require additional individual work (e.g., writing, data analysis, visualization development, etc.).

2. Discussions (25% - 6 Discussions): There will be 6 discussions with about three open questions. You are expected to participate in the online discussion on these questions. "Presence" is required for these discussions. You are expected to post substantive

contributions to the discussion each time. You are also expected to respond to at least one of the others' responses. Your discussion will be graded based on your participation and interaction with others. For the quality of your postings: your contributions should add value to the discussion and hold the potential to enhance everyone's learning experience greatly. You can also post questions of your own, which also accounts for participation in the discussion forum. I will also participate in each of the Spatial Forum from start to end. Multi-media responses (e.g., recorded screens or videos) are also encouraged and recommended.

3. Project (30%): Project Plan (5%), Presentation (5%), Report (15%), Peer Review (5%) - Students will respond to a real problem posed identified by a partner organization, the literature, or their own experience. The goal is to integrate material covered in the course as applied to a real problem that needs to be addressed.
4. In-Class Assignments (10%): Students will complete a variety of practice assignments. These will be formative assessments of either key concepts or key skills. These will become particularly relevant as the semester continues and we begin to experiment with new spatial analysis tools.

Grading Scale and Grading Policies: Final Grades will be assigned using the following breakdown:

A 90-100
B 80-89
C 70-79
D 60-69
F <60

There is no reason you can't all get an A in this class. I do not grade on a curve - I will grade based on the quality of the work only. If you attend lecture (or watch online), complete the discussions and in-class practice, and attend office hours occasionally, you should have all the resources you need to excel on the labs and course project.

You are expected to complete and submit all coursework by the stated deadlines in WyoCourses. Late work may be submitted only with instructor approval granted at least 24 hours prior to the deadline and in accordance with college policies. Five percent of the total points possible will be auto-deducted at daily intervals for late submisisons without permission.

Select assignments may be considered for re-evaluation provided the original assignment was submitted on time. If revisions are requested, please return the revised assignment for re-evaluation within 72 hours. Late assignments are exempt from this Resubmission policy.

Attendance and Absence policies. Students are responsible for all missed work. It is also the absentee's responsibility to get all missing notes of materials. Students should contact the instructor to request extensions.

Expectations for Feedback: You can generally expect responses to emails and turnaround of grades as noted below.

- **Emails & WyoCourses Messaging** - Anticipated turnaround time for responding to WyoCourses messages and messages sent using email or Teams is within 24 hours. This may vary during weekends, holidays, or work-related travel. I will communicate any special circumstances via WyoCourses Announcements.
- **Lab and Discussion Activities** - Anticipated turnaround for grading week-to-week assignments is within 1 week of the assignment deadline.
- **Course Project Activities** - Anticipated turnaround time for grading course project assignments is within 2 weeks of the deadline.

Classroom Behavior Policy: At all times, treat your presence in class meetings and your enrollment in this course as you would a job. Act professionally, arrive (join) on time, pay attention, complete your work in a timely and professional manner, and treat all deadlines seriously. You will be respectful towards your classmates and instructor(s). Spirited debate and disagreement are to be expected in any classroom and all views will be heard fully, but at all times we will behave civilly and with respect towards one another. Personal attacks, offensive language, name-calling, and dismissive gestures are not warranted in a learning atmosphere. As the Instructor of Record, I have the right to dismiss you from the meetings, study sessions, electronic forums, and other areas where disruptive behavior occurs. At all times, as per University Regulation 8-30 students should follow the University's Student Code of Conduct and refrain from actions that lead to the "disruption or obstruction of teaching, research, [and] administration" at the university. Link to Student Code: http://www.uwyo.edu/dos/conduct/index.htmlLinks to an external site..

Classroom Statement on Diversity: The University of Wyoming values an educational environment that supports students of all backgrounds and viewpoints. Diversity of viewpoints is considered a resource for learning. Topics may be difficult, not only intellectually but emotionally; however, discussions are essential to meeting the course's student learning outcomes and assisting students in developing problem-solving and critical-thinking skills. During all conversations, respect and civility are of utmost importance.

Disability Support: The University of Wyoming is committed to providing equitable access to learning opportunities for all students. If you have a disability, including but not limited to physical, learning, sensory or psychological disabilities, and would like to request accommodation in this course due to your disability, please register with and provide documentation of your disability as soon as possible to Disability Support Services (DSS), Room 128 Knight Hall. You may also contact DSS at (307) 766-3073 or udss@uwyo.edu. It is in the student's best interest to request accommodation within the first week of classes, understanding that accommodations are not retroactive. Visit the DSS website for more information at: www.uwyo.edu/udssLinks to an external site.

Academic Dishonesty Policies: "Academic dishonesty will not be tolerated in this class. Cases of academic dishonesty will be treated in accordance with UW Regulation 2-114. The penalties for academic dishonesty can include, at my discretion, an "F" on an exam, an "F" on the class component exercise, and/or an "F" in the entire course. Academic dishonesty means anything that represents someone else's ideas as your own without attribution. It is intellectual theft – stealing - and includes (but is not limited to) unapproved assistance on examinations, plagiarism (use of any amount of another person's writings, blog posts, publications, and other materials without

attributing that material to that person with citations), or fabrication of referenced information. Facilitation of another person's academic dishonesty is also considered academic dishonesty and will be treated identically." Academic dishonesty also includes use of artificial intelligence in violation of the Use of AI Technology policy for this course.

AI Technology: Standards regarding AI technology use are evolving quickly in academic and professional settings. The current guidance for this course appears below.

In summary: Use Only with Prior Permission

- You are permitted to use advanced automated artificial intelligence or machine learning tools on assignments in this course if the assignment prompt stipulates that AI use is permitted and/or encouraged, or if instructor permission is obtained in advance (for example, in the case of multilingual learners who want to explore AI for translation).
- In cases where use of advanced automated artificial intelligence or machine learning tools on assignments is permitted, that use must be properly documented and credited. For example, text generated using ChatGPT-3 should include a citation such as: "Chat-GPT-3. (YYYY, Month DD of query). "Text of your query." Generated using OpenAI. https://chat.openai.com/" Material generated using other tools should follow a similar citation convention.
- Unless given explicit permission to use those tools, you are expected to complete each assignment without substantive assistance from others, including automated tools.

Duty to Report: UW faculty are committed to supporting students and upholding the University's non-discrimination policy. Under Title IX, discrimination based upon sex and gender is prohibited. If you experience an incident of sex- or gender-based discrimination, we encourage you to report it. While you may talk to a faculty member, understand that as a "Responsible Employee" of the University, the faculty member MUST report information you share about the incident to the university's Title IX Coordinator (you may choose whether you or anyone involved is identified by name). If you would like to speak with someone who may be able to afford you privacy or confidentiality, there are people who can meet with you. Faculty can help direct you or you may find info about UW policy and resources at http://www.uwyo.edu/reportitLinks to an external site. You do not have to go through the experience alone. Assistance and resources are available, and you are not required to make a formal complaint or participate in an investigation to access them.

Substantive changes to syllabus: All deadlines, requirements, and course structure are subject to change if deemed necessary by the instructor. Students will be notified verbally in class, on our WyoCourses page announcement, and via email of these changes.

Campus Resources:

Disability support service: udss@uwyo.edu, (307)766-3073, 128 Knight Hall, www.uwyo.edu/udssLinks to an external site.

- Counseling Center: uccstaff@uwyo.edu, (307)766-2187, (307) 766-8989 (After hours), 341 Knight Hall, uwyo.edu/uccLinks to an external site.
- Academic affairs: (307) 766-4286, 312 Old Main, uwyo.edu/acadaffairsLinks to an external site.

- Dean of students office: dos@uwyo.edu, (307)766-3296, 128 Knight Hall, uwyo.edu/dosLinks to an external site.
- UW Police Department: uwpd@uwyo.edu, (307)766-5179, 1426 E Flint St, uwyo.edu/uwpdLinks to an external site.
- Student code of conduct website: https://www.uwyo.edu/step/index.htmlLinks to an external site.

Course Outline:

***Note – each topic below corresponds approximately to one module (lecture), which may be accompanied by in-class assignments in later classes or may be stand-alone.*

SECTION 1 - TOPICS	**ASSIGNMENTS**
Background and Concepts	Introductions
• Introduction to the Course & Spatial Modeling	Intro Discussion
• Conceptual Frameworks for Spatial Analysis	Lab 1 Part 1
• Spatial Analysis Methodology	Lab 1 Part 2
• Spatial Model Evaluation and Validation	Discussion 1

SECITON 2 - TOPICS	**ASSIGNMENTS**
Spatial Data Analysis	
• Spatial Point Pattern Analysis	Discussion 2
• Interpolation	Lab 2
• Spatial Regression	Discussion 3
• 3D Visualization	Lab 3
• Raster Analysis	In-class

SECTION 3- TOPICS	**ASSIGNMENTS**
Spatial Modelling and Data Analysis	
• Secondary Data – Resources and Uses	In-class
• Spatial Classification	In-class

• Space-time Analysis	
• Spatial Analysis in GEE	In-class (x2)
• Spatial Analysis in Python	In-class (x2)
• Spatial Analysis in R	In-class
• Machine Learning with Spatial Analysis	
SECTION 4 – PROJECT-RELATED TOPICS	**ASSIGNMENTS**
Proposal Writing	
Pseudocode	Misc
Project Work	

Note: Section 4 will overlap with other Sections. The schedule will be determined by students' collective progress, but the goal is to have this done ahead of the various projects in your other classes so you have one less thing to do around finals.