

# GIS4120/5120

## Geospatial Analytics

Fall 2024

### Course Information

**Course Number:** GIS4120/5120

**Meeting Times:** Tuesday and Thursdays 8:00 AM to 9:15 AM

**Location:** Room 103, Des Peres Hall, 3694 W Pine Mall, St. Louis, MO 63108

**Pre-requisites:**

Introduction to GIS (GIS4050/5050), Introduction to Remote Sensing (GIS4040/5040), Programming for GIS and Remote Sensing (GIS4090/5090)

### Course Description

This course introduces students to the fundamental concepts and frameworks of spatial analysis, emphasizing the role of geospatial technology in addressing grand societal challenges. Students will explore a range of topics, including spatial analysis processes, data exploration, surface and field analysis, and the application of Python and big data in geospatial contexts. At the end of the course, students will be able to tackle a geospatial analytics project including data collection, data processing, analysis and making inference like a geospatial scientist.

### Instructor Information

**Instructor:** Sourav Bhadra, *Ph.D.*

**Email:** [sourav.bhadra@slu.edu](mailto:sourav.bhadra@slu.edu)

**Teaching Assistant:** Md. Ahasan Habib ([mdahasan.habib@slu.edu](mailto:mdahasan.habib@slu.edu))

**Office Hours:** By Appointment

### Learning Outcomes

- Explain and apply fundamental concepts of spatial analysis.
- Explore and analyze spatial data using statistical methods.
- Conduct surface and field analyses, including geometry and interpolation.
- Use Python and geospatial tools for complex analyses.
- Analyze and interpret multidimensional climate data.
- Design, execute, and present a geospatial analysis project.

### Required Materials

#### Textbook

De Smith, M.J., Goodchild, M.F. and Longley, P. (2007) Geospatial Analysis: A Comprehensive Guide to Principles, Techniques and Software Tools (6<sup>th</sup> Edition). Troubador Publishing Ltd., Leicester.

## Software

ArcGIS Pro, Anaconda3

## Evaluation and Grading

### Grading Weight

- Attendance (5%)
- Lab Assignments (45%)
- Midterm Exam (25%)
- Final Project (25%)

### Grade Distribution

| Quality of Performance                     | Letter Grade | Range (%) | GPA  |
|--|--------------|-----------|------|
| Excellent - work is of exceptional quality | A            | 93 – 100  | 4.00 |
| Excellent                                  | A-           | 90 – 92.9 | 3.70 |
| Good - work is above average               | B+           | 87 – 89.9 | 3.30 |
| Satisfactory                               | B            | 83 – 86.9 | 3.00 |
| Below Average                              | B-           | 80 – 82.9 | 2.70 |
| Poor                                       | C+           | 77 – 79.9 | 2.30 |
| Poor                                       | C            | 70 – 76.9 | 2.00 |
| Failure                                    | F            | < 70 >    | 0.00 |

## Expectations from Students

- Attend every class session, as each lecture builds on the previous one. If you anticipate missing a class, please inform me in advance.
- Arrive on time to ensure you don't miss any crucial information.
- You are responsible for catching up on any material or announcements, including changes in assignments, meeting times, or due dates, if you miss a class.
- Participation isn't just about speaking; active listening and thoughtful contributions that advance the discussion are equally important.
- Submit all assignments at the beginning of class on the due date. Late submissions will impact your grade.
- To maintain a focused learning environment, refrain from non-academic activities on electronic devices during class.
- If you anticipate any disruptions, such as an emergency phone call or appointment, please notify me ahead of time.

## Lab Assignments

There will be a total of 8 labs (tentatively) in this course. Students are expected to follow the instructions provided in the lab manual and answer all the questions thoroughly. The lab assignments make up 45% of your overall grade, so please ensure you submit them on time to maintain a strong academic standing.

## Mid-term Exam

The mid-term exam is scheduled for October 17 during our regular class time. The exam will primarily consist of open-ended questions based on our lectures. It's designed not to test your memorization of concepts, but to assess your reasoning skills and your ability to apply geospatial concepts to real-world scenarios. We will go over the exam details together in our upcoming meetings.

## Class Projects

The class project is a significant component of your learning experience, contributing 25% to your final grade. This project is an opportunity for you to apply the geospatial analytics concepts and techniques we've explored throughout the course to a real-world problem. You are expected to work individually to develop an original project that showcases your analytical skills, creativity, and understanding of geospatial data.

*For undergraduate students who registered for GIS4120: for the class project, you can choose any lab assignment, use a different dataset to complete the tasks as mentioned in the lab and present. You are NOT required to submit a report. I will make sure you have the right sets of goals specified for the class project.*

## Schedule

| Week | Date   | Topics  | Due                              |
|------|--------|---|----------------------------------|
| 1    | Aug 22 | Introduction and overview of the course                   |                                  |
| 2    | Aug 27 | Lec 1: Conceptual frameworks of spatial analysis          |                                  |
|      | Aug 29 | Lec 1: Conceptual frameworks of spatial analysis (contd.) |                                  |
| 3    | Sep 3  | Lec 2: Spatial analysis as a process                      | Make a map                       |
|      | Sep 5  | Lab 1: Suitability analysis                               |                                  |
| 4    | Sep 10 | Lec 3: Data exploration and spatial statistics (contd.)   | Lab 1: Suitability analysis      |
|      | Sep 12 | Lab 2: Exploratory data analysis                          |                                  |
| 5    | Sep 17 | Lec 3: Data exploration and spatial statistics (contd.)   |                                  |
|      | Sep 19 | Lab 2: Exploratory data analysis (contd.)                 |                                  |
| 6    | Sep 24 | Lec 4: Surface and field analysis                         | Lab 2: Exploratory data analysis |
|      | Sep 26 | Lab 3: Surface geometry                                   |                                  |
| 7    | Oct 1  | Lec 4: Surface and field analysis (contd.)                |                                  |
|      | Oct 3  | Lab 4: Drainage delineation                               | Lab 3: Surface geometry          |
| 8    | Oct 8  | Lec 4: Surface and field analysis (contd.)                |                                  |

|    |        |  |   |
|----|--------|--|---|
|    | Oct 10 | Lab 5: Spatial interpolation                           | Lab 4: Drainage delineation                   |
| 9  | Oct 15 | Midterm Q&A  |   |
|    | Oct 17 | Midterm Exam   | Class project abstract                        |
| 10 | Oct 22 | Lab 6: Geospatial analysis using python                | Lab 5: Spatial interpolation                  |
|    | Oct 24 | No Class (Fall Break)                                  |   |
| 11 | Oct 29 | Lec 5: Climate data analysis (Guest Lecture)           | Lab 6: Geospatial analysis using python       |
|    | Oct 31 | Lab 7: Multidimensional climate data analysis          |   |
| 12 | Nov 5  | Lec 6: Big data in Geospatial Analytics                |   |
|    | Nov 7  | Lab 7: Multidimensional climate data analysis (contd.) |   |
| 13 | Nov 12 | Lab 8: Google earth engine                             | Lab 7: Multidimensional climate data analysis |
|    | Nov 14 | Lab 8: Google earth engine (contd.)                    |   |
| 14 | Nov 19 | Project Q&A  |   |
|    | Nov 21 | Lab 8: Google earth engine (contd.)                    |   |
| 15 | Nov 26 | Lec 7: Geocomputational methods                        | Lab 8: Google earth engine                    |
|    | Nov 28 | No Class (Happy Thanksgiving!)                         |   |
| 16 | Dec 3  | Project presentation                                   | Submit presentation by 8 AM                   |
|    | Dec 5  | Project presentation                                   |   |
| 17 | Dec 10 | Short report   |   |
|    | Dec 12 | Short report   | Submit short report                           |

## Academic Integrity

Academic integrity is the commitment to and demonstration of honest and moral behavior in an academic setting. Since the mission of the University is "the pursuit of truth for the greater glory of God and for the service of humanity," acts of integrity are essential to its very reason for existence. Thus, the University regards academic integrity as a matter of serious importance. Academic integrity is the foundation of the academic assessment process, which in turn sustains the ability of the University to certify to the outside world the skills and attainments of its graduates. Adhering to the standards of academic integrity allows all members of the University to contribute to a just and equitable learning environment that cultivates moral character and self-respect. The full University-level Academic Integrity Policy can be found on the Provost's Office website at: <https://www.slu.edu/provost/policies/academic-and-course/academic-integrity-policy.pdf>.

## Disability Accommodations

Students with a documented disability who wish to request academic accommodations must formally register their disability with the University. Once successfully registered, students also must notify their course instructor that they wish to use their approved accommodations in the course.

Please contact the Center for Accessibility and Disability Resources (CADR) to schedule an appointment to discuss accommodation requests and eligibility requirements. Most students on the St. Louis campus will contact CADR, located in the Student Success Center and available by email at [accessibility\\_disability@slu.edu](mailto:accessibility_disability@slu.edu) or by phone at 314.977.3484. Once approved, information about a student's eligibility for academic accommodations will be shared with course instructors by email from CADR and within the instructor's official course roster. Students who do not have a documented disability but who think they may have one also are encouraged to contact CADR. Confidentiality will be observed in all inquiries.

*Note: due to accreditation requirements, regulatory differences, and/or location-specific resources, the School of Law, the School of Medicine, and SLU Madrid have their own standard language for syllabus statements related to disability accommodations. Faculty in those units should seek guidance for syllabus requirements from their dean's office.*

## Title IX

Saint Louis University and its faculty are committed to supporting our students and seeking an environment that is free of bias, discrimination, and harassment. If you have encountered any form of discrimination on the basis of sex, including sexual harassment, sexual assault, stalking, domestic or dating violence, we encourage you to report this to the University. Discrimination on the basis of sex includes discrimination on the basis of assigned sex at birth, sex characteristics, pregnancy and pregnancy related conditions, sexual orientation and gender identity. If you speak with a faculty member about an incident that involves a Title IX matter, that faculty member must notify SLU's Title IX Coordinator that you shared an experience relating to Title IX. This is true even if you ask the faculty member not to disclose the incident. The Title IX Coordinator will then be available to assist you in understanding all of your options and in connecting you with all possible resources on and off campus.

If you are pregnant or experiencing a pregnancy related condition, the Title IX Coordinator can assist you in understanding your rights and options as well as provide supportive measures.

Anna Kratky is the Title IX Coordinator at Saint Louis University (DuBourg Hall, room 36; [anna.kratky@slu.edu](mailto:anna.kratky@slu.edu); 314-977-3886). If you wish to speak with a confidential source, you may contact the counselors at the University Counseling Center at 314-977-TALK or make an anonymous report through SLU's Integrity Hotline by calling 1-877-525-5669 or online at <http://www.lighthouse-services.com/slu>. To view SLU's policies, and for resources,

please visit the following web addresses: <https://www.slu.edu/about/safety/sexual-assault-resources/index.php>.

*Note: due to accreditation requirements, regulatory differences, and/or location-specific resources, the School of Law, the School of Medicine, and SLU Madrid have their own standard language for syllabus statements related to Title IX. Faculty in those units should seek guidance for syllabus requirements from their dean's office.*

## Use of Generative AI

You are allowed to use generative AI in a **limited capacity** in this course. Tools such as [ChatGPT, Microsoft Copilot, Gemini, Midjourney, DALL-E or GitHub Copilot] can be used for specific assignments as directed in the assignment. You **CANNOT** use Generative AI to directly generate open-ended question answers in the assignments but you can use it to understand Python codes (if available). Please note the assignments for which generative AI is allowed come after you have been introduced to foundational skills and concepts geospatial analytics. Tools that perform readability analysis, detect tone and provide editing suggestions as well as those that paraphrase, summarize and outline are allowed for general use on any assignment.

Using a generative AI tool may assist your learning by simplifying texts, helping you brainstorm, providing choices of theses when writing, assisting you with forming arguments, providing grammar checks or feedback for structure, debugging code or creating works of art]. However, becoming dependent on generative AI could undermine your learning by eroding your ability to ideate independently, participate fully and intentionally in the writing process, or critically problem solve by debugging your code. The use of generative AI can strip a writer of her/his voice diminishing a creative work. Generative AI still produces inaccurate information and hallucinations are still common which if left unchecked can harm your grade on the assignment. Any work generated with AI should be fact checked to ensure accuracy. You are responsible for the content of your work.

## Course Website

Most of the course related information will be available at:  
<https://souravbhadra.github.io/GIS5120>

## Teams Channel for Communication

Join the course's Teams channel here:

<https://teams.microsoft.com/l/team/19%3APEqzaWkqB1w0uGwgcW1pEgWZqXuazXhdMWkBH7H0OzY1%40thread.tacv2/conversations?groupId=28a4b78b-6926-4ce3-bd21-00f4d220cb5e&tenantId=6711039e-c265-432c-b680-a3af66790e06>

If you have questions or need help with lab assignments or lectures, I encourage you to post your inquiries in Teams. This way, everyone can benefit from the discussion and learn together.

## **GitHub**

The lab materials will be shared through the course's <https://github.com/souravbhadra/GIS5120> repository.