GPHY 482/489 Spatial Analysis
Course Syllabus – Spring 2022

Instructor

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Course description

This course introduces students to the need for spatially informed analyses of data generated across space, and explore where non-spatially informed analyses may fail. We will explore basic spatial analytic methods used across scientific disciplines; across social, physical, and biological sciences.

The course is designed such that students will develop an understanding of quantitative analysis of spatial data, including techniques for pattern analysis, classification, and interpolation within a GIS environment. The freely available, and increasingly used R statistical software package will be the primary environment in which we learn to apply these analyses.

Learning Outcomes

Successfully completing this course will enable the student to:
- Understand how to identify the need to utilize spatially informed analytic techniques;
- Understand the basic descriptive and inferential spatial analyses used in Geography;
- Apply and interpret appropriate spatial analytic techniques for specific research questions in Geography;
- Expand workforce relevant skills in R, pertaining to the analysis of spatial data.

Required textbooks:

Brunsdon, C., and Comber, L. 2018. An Introduction to R for Spatial Analysis and Mapping. **2nd Ed.** Sage. Brunsdon, C., and Comber, L. 2015. *An Introduction to R for Spatial Analysis and Mapping.* Sage. (ISBN 13: 978-1-4462-7295-4)

Burt, J.E., Barber, G.M., and Rigby, D.L. 2009. *Elementary Statistics for Geographers.* The Guilford Press, New York, NY.

Course Calendar

Date	Week	*Topic*
18-Jan	1	Course Introduction: Student Introductions - Student perspectives on spatial data and spatial analysis
20-Jan		**Burt Ch 1/ Fotheringham Ch 1**
25-Jan	2	Displaying, Describing, and Interpreting Data with Statistics: What is Spatial Data and why do other methods fail? Introduction to Spatial Autocorrelation
27-Jan		**Burt Ch 2,3,14 (Join Count Only)**
1-Feb	3	Spatial Autocorrelation and Exploratory Spatial Data Analysis
3-Feb		**Burt Ch 14 (Detailed Review of Final Project Expectations and Timeline)**
8-Feb	4	Statistical Relationships: Regression Analyses I
10-Feb		**Burt Ch 4**
15-Feb	5	Regression Analyses II; Working with R
17-Feb		**Burt Ch 12, 13; Brunsden Ch 1,2**
22-Feb	6	Working with GIS Functions and Spatial Data in R
24-Feb		**Brunsden Ch 3,4**
8-Mar	7	Conducting Regression Analyses with R
10-Mar		**Brunsden Ch 7**
15-Mar	8	Conducting Regression Analyses with R II
17-Mar		**Brunsden Ch 7 (Dataset identification and problem statement due)**
22-Mar	9	**Spring Break - No Classes**
24-Mar		
29-Mar	10	Point Pattern Analyses I
31-Mar		**Burt Ch 14; Brunsden Ch 6 (Introduction and brief literature review due)**
5-Apr	11	Point Pattern Analyses II
7-Apr		**Exploratory Spatial Data Analysis (ESDA) results due**
12-Apr	12	Localized Analysis I
14-Apr		**Burt Ch 14; Brunsden Ch 8 (Proposed Methods of Analysis due)**
19-Apr	13	Localized Analysis II
21-Apr		
26-Apr	14	Additional topics/practice to bring everything together I
28-Apr		**Results due**
3-May	15	Additional topics/practice to bring everything together II
5-May		**Final Class**
10-May	16	
12-May		**Final Submission Due: Friday May 13th by 5pm**

Typical Course Flow

Tuesday 1st half -hour (8:30-9) – Final questions or clarifications for homework due @ 5pm.

Tuesday Main Class (9-10:50) – Delivery of Lecture; Interactive learning of respective R segments (Mainly through the Brunsden Book); Overview of homework to be assigned.

Thursday – Utilize this time to work on current assignments. It is expected that all homework/labs can be completed during the class period. I will be available in either Stone 217 or 218 throughout this period. You may work in either room, or 219. Additionally, if you are a graduate student with an office nearby, you may use that and come to the classroom/lab with questions as needed. Some Thursdays may also be used for guest lectures. These will be announced in advance.

Required Assignments and Final Project:

Homework/Labs -15 (20 points each = 300 total points)

All assignments will be primarily derived from lecture material, readings, and the Burt and Brunsden textbooks. Note that some questions will be found in the lecture, and not otherwise answerable. The assignments consist of both discussion and problem-solving questions. Homework will typically be assigned on the Tuesday corresponding with the lecture, and due **ON TUESDAY AT 5PM** one week after it was assigned. **Homework will not be accepted late without pre-arrangement.** All homework must be submitted in word, excel, or pdf via **Moodle** (other file types may be assigned and noted in assignment). You may work together on assignments, but everyone is required to turn in their own original assignment. DO NOT just copy and "save as" someone else's assignment. If two or more assignments are copies of one another, both will receive zero credit.

I understand this will continue to be a challenging semester with COVID still influencing much of our lives. If you have issues or concerns around your ability to complete an assignment on time as a result of illness or other interference, come talk to me (or email/phone call) prior to the due date (this does not typically mean the night before or morning of the due assignment) and we can discuss a course of action.

Final Project (500 points)

All students will complete a final project/research paper, using one or more techniques learned in class. This project will consist of identifying a dataset and relevant question to be evaluated. The project will be completed in stages throughout the course. The stages include:

1. Dataset identification/description and problem statement (50 points);
2. Introduction and brief literature review (100 points);
3. Exploratory Spatial Data Analysis (ESDA) results (100 points);
4. Proposed Methods of Analysis (50 points);

5. Results (100 points);
6. Final Submission (100 points).

Grading Policy

Course grades will be based on the following components:

Homework/Labs   300 points
Final Project: 500 points
Total Points Available   **800 points**

Grade	Points Needed	Grade	Points Needed	Grade	Points Needed
A	752	**B-**	624	**D**	480
A-	720	**C+**	592	**F**	<480
B+	688	**C**	560		
B	656	**C-**	528		

Course guidelines and policies:

Student Conduct Code

The Student Conduct Code at the University of Montana embodies and promotes honesty, integrity, accountability, rights, and responsibilities associated with constructive citizenship in our academic community. This Code describes expected standards of behavior for all students, including academic conduct and general conduct, and it outlines students' rights, responsibilities, and the campus processes for adjudicating alleged violations.

All students must practice academic honesty. Academic misconduct is subject to an academic penalty by the course instructor and/or a disciplinary sanction by the University. All students are expected to understand their rights and responsibilities provided under t*he Student Conduct Code*

Attendance

In general, students are expected to attend classes in person (masks are to be worn at all times: University of Montana Mask Policy). Given the continued concern over COVID, I will attempt to display all lecture periods via zoom. Actual lecture material and recording will be shared to Moodle as feasible. Please keep in mind that audio from speakers in the classroom are not always clear. There will be several occasions in which I will prerecord a lecture. These will be posted to the Moodle site prior to the scheduled class period and notice will be given. On these days you can watch the lecture at your convenience.

Course withdrawal and other important dates

Use this link for a list of official [Dates and Deadlines for 2022 Spring Semester](#). Responsibility is upon the students to know the dates for withdrawal and other relevant registration issues.

Disability modifications

The University of Montana assures equal access to instruction through collaboration between students with disabilities, instructors, and [Disability Services for Students](#). If you think you may have a disability adversely affecting your academic performance, and you have not already registered with Disability Services, please contact Disability Services in Lommasson Center 154 or call 406.243.2243. I will work with you and Disability Services to provide an appropriate modification.