STAT 534: Spatial Data Analysis

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Spring 2025

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Office Hours: T/R 8:30 - 9:15, T 12:30 -2
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Class Hours: Tuesday-Thursday 10:50-12:05
Class Room: *Wilson Hall 1-144*

Course Description Statistical methods of spatial data analysis, stationary and nonstationary random fields, covariance structures, geostatistical models and analysis, spatial point process models and analysis, spatial lattice models and analysis. An emphasis will be placed on:

1. Creating maps and other data visualization products with spatial data,
2. Identifying differences between the three common spatial data types: point process, geostatistical, and areal data,
3. Using statistical software and either Bayesian or classical statistical techniques to analyze spatial point process, geostatistical, and areal data structures, and

Learning Outcomes:

At the end of the course students will understand

1. point process theory and applications including homogeneous and non-homogeneous Poisson point processes
2. geostatistics including semivariogram estimation and kriging
3. spatial autoregression including covariance estimation, spatial logistic and Poisson models, simultaneous autoregressive models, conditional autoregressive models.

Prerequisites

- Required: STAT 412, STAT 512, and STAT 422
- Preferred: STAT 506, extensive experience with R, and an understanding or interest in Bayesian statistics

Textbooks

- Hierarchical Modeling and Analysis for Spatial Data, Second Edition, by Bannerjee, Carlin, and Gelfand. While the second edition is preferred, the first edition will suffice.

- Animal Movement: Statistical Models for Telemetry Data, by Hooten, Johnson, McClintock, and Morales. *Optional*

Additional Resources

Analysis and data visualization will be implemented with R

Course Policies

Grading Policy

- **25%** of your grade will be determined by homework assignments. Collaboration is encouraged on homework assignments, but everyone should complete their own assignments.
- **75%** of your grade will be determined by a series of three exams with associated take home components. Each exam will correspond to one of the three spatial data types that we will cover in this class.

Collaboration University policy states that, unless otherwise specified, students may not collaborate on graded material. Any exceptions to this policy will be stated explicitly for individual assignments. If you have any questions about the limits of collaboration, you are expected to ask for clarification.

In this class students are encouraged to collaborate on homework assignments, but exams and projects should be completed without collaboration.

Academic Misconduct Section 420 of the Student Conduct Code describes academic misconduct as including but not limited to plagiarism, cheating, multiple submissions, or facilitating others' misconduct. Possible sanctions for academic misconduct range from an oral reprimand to expulsion from the university.

Disabilities Policy Federal law mandates the provision of services at the university-level to qualified students with disabilities. If you have a documented disability for which you are or may be requesting an accommodation(s), you are encouraged to contact the Office of Disability Services as soon as possible.

Approximate Course Outline

1. Course Intro & Preliminaries:

- R
- Plotting spatial data
- Linear Models and Bayesian Inference

2. Point Process Data
3. Point Referenced Data
4. Areal Data