

GEOG 8102 – Advanced Spatial Data Analysis

Wednesday 2:15-5:00pm, 1116 Derby Hall

Instructor

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Office Hours: Mondays 3-4PM, or by appointment

Course Description

OSU Catalog Description: Application of quantitative methods to geographic problems; spatial statistics, area sampling, maps of residuals, regionalization methods, and simulation maps.

My Description: Geography is a diverse discipline with a wide variety of subject matter including physical (environmental), human (socio-economic), and integrated (human-physical) topics of inquiry. Even within physical geography, biogeographers study different phenomena than hydrologists and climatologists. Therefore, it is not surprising to learn that there are a variety of advanced analytical methods that geographers can employ in their studies. This course serves as an introduction to some of the most commonly employed of these advanced analytical approaches. Because geography is so diverse, there are undoubtedly methods we will learn over the course of the semester that you will not need to use in your graduate research. There will also be subject matter we cover that is not specific to your area of study. But the point of the class is to make you good geographers, not just prepare you to conduct your thesis/dissertation work.

The course focuses multivariate methods widely used by geographers and other scientists, including multiple correlation and (spatial) regression, cluster detection, geostatistics and kriging, and other terminology that can make you sound like you know what you're talking about (and hopefully you will when you're done here). By the end of the course, I want you to know how to select the appropriate statistical method to answer a research question, be comfortable using multiple software packages to analyze data and correctly interpret and write-up the results of your statistical analysis.

I don't believe in memorizing formulas or asking students to regurgitate those formulas. Therefore, this course emphasizes hands-on experience and practical understanding. You should leave this course with confidence in the methods we have discussed and an appreciation for how these statistical methods are applied to issues in geographic research. I will not emphasize the "black-box" (mathematical equations) of each statistical approach as much as some other statistics courses do, rather I will emphasize conceptual understanding, how to implement statistical tests in R and interpret the output.

Course Objectives:

1. To develop "statistical literacy," a working understanding of statistics that can help in critically evaluating data-driven results in the discipline of geography (or ecology, etc...).
2. To obtain a rich set of statistical tools for data analysis, with an understanding of the how to choose which tool to use and how to implement them in statistical software.
3. To enable you to confidently and carefully interpret the results of data analyses and clearly communicate those results.

4. To receive practical experience in using real sets of data addressing meaningful research questions.

Course Website

The course schedule, announcements, lecture notes, assignments, readings, datasets, and other course information will be posted on Carmen (<https://carmen.osu.edu>).

Prerequisites

GEOG 5100, or consent of instructor. Students should be familiar with basic probability theory, multiple linear regression, and basic linear algebra.

Required Textbook

There is no required text for this class. I will provide selections from a variety of text books throughout the semester through e-reserves or the class Carmen website. The books these readings will come from include:

- Trevor C. Bailey and Anthony C. Gatrell. (1995). *Interactive Spatial Data Analysis*, Prentice Hall.
- Fortin, M-J. and M. Dale (2005). *Spatial Analysis: A Guide for Ecologists*. Cambridge: University Press.
- Agresti, A. and B. Finlay. (2008). *Statistical Methods for the Social Sciences*, 4th ed. New Jersey: Prentice Hall.
- Helsel, D.R. and R.M. Hirsch. (2002). *Statistical Methods in Water Resources*. USGS. Available online at: <https://pubs.usgs.gov/twri/twri4a3/pdf/twri4a3-new.pdf>.
- Ward, M.D. and K.S. Gleditsch (2008). *Spatial Regression Models*. Thousand Oaks, CA: Sage.

Reference Books

Not specifically required, but could be very helpful as we work through the course:

- Roger S. Bivand, Edzer J. Pebesma, and V. Gómez-Rubio (2013). *Applied Spatial Data Analysis with R*, 2nd edition. Springer, New York.
- Dalgaard, P. (2008). *Introductory Statistics with R*. 2nd edition. New York: Springer.

Course Evaluation

Labs	4 x 10%
Commentaries	3 x 5%
Midterms (take home)	2 x 10%
Final Project	25%

Late assignments (labs, commentaries) up to 1 week late will be downgraded 20%, 100% thereafter. Students must complete all lab assignments to receive a passing grade, even if they are submitted too late to receive any points. Exams must be entirely your own work.

Labs: I will not be handing you a “script” for how to do a statistical analysis during the labs. I will provide you with a dataset and some programming advice and ask you to figure out how to use the software packages we learn to run models and answer a set of broad questions. Lab write-ups are expected to look very similar to a journal article's Results and Discussion section. I will pass out a grading rubric before the first lab so you understand how labs will be graded. There are several R textbooks which provide plenty of examples for how to program the specific analytical approaches we'll be using. You may work on your lab in groups (no more than 3 people). If you do so please only write up one lab so I don't have to read the same assignment more than once.

Commentaries: You will be required to write three short commentaries (2-3 paragraphs) on the assigned, non-textbook readings. Commentaries should be more than a simple summary of the main points of the reading. You might analyze the strengths and weaknesses of an empirical study; discuss the main contributions of a proposed method; and/or discuss an idea or question that emerges from the readings that you wish to explore. You may choose to write a commentary on one of the assigned readings or a journal article of your choice.

Final Project: Another major part of this course is your project poster/presentation. Hopefully, you'll get going on your project early and come talk with me about what you plan to do. That way you can spend the semester working on the analysis you propose. For the end of the semester, you will prepare a poster of your project that is of conference quality (AAG, AGU, APSA, etc). I will provide more details on the poster later in the course. The project presentation will be a brief 5-10 minute talk explaining your poster, similar to what you would do at a poster session at a conference. You will be graded primarily on how well you explain your methodology and results, and not on your speaking skills. Allow for a few minutes of questioning after your presentation.

Academic Misconduct

Please help maintain an academic environment of mutual respect and fair treatment. It is the responsibility of the Committee on Academic Misconduct to investigate or establish procedures for the investigation of all reported cases of student academic misconduct. The term "academic misconduct" includes all forms of student academic misconduct wherever committed; illustrated by, but not limited to, cases of plagiarism and dishonest practices in connection with examinations. Instructors shall report all instances of alleged academic misconduct to the committee (Faculty Rule 3335-5-487). For additional information, see the Code of Student Conduct <http://studentlife.osu.edu/csc/>.

Disability Services

The University strives to make all learning experiences as accessible as possible. If you anticipate or experience academic barriers based on your disability (including mental health, chronic or temporary medical conditions), please let me know immediately so that we can privately discuss options. To establish reasonable accommodations, I may request that you register with Student Life Disability Services. After registration, make arrangements with me as soon as possible to discuss your accommodations so that they may be implemented in a timely fashion. **SLDS contact information:** slds@osu.edu; 614-292-3307; slds.osu.edu; 098 Baker Hall, 113 W. 12th Avenue.