Course Description and Goals

This course considers statistical techniques to evaluate social processes occurring in geographic space. The course introduces students to methods for spatial data analysis and to the applications of these methods. Coverage will include the study of point referenced observations (e.g., observations referenced in latitude and longitude), areal data models (e.g., border-referenced data), and point process models (where the location of events in latitude and longitude is the outcome itself). We also will consider models that allow for a spatial lag as a predictor. We will learn not only how to construct these models but also how to use them in applied analysis.

Heavy emphasis will be given to fundamental concepts and applied work. Prerequisites for the course include a solid understanding of the fundamentals of statistical inference, regression analysis, matrix algebra, and the general linear model.

By the end of the course, you should be able to:

• Manage point-referenced and areal data using software such as WinBUGS and R.
• Estimate models for point and block-referenced data in a variety of frameworks.
• Analytically show how frequentist, hierarchical, and Bayesian models of spatial data are specified and estimated.
• Estimate a point pattern model.

Reading

There are two required books:


Students with Disabilities

Students with disabilities that have been certified by the UGA Disabilities Services office will be accommodated according to university policy. For more information, contact Disabilities Services at 542-8719. If you cannot reach class on the third floor of Baldwin Hall—or my office on the fourth floor—by stairs, please notify me as soon as possible so I can work to make new arrangements.

Academic Integrity

Academic integrity is a core value of institutions of higher learning. All students, upon enrolling, must pledge: “I will be academically honest in all of my academic work and will not tolerate academic dishonesty of others.” It is your responsibility to avoid plagiarism, cheating, and dishonesty. The university policy on academic integrity is posted at: [http://www.uga.edu/honesty/](http://www.uga.edu/honesty/). To qualify the application of the policy in this course: papers should be your own work (though you may ask others for suggestions), and homework assignments can (and should) be done with others provided every keystroke of the final copy is your own.

Course Requirements and Evaluation

Nearly every class will require you to read as well as solve problems, conduct analysis with software, or write ahead of time to prepare. I will distribute these homework assignments one class ahead of time. With homework assignments, you are encouraged to work together. However, you need to turn in your own solution set, typed and legible, where each keystroke is your own. These assignments will be graded pass/fail and are due in person at the start of class. I also will provide feedback on request to anyone who writes “please comment” at the top of a homework assignment. If you attend regularly and your class participation is average, then your score for “homework, attendance & participation” will be based on the proportion of homework assignments you pass. If your participation and attendance is particularly impressive or particularly poor, then this grade will be increased or decreased accordingly.

The research paper should be in the format of a journal article. Your paper must apply methods used in this course. You may conduct original research or complete a replication of something already published that either uses spatial methods or wrongfully omits them. The paper should be written exactly as it would be for journal submission. That entails two things in particular, (1) that it be written for a journal audience and not for the instructor of a methods course, and (2) that it not concentrate unduly on methodological issues. The burden of (1) is to explain that which needs explanation to a social scientific professional audience and not that which does not, often a pretty tough call. On (2) I recommend a relatively low tech paper, which often will display little knowledge of the course materials, and then you should add a technical appendix full of technical talk for class purposes. The purpose, of course, is that journal readers will not want to read an excess of technical talk just because you need to prove
that you can speak it for a class. For suggestions on how to write a replication paper for a class like this, read the following article by Gary King: http://bit.ly/pubPub

Finally, you are required to present your paper to the class in a conference-style presentation with slides during the exam period. In the event that other classes in the department schedule a poster session, I may replace the speaking assignment with a poster presentation. If that happens, consider that there are two general strategies for formatting a professional poster: (1) Create a PowerPoint presentation and tack printouts of the slides onto a board. (2) Use PowerPoint or \LaTeX{} to create a poster-size document, which you then print on one large sheet. The latter is generally the sharper, more professional choice. For tips on doing this in \LaTeX{}, see Ramirez & Monogan’s (2008) article, “Posters in \LaTeX{},” as well as example software code at: http://j.mp/latexcourse. A nice treatment of posters in PowerPoint is posted at: http://faculty.washington.edu/robinet/poster.html

No late work will be accepted on any assignment. Your final grade will be based on the sum of points earned from the following assignments:

- Homework, in-class assignments, & participation 50 pts.
- Research paper 40 pts.
- Research presentation 10 pts.

Grades are constructed to reflect the university standards posted at http://bulletin.uga.edu/Bulletin_Files/acad/Grades.html which are summarized below. Grades will be based on how many points you earn according to the following distribution:

- “Passing” D =60-69 pts.
- “Failure” F =fewer than 60 pts.

Auditing the Course

Course auditors are welcome in this class, provided there are enough students enrolled for credit. Please keep up with weekly reading and homework. No assignments will be graded, though. To audit a course: Access the “student registration main menu” from the main page on OASIS. Once selected, sign up for the course you wish to audit as usual. Once it is on your schedule on OASIS, select “change credit hours or grading status” from the top of your schedule screen. This will allow you to change the course from a credited course to an audit status. Please note that you must select audit status before the Drop/Add period ends for students or you will not be able to audit the course.
COURSE SCHEDULE

Jan. 9: Overview of Spatial Data Problems
Reading: Banerjee, Carlin, & Gelfand, Chapter 1 and Ward & Gleditsch, Chapter 1

Jan. 16: Spatially Lagged Dependent Variables
Reading: Ward & Gleditsch, Chapter 2

Jan. 23: NO CLASS, INSTRUCTOR OUT OF TOWN

Jan. 30: Spatial Error Models
Reading: Ward & Gleditsch, Chapter 3

Feb. 6: Point-Referenced Data Models
Reading: Banerjee, Carlin, & Gelfand, Sections 2.1-2.3

Reading: Banerjee, Carlin, & Gelfand, Sections 2.4-2.5

Feb. 20: Basics of Areal Data Models
Reading: Banerjee, Carlin, & Gelfand, Sections 3.1-3.2

Feb. 27: Basics of Areal Data Models
Reading: Banerjee, Carlin, & Gelfand, Sections 3.3-3.5

Mar. 6: Basics of Bayesian Inference
Reading: Banerjee, Carlin, & Gelfand, Chapter 4

Mar. 13: NO CLASS, UNIVERSITY HOLIDAY

Mar. 20: Hierarchical Modeling for Univariate Spatial Data
Reading: Banerjee, Carlin, & Gelfand, Sections 5.1-5.2 and Ward & Gleditsch, Chap. 4

Mar. 27: Hierarchical Modeling for Univariate Spatial Data
Reading: Banerjee, Carlin, & Gelfand, Sections 5.3-5.6

Apr. 3: Spatial Misalignment
Reading: Banerjee, Carlin, & Gelfand, Chapter 6

Apr. 10: To Be Announced. (Possibly: Spatiotemporal Modeling.)

Apr. 17: Multivariate Spatial Modeling
Reading: Banerjee, Carlin, & Gelfand, Chapter 7

Apr. 24: PAPERS DUE and Point Pattern Analysis

May 1: IN-CLASS PRESENTATIONS, BALDWIN 302, 3:30-6:30