

Course Information for STAT:6530 “Environmental and Spatial Statistics”

Spring 2017

Instructor

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Course Format

Lectures 9:30 – 10:20 MWF in 74 SH. Occasionally we may meet instead in the Statistics Graduate Computing Lab, 346 SH.

Office Hours

1:30 – 3:30 pm Mondays, 1:30-3:00 pm Thursdays, or by appointment

Department Information

Department of Statistics and Actuarial Science, 241 Schaeffer Hall, Phone 335-2082

Department Executive Officer

Professor Joseph Lang, 241 SH, Phone 335-0712, E-mail joseph-lang@uiowa.edu

Textbook

For the first two-thirds of the course, lecture notes, freely provided for download from Professor Zimmerman’s webpage, will serve as a quasi-textbook, and these will be supplemented by assigned readings (excerpts of books) made available to the students in the course. Further background reading for this part of the course may be found in *Hierarchical Modeling and Analysis for Spatial Data*, by Banerjee, Carlin, and Gelfand (Chapman & Hall/CRC Press), but there is no need to purchase this book. For the final third of the course, the textbook will be *Spatial Point Patterns*, by Baddeley, Rubak, and Turner (CRC Press). Purchasing or otherwise getting ahold of a copy of this book is advisable.

Course Prerequisites

22S:152 (or equivalent) and 22S:154 (or equivalent).

Course Objectives

To learn some of the most important methods for explicitly accounting for time and space (mostly the latter) in the statistical analysis of environmental data. In addition to learning the methods, it is our goal to learn when and why they are appropriate, what the underlying assumptions are, and how to implement the methods using various statistical software packages. With rare exceptions, we will not be concerned with deriving the methods using statistical theory, but we will occasionally use statistical theory to obtain statistical properties of the methods.

Students taking this course are mainly of two types: (1) Statistics M.S. and Ph.D. students, who have had courses more advanced than the prerequisites for this course; (2) Gradu-

ate students from Geography, Civil Engineering, and other fields who barely have (or in some cases simply don't have) the necessary course prerequisites. Currently, we need students of both types in order to have healthy enrollment for the course. The course objectives differ slightly for the two groups: the first group needs a theoretical understanding of the statistical methodology, while the second does not. Accordingly, the course content includes some theory, but homework and exam problems requiring more advanced theory will be assigned to only the first group; those problems will be replaced with more applied problems for the second group.

Major Topics Covered

- Trends, variability, and correlation
- Exploratory temporal and spatial data analysis
- Geostatistical models, including covariance functions and semivariograms
- Semivariogram and covariance function estimation
- Kriging (spatial prediction)
- Spatial regression
- Geostatistics on river networks
- Lattice (areal) data analysis, including measures of spatial autocorrelation and disease mapping
- Spatial point pattern analysis: univariate
- Spatial point pattern analysis: multivariate
- Methods for sampling environmental populations (time permitting)

Computing

Substantial computing will be necessary to complete many homework assignments and the final project. Our software of choice will be R, but we will also use SAS occasionally. Instructions on their use will be provided in class.

Homework

Written homework assignments are an essential component of the course. Assignments will be given approximately every week to 10 days, except around the times of exams or projects. Assignments must be turned in at the beginning of class on the day they are due. Unless prior arrangements are made, homework turned in late will receive a score no higher than 50%. You may work on homework problems together, but outright plagiarism is prohibited. Each student must write up their own work.

Some assignments will involve the analysis of data using a computer. Any computer output you wish to include with your homework should be fully labeled and annotated, and should be integrated with other parts of the homework by electronically cutting and pasting.

Some homework assignments may include some problems assigned only to Statistics graduate students, and other problems assigned only to non-Statistics graduate students. Every effort is made to “equalize” these assignments.

Attendance

Attendance at lectures and participation in discussions are expected. Coming late to class, leaving early, or failing to attend class often will lower your grade.

Midterm Exams

Two in-class midterm exams will be given; the first in early March, and the second in late April. These exams will be “closed-book” but “open-notes,” meaning that during the exam you can look at your lecture notes, past homework assignments, and anything else that you have written, but you may not look at other printed or electronic materials. As with homeworks, some exam problems may be assigned only to Statistics graduate students and others only to non-Statistics graduate students.

Data Analysis/Simulation Projects

Two data analysis/simulation projects will be given during the semester. The first will be handed out in early March and due in late March; the second will be handed out in late April and due by the final exam time assigned to our course. (We won’t have an in-class final exam; the second project can, if you wish, be regarded as taking the place of a final exam.) These projects will involve a more complete, in-depth analysis of a spatial dataset or a spatial statistics topic than is typical of a problem on a homework assignment. In contrast to homework assignments, you must work independently and not communicate with other class members about the projects.

Grading

- Homework and Attendance, 30%
- Midterm Exams, 40% (20% each)
- Data Analysis/Simulation Projects, 30% (15% each)

Plus-minus grading will be used.

Administrative Home

The College of Liberal Arts and Sciences is the administrative home of this course and governs matters such as the add/drop deadlines, the second-grade-only option, and other related issues. Different colleges may have different policies. Questions may be addressed to 120 Schaeffer Hall, or see the CLAS Academic Policies Handbook at <https://clas.uiowa.edu/students/handbook>.

Electronic Communication

University policy specifies that students are responsible for all official correspondences sent to their University of Iowa e-mail address (@uiowa.edu). Faculty and students should use this account for correspondences (Operations Manual, III.15.2, k.11).

Accommodations for Disabilities

The University of Iowa is committed to providing an educational experience that is accessible to all students. A student may request academic accommodations for a disability (which includes but is not limited to mental health, attention, learning, vision, and physical or health-related conditions). A student seeking academic accommodations should first register with Student Disability Services and then meet with the course instructor privately in the instructor's office to make particular arrangements. Reasonable accommodations are established through an interactive process between the student, instructor, and SDS. See <https://sds.studentlife.uiowa.edu/> for information.

Academic Honesty

All CLAS students or students taking classes offered by CLAS have, in essence, agreed to the College's Code of Academic Honesty: "I pledge to do my own academic work and to excel to the best of my abilities, upholding the IOWA Challenge. I promise not to lie about my academic work, to cheat, or to steal the words or ideas of others; nor will I help fellow students to violate the Code of Academic Honesty." Any student committing academic misconduct is reported to the College and placed on disciplinary probation or may be suspended or expelled (CLAS Academic Policies Handbook).

CLAS Final Examination Policies

The final examination schedule for each class is announced by the Registrar generally by the fifth week of classes. Final exams are offered only during the official final examination period. No exams of any kind are allowed during the last week of classes. All students should plan on being at the UI through the final examination period. Once the Registrar has announced the date, time, and location of each final exam, the complete schedule will be published on the Registrar's web site and will be shared with instructors and students. It is the student's responsibility to know the date, time, and place of a final exam.

Making a Suggestion or a Complaint

Students with a suggestion or complaint should first visit with the instructor (and the course supervisor), and then with the departmental DEO. Complaints must be made within six months of the incident (CLAS Academic Policies Handbook).

Understanding Sexual Harassment

Sexual harassment subverts the mission of the University and threatens the well-being of students, faculty, and staff. All members of the UI community have a responsibility to uphold this mission and to contribute to a safe environment that enhances learning. Incidents of sexual harassment should be reported immediately. See the UI Office of the Sexual Misconduct Response Coordinator for assistance, definitions, and the full University policy.

Reacting Safely to Severe Weather

In severe weather, class members should seek appropriate shelter immediately, leaving the classroom if necessary. The class will continue if possible when the event is over. For more information on Hawk Alert and the siren warning system, visit the Department of Public Safety website.