

# STAT 406: Statistical Methods for Spatial Data

Instructor: Dr. Petrutza Caragea

Spring 2008

## Course Outline and Information

- Meeting times: TTR 11-12:20 in Agronomy Hall, Room 2026

- Contact information: Office 1: 1452 Wilson Hall Phone: 294-5582  
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Course URL: [www.public.iastate.edu/~pcaragea/stat406](http://www.public.iastate.edu/~pcaragea/stat406)

Office hours: After class and by appointment.

- **Computing:** We will be using R: a language and environment for statistical computing. Use of this packages will be covered in the class. No prior experience with R is expected.

- **Topics Outline:**

- **Introduction:** Geo-referenced data
- **Part I: Geostatistical Analysis:**  
Exploratory Analysis.  
Estimation and prediction for spatial processes:  
Semivariograms and Covariance models;  
Kriging: simple, ordinary and universal.  
Stationary vs. Non-stationary spatial models.
- **Part II: Lattice/Areal Data Analysis:**  
Exploratory data analysis;  
Spatial Autocorrelation and Spatial Regression Models.
- **Part III: Spatial Point Processes:**  
Introduction, Historical Context;  
Locations of Events vs. Counts of Events;  
Testing for spatial randomness;  
Second-Order Properties of Point Patterns;  
Estimation of K- and L- functions;  
Clustering and Parent Processes.

– Part IV: Special Topics in Spatial Statistics.

- Computation and Lab: I have reserved the second lecture of every week to a lab period. During these, we will go through "hands-on" examples illustrating how to use R to analyze spatial data.

The primary language used is the statistical package **R**, which has the advantages that it is available at no cost and includes easily obtained modules that perform many of the basic computations needed for practical spatial data analysis.

- Assignments and Final Project: There will be regular assignments throughout the semester. These assignments will mostly require you to apply concepts taught in class to various data sets, therefore mostly computational. However, each assignment has to contain your explanations as to what you have done, why, and, most importantly, what your conclusions are. You are encouraged to work in groups, but the write-up has to be done individually. A semester project will be required. Past experience has shown that some students wish to analyze data from their own graduate research or from related problems in their field of study. While these problems may result in excellent projects, it is also sometimes the case that they involve complications or issues that require modification of the fundamental methods covered in the course, or occasionally a more advanced approach is needed in total. Course grades will be based on the assignments, the final project and its presentation toward the end of the semester.
  - Class Examples: Students will be asked to identify data sets of interest to them during the first two weeks of the semester. If at all possible, these data sets will be incorporated into the set of examples to be used throughout the course. These examples may also serve to illustrate situations in which the basic practical approaches that form the core of Stat 406 are less than fully adequate for the problem under consideration, and more sophisticated methods need to be investigated.
  - The Special Topics section will be decided on according to the main interest of students enrolled. Topics that might be considered include spatio-temporal processes, hierarchical models, marked point patterns...
- Iowa State University complies with the Americans with Disabilities Act and Sect 504 of the Rehabilitation Act. If you have a disability and anticipate needing accommodations in this course, please contact Petrutza Caragea within the first two weeks of the semester. Retroactive requests for accommodations will not be honored. Before meeting with Petrutza Caragea, you will need to obtain a SAAR form with recommendations for accommodations from the Disability Resources Office, located in Room 1076 on the main floor of the Student Services Building. Their telephone number is 515-294-6624.