STAT 598(CRN 58899)/FNR 598 (CRN 65659) Applied Spatial Statistics
TTh 3:00-4:15, MATH 215
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Prerequisite: A graduate course in statistics or probability.

Primary Audience: Students who are interested in analyzing spatial data.

Description: This course covers a wide range of statistical models and methods for data that are collected at different spatial locations and perhaps at different times. These data are called spatial or spatio-temporal data, which are prevalent in many scientific disciplines such as agronomy, plant pathology, forestry and natural resources, environmental and health studies, climatology, geology, biosecurity, etc. Due to the advance in technology, massive spatial data are collected in various disciplines, which do require novel methods to process and analyze. Consequently, spatial statistics is currently one of the most active research areas in statistics. This course will introduce the classical methods as well as some newly developed ones, and will provide ample hands-on activities. The programming language R and a few packages for analyzing spatial data will be introduced. The primary objective is for students to be able to identify appropriate methods and analyze spatial data in their research.

Topics: This course covers statistical methods for geo-referenced data (such as ozone measurements from different monitoring stations), spatial point patterns (such as incidents of plant/human disease), and areal data (such as county statistics in the US). An incomplete list of topics is as follows.

- Stationarity and variogram models
- Fitting a variogram model
- Kriging or best linear unbiased prediction (simple kriging, cokriging, and universal kriging).
- Kriging with large datasets
- Non-stationary models
- Spatio-temporal models
- Multivariate methods (direct and cross covariograms, cokriging)
- Conditional autoregressive models
- Spatial point patterns
- Complete randomness and Poisson processes
- Cluster processes and inhibition processes
- K-function
- Intensity function and inhomogenous Poisson processes
- Simulation of spatial processes and spatial point patterns

Grading: Based on classroom participation (10%), homework (30%), projects (30%) and one exam (30%).

Textbook: No textbook is required. Lecture notes and handouts will be distributed in class and available on the course website.