

INSTRUCTOR:

Dr. Wenxuan Zhong

email: WENXUAN@UGA.EDU

webpage: <http://faculty.franklin.uga.edu/wenxuan/content/courses> (include this site in your BOOKMARKS)

TA: Kim, Sangjin. Office hour: (TBD)

Office Hours: 10:45AM-11:45AM

Textbook:

The course material will be based on a set of notes given by the instructor. The reference books are:

Hierarchical Modeling and Analysis for Spatial Data. Banerjee, Carlin and Gelfand. Chapman and Hall.

Statistics for Spatial Data: Noel Cressie. Wiley & Sons. 1993.

(more complete and more advance level: It is a very good reference book but at an advance level)

Schedule:

STATISTICS BUILDING: 307 on TR: 9:30-10:45am.

Labs:

Sometimes the class will be held in the computer lab. It will be announced on the web the dates for the labs.

Lecture Notes

Lecture notes and handouts will be distributed in class.

Paper discussion

Each student will lead a half hour discussion of an applied or theoretical published paper in spatial statistics.

Project

There will be a project, a spatial analysis using real data from the environmental, geological and marine biology provided by Dr. Zhong or selected by the student. The project could be also about a topic in spatial statistics chosen by the student (but one which has not been covered in class). There will be an oral presentation of the project (15 minutes).

Deadline to submit Abstract of the project: Feb 27, 2015

Deadline to submit the project: **4/27/2015**

Final Exam:

Take home exam. You will have one week to work on this exam. Deadline to submit exam **4/27/2015**

Grading policy:

The course grade will be based on (in class) midterm, paper discussion, project and a cumulative (take-home) final exam. The relative weight given to each of these components is paper discussion 10%, assignments: 30%, project: 30%, final exam:30%

Objective:

This course will cover a number of areas of spatial statistics applied to real, scientific and interesting problems. A tentative list of more specific topics is as follows:

- Introduction to spatial statistics:
 - Point level models
 - Areal (lattice) models
 - Spatial point processes.

- Estimation and modeling of spatial correlations:
 - estimating variogram
 - fitting parametric models: Matern class
 - maximum likelihood estimation
 - restricted maximum likelihood

- Prediction and Interpolation (kriging):
 - Lagrange multiplier approach
 - conditional inference approach
 - predicting at multiple sites
 - frequentist corrections for unknown covariance structure
 - model misspecification in kriging

- Bayesian spatial statistics:
 - Bayesian estimation
 - Bayesian kriging
 - Bayesian priors for covariance parameters
 - Hierarchical Bayesian methods.

- Spatial-temporal processes.
 - point-level modeling with continuous time
 - nonseparable models
 - dynamic space-time models
 - block-level modeling

- misalignment problem.
- Nonstationary spatial processes:
 - Bayesian deformation approaches
 - eigenfunction expansion of the covariance (EOFs)
 - kernel based methods
 - mixing of process distributions
- Spatial Survival models:
 - parametric models (spatial frailty, logistic regression)
 - semiparametric models (beta mixture, counting process)
 - multivariate models
- Spectral domain:
 - Fourier Theory
 - Spectral Representation of a Spatial Process
 - Spectral Density and periodogram
 - Spectral methods to approximate the likelihood
 - Increasing domain asymptotics
 - Infill asymptotics

The emphasis of the course is to learn the methodology needed to do research on spatial statistics and to analyze real data from environmental, geological and marine biology.