ST 810 M, Fall 2000
SPATIAL STATISTICS
http://www.stat.ncsu.edu/~fuentes/st810

Instructor:

Dr. Montserrat Fuentes
Office: Patterson 210 C, phone: 515-1921
email: fuentes@stat.ncsu.edu
webpage: `www.stat.ncsu.edu/~fuentes/st810` (*include this site in your Bookmarks*)
Office Hours: TU from 10am to 12pm

Course prerequisites:

ST 552 Linear Models and Variance Components.

Textbook:

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

- *Introduction to Geostatistics.* P.K. Kitanidis. University Press. 1997. (this is a basic level and helpful book for the geostatistics part of this course. I recommend it ONLY for students without any previous knowledge of spatial statistics).
- *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.)
- *Interpolation of Spatial Data.* M. Stein. Springer, 1999. (Very advance level, this is a good reference book for spatial statistics in the spectral domain)

(These books are available in NCSU Central Bookstore and also on reserve at the main library).

Schedule:

Harrelson 238: 1:05–2:20 TU. and TH.

Labs:

Sometimes the class will be held in the computer lab, in SICL, located on the ground floor of Harrelson (Room# HA G100). It will be announced on the web the dates for the labs. The software used for this course is SAS, and Splus.

- There is recommended SAS Spatial Prediction notebook. **SAS/STAT Technical Report:** Spatial Prediction Using the SAS System. It is available at the bookstore.
- There is a recommended Splus Spatial Statistics book. **S+Spatial Stats:** User's manual. Mathsoft Inc. It is available at the bookstore.

Lecture Notes:

Lecture notes and handouts will be available on the web,

webpage: `www.stat.ncsu.edu/~fuentes/st810/lectures/lectures.html`

Paper discussion:
Each student will lead a 1/2 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 agricultural science provided by Dr Fuentes 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: September 28, 2000.
Deadline to submit the project: November 16, 2000.

Midterm:
In class exam, October 12.

Final Exam:
Take home exam. You will have one week to work on this exam. Deadline to submit exam: December 11 at 11 am.

Grading policy:
S/U
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%, Midterm: 30%, Project: 30%, Final exam.: 30%.

Objectives:
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:

1. Introduction to spatial statistics.

2. Estimation of spatial correlations:

a. estimating variogram
b. fitting parametric models: Matern class
c. maximum likelihood estimation
d. restricted maximum likelihood
e. Bayesian procedures
f. MINQE estimation

3. Prediction and Interpolation (kriging):

a. Lagrange multiplier approach
b. conditional inference approach
c. Bayesian approach
d. predicting at multiple sites
e. frequentist corrections for unknown covariance structure
f. model misspecification in kriging
g. median polish kriging

4. Spectral domain:
a. Fourier Theory
b. Spectral Representation of a Spatial Process
c. Spectral Density
d. Periodogram
e. Increasing domain asymptotics
f. Infill asymptotics

5. Spatial-temporal processes.

6. Design of spatial networks.

7. Nonstationary spatial processes.

8. Lattice data: Mantel test.

Students will learn how to use existing software, the emphasis of the course is to learn the *methodology* needed to do research on spatial statistics and to analyze real data from the environmental, geological and agricultural sciences.

August 22, 2000.