DATA130013: Time Series and Spatial Statistics

Spring 2017

Instructor:	Nan Zhang	**Class:**	Thur 13:30–16:10, HGX301
Email:	zhangnan@fudan.edu.cn	**Office:**	N210, Zibin Building

Teaching Assistant: To be announced

Course Websites:

1. https://zhangnanfudan.github.io/teaching/
2. Wiki: shjkx.wang (Username: guest; Password: beijing)

Office Hours: Friday 15:00 – 17:00 or by appointment

Textbook:

- Robert Shumway and David Stoffer (2011) *Time Series Analysis and Its Applications: with R Examples*, Springer, 3rd edition
- Noel Cressie and Christopher Wikle (2011). Statistics for Spatio-temporal Data, Wiley

Main References: There are various interesting and useful books related to this course. You can consult them occasionally.

- Jianqing Fan and Qiwei Yao (2015). *The Elements of Financial Econometrics*. Science Press
- Jonathan Cryer and Kung-Sik Chan (2010) *Time Series Analysis with Applications in R*, Springer, 2nd edition
- Peter Brockwell and Richard Davis (2016). *Introduction to Time Series and Forecasting*, Springer, 3rd edition
- Norman Matloff (2011). *The Art of R Programming: A Tour of Statistical Software Design*, No Starch Press

Objectives: This course is designed for advanced undergraduates majoring in mathematics, statistics, and data science. It covers modern topics in time series and spatial statistics and emphasizes their applications to real data sets with statistical programming language R.

Prerequisites: Introductory courses on probability and statistics is assumed. Knowledge of regression analysis is preferred. Programming experience with R is recommended.

Tentative Outline:

- Introduction to time series: examples and concepts
- Regression methods and exploratory data analysis
- Models for stationary time series: autoregressive model, moving Average model, and ARMA model
- Models for non-stationary time series: ARIMA model

- Advanced topics on time domain
- Spectral analysis
- State-space model, Kalman filter
- Introduction to spatial statistics, data visualization
- Spatial random process, spatial correlation, variogram
- Covariance function modeling
- Prediction and Kriging
- Spatial-temporal process

Grading Policy:

Homework	(10%)
Wiki contribution	(10%)
Quiz	(10%)
Project	(10%)
Midterm	(30%)
Final	(30%)

Homework: Problems will be assigned on course website after class meetings and will be due in class on the following Thursday. No late homework will be accepted. Missed homework will receive a grade of zero. The homework will be graded, and each assignment carries equal weight. You are encouraged to work with other students on the homework problems, however, verbatim copying of homework is absolutely forbidden. Therefore each student must ultimately produce his or her own homework to be handed in and graded. It is strongly encourage to type your homework solution using LaTeX.

Wiki contribution: Wiki page is designed as a comprehensive resource for this course. Everyone can make contribution. Class notes, homework problems and extra exercises will be listed on the wiki page and students can assign themselves to edit the materials. Instructor and teaching assistant will help and evaluate each student's work. The evaluation has only two outputs: pass (10) or fail (0).

Quiz: A few (two) in-class quizzes will be arranged. Questions are typically conceptual or related to previous homework.

Project: A project on real data analysis is arranged for each student along the semester. Students are encouraged to look for and analyze one data set of their interest. The progress report is regularly updated on a personal wiki page and checked by teaching assistant. At the end of this semester, a final report is submitted for evaluation.

Midterm: There will be one in-class midterm exam. There will be no make-up exam. If missed, the weight will be carried by the final exam.

Final: Final exam is closed-book and comprehensive. It is scheduled on June 22.

Academic Honesty: Lack of knowledge of the academic honesty policy is not a reasonable explanation for a violation.