جامعة الملك عبدالله
للعلوم والتقنية
King Abdullah University of
Science and Technology

Course Syllabus: Spatial Statistics - STAT 370

Division	Computer, Electrical and Mathematical Sciences & Engineering
Course Number	STAT 370
Course Title	Spatial Statistics
Academic Semester	Fall
Academic Year	2019/2020
Semester Start Date	08/25/2019
Semester End Date	12/10/2019
Class Schedule (Days & Time)	01:00 PM - 02:30 PM | Sun Wed

Instructor(s)

Name	Email	Phone	Office Location	Office Hours
Marc Georges Genton	Marc.Genton@KAUST.EDU.SA	+966128080244	4114, 1, Al-Khawarizmi (bldg. 1)	2:30-3:30PM on Sunday and Wednesday, or by appointment

Teaching Assistant(s)

Name	Email
Wanfang Chen	wanfang.chen@kaust.edu.sa

Course Information

Comprehensive Course Description	Course Outline: - Geostatistical data: Random fields; Variograms; Covariances; Stationarity; Non-stationarity; Kriging; Simulations. - Lattice data: Spatial regression; SAR, CAR, QAR, MA models; Geary/Moran indices. - Point patterns: Point processes; K-function; Complete spatial randomness; Homogeneous/inhomogeneous processes; Marked point processes. - Special topics (based on interests of participants): Spatio-temporal modeling; Multivariate random fields; Processes on spheres; Non-Gaussian random fields.
Course Description from Program Guide	This course is an introduction to the concepts and applications of spatial statistics. It covers the following topics. Geostatistical data: Random Fields; Variograms; Covariances; Stationarity; Non-stationarity; Kriging; Simulations. Lattice data: Spatial regression; SAR, CAR, QAR, MA models; Geary/Moran indices. Point patterns: Point processes; K- function; Complete spatial randomness; Homogeneous/inhomogeneous processes and Marked point processes.
Goals and Objectives	By the end of the course, the student will be able to: (1) Understand the concepts of spatial statistics. (2) Apply the concepts of spatial statistics to real data sets. (3) Use the software R (or others) to perform spatial analysis of real data sets.
Required Knowledge	STAT 220, 230, 240, 250; STAT 320 recommended; or equivalent background with permission from instructor

Reference Texts	Textbook: - Cressie, N. and Wikle, C. (2011). Statistics for Spatio-Temporal Data. Wiley. (electronic version available from the Library) Other books: - Banerjee, S., Carlin, B. P., Gelfand, A. (2003). Hierarchical Modeling and Analysis for Spatial Data. Chapman & Hall/CRC. - Chiles, J. P., Delner, P. (1999). Geostatistics. Modeling Spatial Uncertainty. Wiley. - Cressie, N. (1993). Statistics for Spatial Data. Wiley. - Goovaerts, P. (1997). Geostatistics for Natural Ressource Evaluation. Oxford University Press. - Schabenberger, O., and Gotway, C. A. (2005). Statistical Methods for Spatial Data Analysis. Chapman & Hall/CRC. - Stein, M. L. (1999). Interpolation of Spatial Data. Some Theory for Kriging. Springer. - Wackernagel, H. (2003). Multivariate Geostatistics. An Introduction with Applications. Springer. - Waller, L., Gotway, C. A. (2004). Applied Spatial Statistics for Public Health Data. Wiley. - Wikle, C. K., Zammit-Mangion, A., and Cressie, N. (2019). Spatio-Temporal Statistics with R, Boca Raton, FL, Chapman & Hall/CRC. (electronic version available from https://spacetimewithr.org) - Other references and papers: cemse.kaust.edu.sa/stsds
Method of evaluation	**50.00**% - Course Project(s) **25.00**% - Oral presentation **25.00**% - Homework /Assignments
Nature of the assignments	- Homework assignments (25%): Homework assignments will be given throughout the semester. Assignments will be collected at the START of class on the date due. Late assignments will not be accepted. - Paper presentations (25%): Each student will present one paper in class. - Project (50%): A project, done individually. A project report will be due near the end of the semester and presented in class (20 minutes). More details will be given as the semester progresses. Late projects will not be accepted.
Course Policies	See above.
Additional Information	

Tentative Course Schedule *(Time, topic/emphasis & resources)*		
Week	**Lectures**	**Topic**
1	Sun 08/25/2019 Wed 08/28/2019	Introduction Effect of dependence
2	Sun 09/01/2019 Wed 09/04/2019	Random fields Covariances
3	Sun 09/08/2019 Wed 09/11/2019	Variograms Estimation and fitting
4	Sun 09/15/2019 Wed 09/18/2019	Kriging Robustness, asymptotics
5	Sun 09/22/2019 Wed 09/25/2019	University holiday Nonstationarity
6	Sun 09/29/2019 Wed 10/02/2019	Multivariate random fields Multivariate random fields
7	Sun 10/06/2019 Wed 10/09/2019	Paper presentations Paper presentations
8	Sun 10/13/2019 Wed 10/16/2019	Paper presentations Paper presentations
9	Sun 10/20/2019 Wed 10/23/2019	ExaGeoStatR ExaGeoStatR
10	Sun 10/27/2019 Wed 10/30/2019	Mid-semester break Space-time
11	Sun 11/03/2019 Wed 11/06/2019	Space-time Space-time
12	Sun 11/10/2019 Wed 11/13/2019	Space-time Lattice
13	Sun 11/17/2019 Wed 11/20/2019	Point processes Workshop talks
14	Sun 11/24/2019 Wed 11/27/2019	Project presentations Project presentations
15	Sun 12/01/2019 Wed 12/04/2019	Project presentations Project presentations + Project report due 11/28 at 5pm
16	Sun 12/08/2019	No Exam

Note

The instructor reserves the right to make changes to this syllabus as necessary.