The University of Southern Mississippi
Department of Coastal Sciences
COA 616 Geostatistics in Environmental Science

COURSE SYLLABUS

Instructor

Wei Wu
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Class Hours

Class meets 11:30 – 12:45 on Tuesday and Thursday

Office Hours

TBD

Prerequisites

GIS, fundamental statistical theory typically taught in an introductory course on probability and inference, matrix algebra, or permission of the instructor.

Credit Hours

3

Course Description

Quantitative analysis of spatial data has become an essential component of geology, geography, environmental science, biology, and many other disciplines. This course is an introduction to the analysis, description and modeling of geospatial data using traditional geostatistics and spatial statistics for lattice data. It will enable the students to 1) explore spatial patterns; 2) quantify spatial continuity; 3) perform spatial estimation and predictions; and 4) understand stochastic simulation. The practical applications of underlying theory will be emphasized though the use of R. The students are expected to bring their own spatial data for the term project.

Course Objective

The students are expected to be able to apply different spatial interpolation methods and explain their advantages and disadvantages. The students should know how to implement different types of kriging and spatial regression models in R.

Textbook

Geostatistics for Environmental Scientists / 2nd Edition. R. Webster and M.A. Oliver, 2007 John Wiley & Sons, Ltd. Available online at the USM library website.

Other references

Statistical methods for spatial data analysis. O. Schabenberger and C.A. Gotway, 2005. Chapman and Hall / CRC.

An introduction to applied geostatistics. E.H. Isaaks and R.M. Sruvastava, 1989. Oxford University Press, Inc.

Spatial statistics. B.D. Ripley, 1981. John Wiley & Sons, Inc.

Model-based geostatistics P.J. Diggle and P. J. Ribeiro Jr. 2007. Springer Science + Business Media, LLC.

Statistics for Spatial Data. Revised edition. N. Cressie, 1993. John Wiley & Sons.

Research Component

The students are required to bring their own spatial data and test one hypothesis related to Ecology, Environmental Science or Marine Science etc. by applying the tools learned in this course. The students need to write the analyses up in the final paper and do an oral presentation on their paper.

Evaluation Criteria

Homework assignments = 60%

Term project = 40% (data presentation: 5%, final presentation: 10%, final paper: 25%)

Grading Scale

A	93 – 100	Excellent
A-	89 – 92.9	Very Good
B+	85 – 88.9	Good
B	80 – 84.9	Satisfied
B-	75 – 79.9	Adequate, but needs improvement
C+	70 – 74.9	
C	65 – 69.9	
C-	60 – 64.9	Minimum passing
F	0 – 59.9	

Late Assignment or Projects

Lab problems will be due one week after assignment. Labs won't be accepted if they are more than 1 week late. It is highly recommended the students use this benefit only once for unforeseeable situations. Exception may be considered under the extreme circumstances such as family emergency or work-related reasons (e.g. long field trip) AND the instructor being notified timely.

Lab Redo Policy

You may choose to redo the lab assignments to improve your grade, but keep in mind that the full mark for redo is 90 instead of regular 100.

Academic Integrity Statement

All students at the University of Southern Mississippi are expected to demonstrate the highest levels of academic integrity in all that they do. Forms of academic dishonesty include (but are not limited to):

1. Cheating (including copying from others' work)
2. Plagiarism (representing another person's words or ideas as your own; failure to properly cite the source of your information, argument, or concepts)
3. Falsification of documents
4. Disclosure of test or other assignment content to another student
5. Submission of the same paper or other assignment to more than one class without the explicit approval of all faculty members' involved
6. Unauthorized academic collaboration with others
7. Conspiracy to engage in academic misconduct

Engaging in any of these behaviors or supporting others who do so will result in academic penalties and/or other sanctions. If a faculty member determines that a student has violated our Academic Integrity Policy, sanctions ranging from resubmission of work to course failure may occur, including the possibility of receiving a grade of "XF" for the course, which will be on the student's transcript with the notation "Failure due to academic misconduct." For more details, please see the University's Academic Integrity Policy (https://www.usm.edu/institutional-policies/policy-acaf-pro-012). Note that repeated acts of academic misconduct will lead to expulsion from the University.

Disability Statement

If a student has a disability that qualifies under the Americans with Disabilities Act (ADA) and requires accommodations, he/she should contact the Office for Disability Accommodations (ODA) for information on appropriate policies and procedures. Disabilities covered by ADA may include learning, psychiatric, physical disabilities, or chronic health disorders. Students can contact ODA if they are not certain whether a medical condition/disability qualifies.

Address:

The University of Southern

Mississippi Office for Disability

Accommodations 118 College
Drive # 8586
Hattiesburg, MS 39406-0001
Voice Telephone: 601.266.5024 or 228.214.3232
Fax: 601.266.6035
Individuals with hearing impairments can contact ODA using the Mississippi Relay Service at 1.800.582.2233 (TTY) or emailing ODA at oda@usm.edu.

Tentative Schedule

Class time	Topic
9/4 & 9/6	Introduction to the course, statistics review, exploratory data analysis in R (W&O Ch. 1-2)
9/11 & 9/13	Spatial autocorrelation, Moran's I and Geary's C, Local indicators of spatial association (LISA)
9/18 & 9/20	Spatial autocorrelation: Estimating semivariances and covariances (W&O: Ch. 4.9)
9/25 & 9/27	Theory of regionalized variables and variogram modeling (W&O: Ch. 4.2 & 5.2)
10/2 & 10/4	Variogram modeling II (W&O Ch. 5.3 & 5.6)
10/9 & 10/11	Variogram modeling III (W&O Ch. 5.5) and spatial interpolation (Ch. 3)
10/16 & 10/18	Ordinary kriging (Ch. 8.1 – 8.3)
10/23 & 10/25	Ordinary kriging II (Ch. 8.6, 8.12), Mixed effects model
10/30 & 11/1	Final project data presentation and indicator kriging and stochastic simulation (Ch. 11.1-11.3, Ch. 12.1)
11/6 & 11/8	Stochastic simulation II (Ch. 12.2)
11/13 & 11/15	Simple kriging and universal kriging
11/20	Bayesian kriging
11/27	Spatial autoregressive models for lattice data
11/29	Work on final projects
12/4	Final presentation