Course	**GISC 7361.001.13f. Spatial Statistics/ECON 7311.001.13f. Special Topics in Econometric and Spatial Analysis**
Professor	Dr. Daniel A. Griffith, Ashbel Smith Professor of Geospatial Information Sciences
Term	Fall 2013 (August 27 - December 19)
Meetings	Tuesday 4-6:45 pm; GR 3.602

UTD

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Office Hours	TBA
Other Information	I do not read WebCT mail; all course materials are available from the eppsgreen server.

General Course Information

Pre-requisites, Co-requisites, & other restrictions
GISC 6301 and GISC 7310 (or their equivalents); computer literacy; GISC 6311 or GISC7360 pre-/co-requisite desired.

Course Description
This course covers spatial statistical analysis in a data analytic way, building upon the standard linear regression model and visualizing with a geographic information system. Mathematical ideas are illustrated with data and numerical examples employing commercial software. Students are introduced to elementary spatial statistics and data handling, a conceptual overview of the theory of spatial statistics, areal unit configuration and locational information, reformulating classical linear statistical models and semivariogram modeling, spatial autocorrelation and spectral analysis, missing data on a two-dimensional surface and kriging, and error propagation analysis. Each student will perform analyses on a georeferenced data set of her/his choice. Computer software used includes SAS, R, Mathematica, and ArcGIS.

Learning Outcomes
- Explain the meaning of spatial autocorrelation.
- Detect spatial autocorrelation in georeferenced data.
- Account for the effects of spatial autocorrelation in georeferenced data.
- Differentiate between global and local statistics.
- Differentiate between spatial autoregressive and semivariogram modeling.
- Implement spatial autoregressive models.
- Implement semivariogram models.
- Implement spatial filter models.
- Estimate data values for unobserved locations.
- Know how to undertake Bayesian map analysis
- Know how to undertake frequentist random effects analysis.
- Know how to read and interpret spatial statistical papers.

Required Texts & Materials
Chun, Y. and D. Griffith. 2013. *Spatial Statistics and Geostatistics: Theory and Applications for Geographic Information Science And Technology*. Thousand Oaks, CA: SAGE.

Suggested Texts, Readings, & Materials
Arbia, G. 2006. *Spatial Econometrics*. Berlin: Springer-Verlag.
Anselin, L. 1988. *Spatial Econometrics*. Boston: Kluwer.
Cressie, N. 1991. *Statistics for Spatial Data*. NY: Wiley.
Cressie, N., and C. Wikle. 2011. *Statistics for Spatio-temporal Data*. NY: Wiley.
Gelfand, A., P. Diggle, M. Fuentes, and P. Guttorp (eds.). 2010. *Handbook of Spatial Statistics*. B oca Raton, FL: Chapman & Hall/CRC.
Griffith, D. 1988. *Advanced Spatial Statistics*. Boston: Kluwer.
Griffith, D.1987. *Spatial Autocorrelation: A Primer*. Washington, DC: AAG.
Griffith, D. 1993. *Spatial Regression Analysis on the PC: Spatial Statistics Using SAS*. Wash-

ington, DC: AAG.

Griffith, D. 2003. *Spatial Autocorrelation and Spatial Filtering: Gaining Understanding through Theory and Scientific Visualization*. Berlin: Springer-Verlag.

Griffith, D., and L. Layne. 1999. *A Casebook for Spatial Statistical Data Analysis*. NY: Oxford U. Press.

Haining R. 1990. *Spatial Data Analysis in the Social and Environmental Sciences*. Cambridge, UK: Cambridge U. Press.

Haining, R. 2003. *Spatial Data Analysis: Theory and Practice*. Cambridge, UK: Cambridge University Press.

LeSage, J., and R. Pace. 2009. *Introduction to Spatial Econometrics*. Boca Raton, FL: CRC Press.

Mateu, J., and W. Müller (eds.). 2013. *Spatio-temporal Design: Advances in Efficient Data Acquisition*. NY: Wiley.

Müller, W. 2007. *Collecting Spatial Data: Optimum Design of Experiments for Random Fields*., 2nd ed. NY: Physica-Verlag.

Assignments & Academic Calendar

August 27	Background review: what is spatial autocorrelation? (Ch. 2)
September 3	Spatial sampling (Ch. 3)
September 10	Spatial composition and configuration (Ch. 4)
September 17	Eigenfunction theory relevant to spatial statistics.
September 24	Spatially adjusted regression and related spatial econometrics (Ch. 5)
October 1	Class presentation of data analyses.
October 8	Local statistics: hot and cold spots (Ch. 6)
October 15	Analyzing spatial variance and covariance with geostatistics and related techniques (Ch. 7)
October 22	Methods for spatial interpolation in two-dimensions (Ch. 8)
October 29	Concluding comments: intermediate topics in spatial statistics (Ch. 9)
November 5	USEPA atrazine assessment: a special application of spatial statistics
November 12	**Mid-term examination**
November 19	Learning GeoDa (http://geodacenter.asu.edu/): "deliberate practice" learning
December 3	Group presentation demonstrating GeoDa
December 10	Class presentation of data analyses & **final examination** distribution
Exam dates	Mid-term examination: November 12; Final examination due: December 19, by 5pm

Course Policies

<table>
<tr><td rowspan="2">Grading (credit) Criteria</td><td colspan="7">e-mail connection: P/F
class data set analyses: 10%
mid-term examination: 30%
final examination (including comprehensive data analysis): 60%</td></tr>
<tr><td rowspan="3">course grading:</td><td>A+</td><td>91 - 100</td><td>B+</td><td>77-79</td><td>C+</td><td>67-69</td></tr>
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		A+	91 - 100	B+	77-79	C+	67-69
	course grading:	A	85 – 90	B	73-76	C	63-66
		A-	80 – 84	B-	70-72	C-	60-62

Make-up Exams	An exam cannot be made up without a legitimate excuse accompanied by proper formal documentation (e.g., a doctor's excuse).
Extra Credit	Extra credit is not available because it tends to interfere with a student's focusing upon completing assignments for the course, and permits students to choose not to or to poorly complete selected assignments designed as part of the course.
Late Work	Work will not be accepted late without a legitimate excuse accompanied by proper formal documentation (e.g., a doctor's excuse).
Class Attendance	Each student is expected to attend every lecture, and will be excused from doing so only for legitimate reasons that are accompanied by the provision of proper formal documentation (e.g., a doctor's excuse). Each student has the responsibility to access all information presented during a missed class

	session from other sources; the faculty instructor is not responsible for ensuring that students have missed materials. Furthermore, each student is expected to actively participate, which means to do more than just show up and occupy a seat in the classroom. Rather, students are expected to arrive to class *ON TIME* and to be properly and fully prepared to participate in class discussions and/or exercises.
Classroom Citizenship	Students arriving to a class session after it has begun are expected to enter quietly and take a seat in the least disruptive manner; student leaving a class session early are expected to do so in the least disruptive manner. Students are expected to display a positive attitude toward learning by conducting themselves with civility, respect for others (e.g., sharing thoughts and actively listening to the thoughts and comments of peers and the instructor), and general good, courteous behavior, including not engaging in cell phone (which should be silenced), personal movies/TV and personal newspaper (or other reading materials) usage, and not participating in social discussion groups during class time.
Student Conduct and Discipline	The University of Texas System and The University of Texas at Dallas have rules and regulations for the orderly and efficient conduct of their business. It is the responsibility of each student and each student organization to be knowledgeable about the rules and regulations which govern student conduct and activities. General information on student conduct and discipline is contained in the UTD publication, *A to Z Guide*, which is provided to all registered students each academic year. The University of Texas at Dallas administers student discipline within the procedures of recognized and established due process. Procedures are defined and described in the *Rules and Regulations, Board of Regents, The University of Texas System, Part 1, Chapter VI, Section 3*, and in Title V, Rules on Student Services and Activities of the university's *Handbook of Operating Procedures*. Copies of these rules and regulations are available to students in the Office of the Dean of Students, where staff members are available to assist students in interpreting the rules and regulations (SU 1.602, 972/883-6391). A student at the university neither loses the rights nor escapes the responsibilities of citizenship. He or she is expected to obey federal, state, and local laws as well as the Regents' Rules, university regulations, and administrative rules. Students are subject to discipline for violating the standards of conduct whether such conduct takes place on or off campus, or whether civil or criminal penalties are also imposed for such conduct.
Academic Integrity	The faculty expects from its students a high level of responsibility and academic honesty. Because the value of an academic degree depends upon the absolute integrity of the work done by the student for that degree, it is imperative that a student demonstrate a high standard of individual honor in his or her scholastic work. Scholastic dishonesty includes, but is not limited to, statements, acts or omissions related to applications for enrollment or the award of a degree, and/or the submission as one's own work or material that is not one's own. As a general rule, scholastic dishonesty involves one of the following acts: cheating, plagiarism, collusion and/or falsifying academic records. Students suspected of academic dishonesty are subject to disciplinary proceedings. *Plagiarism, especially from the web, from portions of papers for other classes, and from any other source is unacceptable and will be dealt with under the university's policy on plagiarism (see general catalog for details). This course will use the resources of turnitin.com, which searches the web for possible plagiarism and is over 90% effective.*
E-mail Use	The University of Texas at Dallas recognizes the value and efficiency of communication between faculty/staff and students through electronic mail. At the same time, email raises some issues concerning security and the identity of each individual in an email exchange. The university encourages all official student email correspondence be sent only to a student's U.T. Dallas email address and that faculty and staff consider email from students official only if it originates from a UTD student account. This allows the university to maintain a high degree of confidence in the identity of all individual corresponding and the security of the transmitted information. UTD furnishes each student with a free email account that is to be used in all communication with university personnel. The Department of Information Resources at U.T. Dallas provides a method for students to have their U.T. Dallas mail forwarded to other accounts.
Withdrawal from Class	The administration of this institution has set deadlines for withdrawal of any college-level courses. These dates and times are published in that semester's course catalog. Administration procedures must be followed. It is the student's responsibility to handle withdrawal requirements from any class. In other words, I cannot drop or withdraw any student. You must do the proper paperwork to ensure that you will not receive a final grade of "F" in a course if you choose not to attend the class once you are enrolled.
Student	Procedures for student grievances are found in Title V, Rules on Student Services and Activities, of

Grievance Procedures	the university's *Handbook of Operating Procedures*. In attempting to resolve any student grievance regarding grades, evaluations, or other fulfillments of academic responsibility, it is the obligation of the student first to make a serious effort to resolve the matter with the instructor, supervisor, administrator, or committee with whom the grievance originates (hereafter called "the respondent"). Individual faculty members retain primary responsibility for assigning grades and evaluations. If the matter cannot be resolved at that level, the grievance must be submitted in writing to the respondent with a copy of the respondent's School Dean. If the matter is not resolved by the written response provided by the respondent, the student may submit a written appeal to the School Dean. If the grievance is not resolved by the School Dean's decision, the student may make a written appeal to the Dean of Graduate or Undergraduate Education, and the deal will appoint and convene an Academic Appeals Panel. The decision of the Academic Appeals Panel is final. The results of the academic appeals process will be distributed to all involved parties. Copies of these rules and regulations are available to students in the Office of the Dean of Students, where staff members are available to assist students in interpreting the rules and regulations.
Incomplete Grades	As per university policy, incomplete grades will be granted only for work unavoidably missed at the semester's end and only if 70% of the course work has been completed. An incomplete grade must be resolved within eight (8) weeks from the first day of the subsequent long semester. If the required work to complete the course and to remove the incomplete grade is not submitted by the specified deadline, the incomplete grade is changed automatically to a grade of F.
Disability Services	The goal of Disability Services is to provide students with disabilities educational opportunities equal to those of their non-disabled peers. Disability Services is located in room 1.610 in the Student Union. Office hours are Monday and Thursday, 8:30 a.m. to 6:30 p.m.; Tuesday and Wednesday, 8:30 a.m. to 7:30 p.m.; and Friday, 8:30 a.m. to 5:30 p.m. The contact information for the Office of Disability Services is: The University of Texas at Dallas, SU 22 PO Box 830688 Richardson, Texas 75083-0688 (972) 883-2098 (voice or TTY) Essentially, the law requires that colleges and universities make those reasonable adjustments necessary to eliminate discrimination on the basis of disability. For example, it may be necessary to remove classroom prohibitions against tape recorders or animals (in the case of dog guides) for students who are blind. Occasionally an assignment requirement may be substituted (for example, a research paper versus an oral presentation for a student who is hearing impaired). Classes enrolled students with mobility impairments may have to be rescheduled in accessible facilities. The college or university may need to provide special services such as registration, note-taking, or mobility assistance. It is the student's responsibility to notify his or her professors of the need for such an accommodation. Disability Services provides students with letters to present to faculty members to verify that the student has a disability and needs accommodations. Individuals requiring special accommodation should contact the professor after class or during office hours.
Religious Holy Days	The University of Texas at Dallas will excuse a student from class or other required activities for the travel to and observance of a religious holy day for a religion whose places of worship are exempt from property tax under Section 11.20, Tax Code, Texas Code Annotated. The student is encouraged to notify the instructor or activity sponsor as soon as possible regarding the absence, preferably in advance of the assignment. The student, so excused, will be allowed to take the exam or complete the assignment within a reasonable time after the absence: a period equal to the length of the absence, up to a maximum of one week. A student who notifies the instructor and completes any missed exam or assignment may not be penalized for the absence. A student who fails to complete the exam or assignment within the prescribed period may receive a failing grade for that exam or assignment. If a student or an instructor disagrees about the nature of the absence [i.e., for the purpose of observing a religious holy day] or if there is similar disagreement about whether the student has been given a reasonable time to complete any missed assignments or examinations, either the student or the instructor may request a ruling from the chief executive officer of the institution, or his or her designee. The chief executive officer or designee must take into account the legislative intent of TEC 51.911(b), and the student and instructor will abide by the decision of the chief executive officer or designee.

NOTE: These descriptions/timelines are subject to change at the discretion of the Professor.