



**Course** GISC 7360: GIS Pattern Analysis  
**Professor** Michael Tiefelsdorf  
**Term** Fall Semester 2006  
**Meetings** Thursday, 4:00-6:45 pm in GR3.206 Computer Lab

### Professor's Contact Information

**Office Phone** (972) 883-4954  
**Other Phone** ---  
**Office Location** GR3.120  
**Email Address** tiefelsdorf@utdallas.edu  
**Office Hours** Thursday, 7:00-8:00, or by appointment or when office door is open  
**Other Information** Course related communications are preferred via WebCT. I will check this account once daily.

### General Course Information

**Pre-requisites, Co-requisites, & other restrictions** Intermediate statistical knowledge and GIS skills

**Course Description** This graduate course focuses on the statistical methodology to analyze spatially autocorrelated data. Methods covered in the course deal with point, lattice and surface data in a multivariate framework by accounting for underlying risk surfaces and spatial co-variation. The approach taken is to loosely couple vector based geographic information systems with specialized spatial statistical and geo-statistical software tools

**Learning Outcomes** *Upon completing this class, students will:*

- *Have a working understanding of spatial autocorrelation, spatial processes and spatial statistics;*
- *Understand density or distance based point pattern analysis methods with underlying risk surfaces and how to test for clustering and repulsion*
- *Understand spatial autocorrelation in regression residuals and how to test for it;*
- *Model surfaces with several Kriging interpolation methods and understand the difference between these models;*
- *Be able to apply spatial statistical analysis from a confirmatory and exploratory perspective.*

**Required Texts & Materials** Bailey, Trevor C. and Anthony C. Gatrell (1995). *Interactive Spatial Data Analysis*. New York: John Wiley & Sons (U.S. ISBN 0-470-23502-0, U.K. ISBN 0-582-24493-5).

**Suggested Texts, Readings, & Materials** Davis, John C. (1973). *Statistics and Data Analysis in Geology*. New York: John Wiley & Sons (*Classical reference. Good refresher chapters on inferential statistics and matrix algebra*)

Fox, John (2002). *An R and S-Plus Companion to Applied Regression*. Thousand Oaks: Sage Publications (*Good applied introduction to R and programming in R*)

Hamilton, Lawrence C. (1992). *Regression with Graphics. A second course in applied statistics*. Belmont, CA: Duxbury Press (*Good applied introduction to the concepts of regression analysis and*

*related linear models)*

Johnston, K., J.M. Ver Hoef, K. Krivoruchko, and N. Lucas (2001). *Using ArcGIS Geostatistical Analyst*. Redlands: ESRI Press (*Online available*)

Mitchell, Andy (2005). *The ESRI Guide to GIS Analysis. Volume 2: Spatial Measurements & Statistics*. Redlands: ESRI Press. (*Guided tour through the elementary spatial pattern analysis methods that are implemented in the ArcGIS Toolbox*)

O'Sullivan, David and David J. Unwin (2003). *Geographic Information Analysis*. New York: John Wiley & Sons. (*More elementary than Bailey and Gatrell with stronger GIS focus*)

Wong, David W.S. and Lee, Jay (2005). *Statistical Analysis of Geographic Information with ArcView GIS and ArcGIS*. New York: John Wiley & Sons. (*Basic introduction to the statistical analysis of spatial data and their patterns. Comes with ArcGIS extensions to perform the procedures outline in the book*)

R-project online documentation at <http://www.r-project.org/>

GeoDa online documentation at <http://www.csiss.org/clearinghouse/GeoDa/>

### Assignments & Academic Calendar

[Topics, Reading Assignments, Due Dates, Exam Dates]

<b>Date</b>	<b>Topic and Reading</b>
Aug 17, 2006	Introduction to Pattern Analysis (Handout)
Aug 24, 2006	Introduction to the R statistical environment (Handout)
Aug 31, 2006	Concept of Spatial Processes (B&G Chapter 1)
Sept 7, 2006	Pattern Analysis I (B&G Chapter 3)
Sept 14, 2006	Pattern Analysis II (B&G Chapter 4)
Sept 21, 2006	Regression Refresher (Handout)
Sept 28, 2006	Spatial Regression and Smoothing (B&G Sections 5.5 + 8.2)
Oct 5, 2006	<i>Mid-Term Exam</i>
Oct 12, 2006	Spatial Interpolation I (B&G Chapter 5 + ESRI Geo-statistics Chapter 1)
Oct 19, 2006	Spatial Interpolation II (B&G Chapter 5 + ESRI Geo-statistics Chapter 2)
Oct 26, 2006	Spatial Interpolation III (B&G Sections 6.1-6.2)
Nov 2, 2006	Spatial Autocorrelation in Regression Residuals (B&G Chapter 7 + GeoDa Document)
Nov 9, 2006	Autoregressive Spatial Models (B&G Chapter 7 + GeoDa Document)
Nov 16, 2006	<i>Final Exam</i>
Nov 23, 2006	Thanksgiving

### Course Policies

<b>Grading (credit) Criteria</b>	<p>Policies:</p> <ul style="list-style-type: none"> <li>• Labs need to be solved individually. However, a discussion among the course participants is highly encouraged.</li> <li>• Labs may be split into separate installments.</li> <li>• The pop-quizzes are intended to ensure that the suggested readings are done prior to the lecture.</li> <li>• Participation is highly encourages but not graded. Engagement with the course material will lead to participation and an indirect increase of the course grade. The course will also run an online discussion list.</li> </ul>
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	<b>Requirements</b>	<b>Percent</b>
	<i>Mid-term Exam (open book)</i>	30 %
	<i>Final Exam (open book)</i>	30 %
	<i>Lab 1: Point Pattern Analysis</i>	10 %
	<i>Lab 2: Spatial Interpolation</i>	10 %
	<i>Lab 3: Analysis of Areal Data</i>	10 %
	<i>5 Announced Pop-Quizzes @ 2 % (open book)</i>	10 %
<b>Make-up Exams</b>	none	
<b>Extra Credit</b>	none	
<b>Late Work</b>	<p>Work that is late by one day will lead to a deduction of 10% of its grade.            Work that is late by two days will lead to a deduction of 20 % of its grade.            Later work will not be accepted unless special circumstances can be claimed.            Preferably contact the instructor before the deadline if you think that you may need to hand your assignment in late.</p>	
<b>Special Assignments</b>	none	
<b>Class Attendance</b>	required	
<b>Classroom Citizenship</b>	A respectful interaction among all course participants is expected.	
<b>Field Trip Policies</b>	No field trips are offered in this course	
<b>Student Conduct and Discipline</b>	<p>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, <i>A to Z Guide</i>, which is provided to all registered students each academic year.</p> <p>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 <i>Rules and Regulations, Board of Regents, The University of Texas System, Part 1, Chapter VI, Section 3</i>, and in Title V, Rules on Student Services and Activities of the university's <i>Handbook of Operating Procedures</i>. 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).</p> <p>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.</p>	
<b>Academic Integrity</b>	<p>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.</p> <p>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</p>	

	<p>falsifying academic records. Students suspected of academic dishonesty are subject to disciplinary proceedings.</p> <p>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.</p>
<b>Email Use</b>	<p>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.</p>
<b>Withdrawal from Class</b>	<p>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.</p>
<b>Student Grievance Procedures</b>	<p>Procedures for student grievances are found in Title V, Rules on Student Services and Activities, of the university's <i>Handbook of Operating Procedures</i>.</p> <p>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 dean 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.</p> <p>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.</p>
<b>Incomplete Grades</b>	<p>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,</p>

	the incomplete grade is changed automatically to a grade of <u>F</u> .
<b>Disability Services</b>	<p>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.</p> <p>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)</p> <p>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.</p> <p>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.</p>
<b>Religious Holy Days</b>	<p>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.</p> <p>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.</p> <p>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.</p>
<b>Off-Campus Instruction and</b>	Off-campus, out-of-state, and foreign instruction and activities are subject to state law and University policies and procedures regarding travel and risk-related activities.

<b>Course Activities</b>	Information regarding these rules and regulations may be found at <a href="http://www.utdallas.edu/BusinessAffairs/Travel_Risk_Activities.htm">http://www.utdallas.edu/BusinessAffairs/Travel_Risk_Activities.htm</a> . Additional information is available from the office of the school dean.
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*These descriptions and timelines are subject to change at the discretion of the Professor.*