GEOG 371
Spatial Analysis
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M,W, 11-1

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SPATIAL ANALYSIS

Geographic data from surveys, satellites, and mobile devices and networks, are ubiquitous in daily life and underpin many scientific, business, and policy decisions. Spatial data analysis offers a set of methods, tools and approaches for visualizing and analyzing these 'big' geospatial data. This course introduces spatial analysis methods for point, network and area data, and it provides hands-on experience with the application of these methods in geography and diverse fields. Although spatial analysis is the primary focus, we also review important underlying statistical and GIS concepts. Students gain experience with established software tools in the course lab exercises. Spatial analysis methods, and their assumptions, use, and potential abuse, in geography and other disciplines are addressed. Although all labs are computer-based, you will need an inexpensive calculator for exams.

READINGS: On e-reserves and/or Compass web site

Several readings are from the following:

McGrew JC, Monroe CB (2000) *An Introduction to Statistical Problem Solving in Geography*, 2nd Edition. Boston: McGraw-Hill. (M+M)

Computer software used in this class includes: ArcGIS, Excel, SPSS, GeoDA

COURSE OBJECTIVES:

This course covers methods and tools for analyzing spatial data – data that identifies the geographic locations of features, people, and processes on or near the Earth's surface. We emphasize methods, their application, and the software tools for implementing the methods. After completing this course, students should be able to:

1. Understand the distinctive properties of spatial data and the concepts used in analyzing spatial data
2. Understand a basic set of methods for analyzing point, network, and areal spatial data
3. Apply spatial analysis methods to a practical or research problem and present the results clearly and effectively
4. Work with a set of well-established software tools for spatial analysis
5. Critically evaluate the use of spatial analysis methods in research and planning activities

COURSE REQUIREMENTS:

Labs	15%
Homework & Group assignments	20%
2 Quizzes	5% each
Midterm and Final Exams	15% each
Final Project and Presentation	25%

The labs are in-class, individual or group assignments designed to enhance understanding of spatial analysis concepts and methods. You will do the labs during the second hour of each class period. Your grade for the labs will be based on class attendance and completion of the labs, and these cannot be made up if you are absent, unless you have a doctor's or Dean's note.

The final project for the class involves the analysis of a data set of your choice using methods discussed in class. The topic for the project must be geography-related, but beyond that it is completely open. Choose something that interests you. The topic can be related to human or physical geography or geographic techniques: topics like environmental quality, demographics, crime, health, climate, voting, and natural hazards are very appropriate for spatial analysis. You can collect your own data, use data from the web or from public or private agencies. Be sure that you can defend the quality of data and that you are aware of data limitations.

Late policy: Assignments handed in after class on the due date will receive a 3% penalty, and the penalty will increase by 3% for each additional day late.

COURSE SCHEDULE (approximate):

Topic		Reading
1/20	Spatial thinking	
1/25	Descriptive statistics review	Golledge (2003)
1/27	Descriptive statistics and mapping http://nationalatlas.gov/articles/mapping/a_statistics.html	
2/1	Spatial statistical concepts: Measuring distance and shape	
2/3	Descriptive spatial statistics for point data	Ebdon, pp. 128-143
2/8	Point data-- Measuring dispersion	
2/10	**QUIZ 1**; New topic Measuring concentration for area data	
2/15	Location quotients and spatial segregation	
2/17	Spatial analysis for network data, I	Wong & Lee, p. 304-13
2/22	Spatial analysis for network data, II	**GROUP project due**
2/24	Probability concepts	
2/29	Probability distributions and spatial analysis	
3/2	Probability mapping	
3/7	**MIDTERM EXAM**	
3/9	Hypothesis testing review	Haines-Young & Fish
3/14	Statistical tests for comparing maps	**Research Problem due**
3/16	Contingency tables	M+M, pp. 166-170
3/28	Correlation analysis	M+M, Ch. 13
3/30	**NO CLASS**	
4/4	Map correlation and regression	**Background Literature due**
4/6	Nonlinear and rank correlation	
4/11	**QUIZ 2**; New topic: Inferential spatial analysis	
4/13	Spatial analysis of point patterns	O'Sullivan & Unwin, pp. 139-145
4/18	Spatial clustering analysis	
4/20	Spatial autocorrelation for binary data	Burt, Barber, Rigby, pp. 549-564
4/25	Spatial autocorrelation analysis, Moran's I	
4/27	Detecting hot/cold spots	
5/2	Term project presentations	
5/4	Term project presentations	

FINAL EXAM will be held at the scheduled time for the final exam.

Due Dates related to term project:

3/14 – Statement of research problem due
4/4 – Write-up on background literature due
5/11 – Term Paper due, by 5 PM

Readings and application articles that may be of interest:

Burt, J., Barber, G., Rigby, D. *Elementary Statistics for Geographers*, 3rd Edition. New York: Guilford.

Chakraborty J, Bosman M (2005) Measuring the digital divide in the US: Race, income and personal computer ownership. *Professional Geographer*, 57(3):395-410

Crossny, KB (2010), Is predatory mortgage lending spatially clustered? *Professional Geographer*, 62(2), 153-170.

Dall'Erba S. (2010) Spatial Autocorrelation. In *Encyclopedia of Human Geography*, eds R. Kitchen and N. Thrift. Mimeo.

Dupuy, G. & V. Stransky (1996) Cities and highway networks in Europe. *Journal of Transport Geography*, 4(2), 107-121.

Ebdon, D. (1985) *Statistics in Geography*, 2nd Edition. London: Blackwell. ch. 7

Haines-Young R. and Fish R. (2009) Hypothesis testing. In *Encyclopedia of Human Geography*, eds. R. Kitchen and N. Thrift. Elsevier.

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Levine N., Kim K, Nitz L (1995) Spatial analysis of Honolulu motor vehicle crashes I: Spatial patterns. *Accidents Analysis and Prevention*, 27(5):663-674.

Li W, Airress C, Chen ACC, Leong KJ, Reich V (2010). Katrina and migration: Evacuation and return by African-Americans and Vietnamese-Americans in an Eastern New Orleans suburb. *Professional Geographer*, 62(1), 103-118.

Margai F. (2001) Health risks and environmental inequity: A geographic analysis of accidental releases of hazardous materials. *Professional Geographer*, 53(3):422-434.

McPhearson A, McConnell J, Vance A, Vanchan V. (2006) The impact of US anti-terrorism policies on Canada-U.S. cross-border commerce: An exploratory study from Western New York and Southern Ontario. *Professional Geographer*, 58(3):266-277.

Oppong J. (1998), A vulnerability interpretation of the geography of HIV/AIDS in Ghana. *Professional Geographer*, 50(4), 437-448.

O'Sullivan, D. and Unwin, D. (2010). *Geographic Information Analysis*, 2nd Edition. New York: John Wiley.

Oyana TJ, Margai F (2010). Spatial patterns and health disparities in pediatric lead exposure in Chicago. *Professional Geographer*, 62(1), 46-65.

Ratliffe J, Breen C (2011) Crime diffusion and displacement: Measuring the side effects of police operations. *Professional Geographer*, 63(2), 230-243.

Suckling P., Walker A. (2006) Spatial and temporal characteristics of tornado path direction. *Professional Geographer*, 58(1), 20-38.

Tate, W. (2008) Geography of opportunity: Poverty, place and educational outcomes. *Educational Researcher,* 37, 397. http://edr.sagepub.com/cgi/content/abstract/37/7/397

Taylor P, Catalano G, Walker D (2002) Measurement of the world city network. *Urban Studies*, 39(13):2367-2376.

Wilson D. and Muller T. (2004) Representing "neighborhood": Growth coalitions, newspaper reporting and gentrification in St. Louis. *Professional Geographer*, 56(2):282-294.

Wolch J., Rahimian A., Koegel P. (1993) Daily and periodic mobility patterns of the urban homeless. *Professional Geographer*, 45(2), 159-169.

Wong, D. W. S. and Lee, J. (2005) *Statistical Analysis of Geographic Information with ArView and ArcGIS*. New York: John Wiley.

Wright, R., Ellis, M., Holloway, S., Wong, S. (2014) Patterns of racial diversity and segregation in the U.S.: 1990-2010. *Professional Geographer*, 66:2, 173-182.