Sociology 187.033
Principles and Methods of Geographic Information System

Fall, 2005
CIT 265
TH 4:00 – 6:20

Instructor

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Course Description

This course is intended to address a set of key questions regarding Geographic Information System and its applications in social sciences. What is GIS? Why do we use GIS? How do we use GIS? What kinds of questions can we address with GIS?

This course covers (a) the fundamental principles and methods of handling different types of geographic datasets, (b) the key analytical and modeling tools used in GIS, (c) the conceptual and theoretical development of GIS applications, (d) the methods and techniques of GIS spatial analysis, and (e) GIS as an additional dimension in social sciences. We will use real examples from published GIS applications addressing a wide-range of substantive research questions in various disciplines.

This course consists of two components: lectures and laboratory exercises. They are closely integrated. The lectures are designed to introduce the conceptual and theoretical aspects of GIS methods and principles that students will learn to experiment in the laboratory exercises.

Corresponding to contents of lectures, a series of topic-specific laboratory exercises with the necessary datasets will provide hands-on experiences in handling the geographic data and applying GIS methods. Laboratory exercises will be carried out with ArcGIS- a popular GIS software from ESRI and GeoDa- a special spatial analysis software. Both of them are installed on computers in CIT 265.

Each student is also required to practice their learning by designing and carrying out an independent course project. It is aimed to aid students to develop conceptual and theoretical understanding, and technical skills to practice GIS applications in the topic of their choice. As part of the project, students are expected to design a professional quality poster of 42” by 42” and write a short report.

Goals

By the end of the course, students should:
1) gain conceptual understanding of Geographic Information System and the logic of adding a spatial dimension to scientific research;
2) gain knowledge of GIS applications in the field of social science through selective readings;
3) acquire familiarity with underlying principles and methods of spatial data representation and presentation;
4) acquire analytical and computing skills to conduct spatial data exploratory analysis with specialty software.

Prerequisites: Knowledge of Microsoft Windows operating system, data handling in Excel and file management.

Course Materials:

Textbook: There are two textbooks required for this course: (a) *Geographic Information Systems and Science* and (b) *Principles of Geographical Information Systems*. The supplementary readings will be made available in PDF format through the course website.

Supplementary Readings:

Agumya, A. and Gary J. Hunter, 2002. "Responding to the Consequences of Uncertainty in Geographical Data." *International journal of geographical information science*, 16(5): 405-417. (S12)

Buzzelli, Michael, Michael Jerrett, Richard Burnett, and Norm Finklestein. 2003. "Spatiotemporal Perspectives on Air Pollution and Environmental Justice in Hamilton, Canada, 1985-1996." *Annals of the Association of American Geographers*, 93(3): 557-573. (S7)

Goodchild, M.F. 2004. "GIScience: Geography, Form, and Process." *Annals of the Association of American Geographers* 94(4): 709–714. (S1)

Gregory, Ian N. and Paul S. Ell. 2005. "Breaking the boundaries: geographical approaches to integrating 200 years of the census." *Journal of the Royal Statistical Society*, 168, *Part* 2: 419–437. (S8)

Kumar, Naresh. 2004. "Changing Geographic Access to and Locational Efficiency of Health Services in two Indian Districts between 1981 and 1996", *Social Science & Medicine* 58 (2004) 2045–2067. (S11)

Kwan, Mei-Po. 2002. Time, Information Technologies and the Geographies of Everyday Life. *Urban Geography*, 23(5):471-482. (S3)

Kwan, Mei-Po. 2000. “Interactive Geovisualization of Activity-Travel Patterns Using Three-Dimensional Geographical Information Systems: A Methodological Exploration with a Large Data Set.” *Transportation Research C*, 8:185-203. (S5)

Messner, Steven F., Luc Anselin, Robert D. Baller, Darnell F. Hawkins, Glenn Deane, and Stewart E. Tolnay. 1999. "The Spatial Patterning of County Homicide Rates: An Application of Exploratory Spatial Data Analysis." Journal of Quantitative Criminology, 15 (4):423-450. (S9)

Miller, H . and E. A. Wentz, 2003. “Representation and Spatial Analysis in Geographic Information Systems” *Annals of the Association of American Geographers*, 93(3): 574-594. (S2)

Sampson, Robert J. and Jeffrey Morenoff. 2004. Durable Inequality: Spatial Dynamics, Social Processes, and the Persistence of Poverty in Chicago Neighborhoods. In *Poverty Traps*, edited by Samuel Bowles, Steve Durlauf, and Karla Hoff. Princeton, N.J.: Princeton University Press. (S10)

Taylor, Peter J. and Graham Gudgin. 1976. "The Myth of Non-Partisan Cartography: A Study of Electoral Biases in the English Boundary Commission's Redistribution for 1955-70", in *Urban Studies*, No. 13, p.p. 13-25. (S6)

Tobler, W.R.1970. “A Computer Movie Simulating Urban Growth in the Detroit Region”, *Economic Geography*, 46, 2 (1970), pp. 234-240. (S4)

Course Requirements

Attendance is mandatory for both lectures and labs. Most lectures and laboratory assignments are integrated tightly and progress gradually. Thus, the knowledge of the previous lectures and skills acquired in the previous laboratory assignments are necessary for the subsequent lectures and laboratory exercises, respectively.

Evaluation will be based on five in-class quizzes (20%), six laboratory exercise reports (30%), five homework assignments (20%), and a course project (30% - report 20% and poster 10%).

Week	Date	Topic	Software	Reading
1	9/08	Introduction		
2	9/15	Definition and components of GIS		B,1; L,1; S1
3	9/22	Spatial representation- Geo-referencing	ArcGIS	L,5; S2
4	9/29	Forming visual reality- Geographic data in computer	ArcGIS	B,3; L,7,10;S3
5	10/06	Geometric Spatial relationship	ArcGIS	L, 3,4; S4
6	10/13	Cartography and Geovisualization- Spatial presentation	ArcGIS	L, 12-14; S5
7	10/20	Spatial relationship of data- an added dimension	ArcGIS	S6
8	10/27	Spatial analysis- spatial modelling	ArcGIS	L, 4,8,16; S7
9	11/03	Spatial analysis- spatial interpolation	ArcGIS	B, 5,6; S8
10	11/10	Spatial analysis- Exploratory Data Analysis	ArcGIS/GeoDa	S9
11	11/17	Spatial analysis- Autocorrelation and Regression	ArcGIS/GeoDa	S10
12	11/24	Thanksgiving recess		
13	12/01	Network analysis		S11
14	12/08	Uncertainties and errors in GIS		B, 9; L, 6; S12

B- Burrough, P.A. and R. A. McDonell. 1998. ***Principles of Geographical Information Systems***. New York: Oxford University Press.

L- Longley, P. A., M.F. Goodchild, D. J. Maguire and D. W. Rhind. 2001. ***Geographic Information Systems and Science***. John Wiley and Sons Ltd.

S- Supplementary readings.