

Economic Applications of Geographical Information Systems

Economics 483 – Fall 2011

Instructor: Julio Videras

Office: Kirner-Johnson 209

Office Phone: x4528

E-mail: jvideras

Office Hours: Tuesday 1PM – 4PM or by appointment

Lecture Times: MW 1PM – 2:15PM

Room: Kirner-Johnson 142

Content

This course introduces Geographical Information Systems (GIS) with applications to economic and social issues. We learn the fundamentals of mapping and spatial data analysis using a well-known software application (ArcGIS), and spatial analysis concepts and techniques. We apply spatial analysis methods to social and economic issues for which location matters. The topics include environmental justice, public health, food access, and economic and racial segregation.

We approach GIS as a set of concepts and skills for critical thinking. We use maps as analytical tools to visualize, explore, and analyze the distribution of socio-economic data in order to offer new insights into economic and social problems. A wide range of organizations now use GIS methods and software: Federal, state, and municipal agencies, non-for-profit organizations, private consulting firms, and academic centers. Examples of applications include public health, urban planning, environmental assessment, transport logistics, and hazard and emergency management.

Goals

- Students will learn the fundamentals of mapping and data analysis using GIS software. Essential GIS skills include: 1) Map design, 2) Obtaining and preparing data for ArcGIS, 3) Joining data to maps, 4) Creating thematic and categorical maps, 5) Attribute and location queries, 6) Creating geodatabases, and 7) GI analysis: identifying patterns, clusters, and relationships.
- Students will learn and apply basic concepts of spatial statistical analysis.
- Students will be able to read critically academic work that applies GI technology and concepts to examine social issues.
- Students will be able to incorporate GIS analysis and maps into their own projects; students will be able to advance their learning of GIS on their own or in a more advanced course.

Required textbook: Wilpen L. Gorr and Kristen S. Kurland, 2011, *GIS Tutorial 1: Basic Workbook*, ESRI Press, Redlands, California. (**GIST1**)

The tutorial includes a CD with the software (a 180-days training license). ArcGIS 10 is installed on all of the Windows public computers in the TE classrooms and labs that ITS manages, including KJ 142. Also available in: KJ 103, KJ 202, KJ 204, KJ 229, Writing Center, Levitt Center, Burke 001, and Science Center 3019.

Grading

Midterm Exam: 15%

Cumulative Final Exam: 20%

GIS Tutorial Assignments: 15%

State Portfolio Assignments: 30%

Presentations: 10%

Participation: 10%

Exam Schedule

Midterm Exam: Monday October 17th and Wednesday October 19th during scheduled class times

Final Exam: Thursday December 15, 9AM – 12PM

Late Work Policy

All assignments are due in class on the specified date. Each student is allowed one two-day grace period that allows you to turn in one assignment 48 hours late. Once you have exercised this option, you will not get credits for late assignments. Students cannot exercise this option for exams or presentations.

Behavior in the classroom

Being late for class and leaving class during lectures are disruptive behaviors. Plan to be on time and refrain from leaving the classroom unless it is absolutely necessary. Please, switch off your cell phones and any other electronic devices. I will ask students that use the computers during lectures for reasons unrelated to the course to excuse themselves from the classroom. Class attendance is important.

Accommodations

I request that any student with a documented disability needing academic adjustments or accommodations speak with me during the first two weeks of class. Students have the responsibility for requesting accommodations and services. All discussions will remain confidential. Students with disabilities should also contact Allen Harrison, Associate Dean of Students for Diversity and Accessibility in the Office of the Dean of Students (Elihu Root House; ext. 4021) who coordinates services for students with disabilities. For more information on disability services:

https://my.hamilton.edu/college/dean_of_students/accessibility/index.html

Assignments

The first set of assignments follows the chapters of the GIS Tutorial (week 2 – week 7).

The second set of assignments requires that you apply your knowledge of ArcGIS to specific themes and research questions. You will analyze data for one US state (from the following five states: CA, NY, NJ, FL, and PA). The unit of analysis will be counties and census tracts. You will examine socio-economic variables

(income, poverty, unemployment, racial/ethnic distribution, etc.), health outcomes, and exposure to environmental hazards; you will describe the spatial distribution of these variables and also perform spatial analysis of their distributions and relationships. By the end of the semester you will have a portfolio examining in detail several socio-economic variables, health outcomes, and environmental issues for the state that is the area of your analysis.

Presentations

Presentations based on readings: 10-minute presentation; you will present a summary of one academic article that utilizes GIS and perform spatial analysis. We will read these articles critically both for their use of GIS and spatial analysis and for their substantive research questions and policy implications. You need to address the discussion questions. Students who are not presenting are expected to read the article and ask informed questions or make informed comments.

State Portfolio: 20-minute presentation; you will select about ten maps that present relevant information about the state you have studied during the semester. You may choose a set of linked maps focusing on one issue or you may choose to present a broad view of social, health, and environmental characteristics of the state. You must make an appointment in the Oral Communications Center for a conference at least 48 hours before the presentation. You must send me the slides at least 24 hours before the presentation. Failing to meet these deadlines will affect your grade. Helpful information from the Oral Communication Center: <https://my.hamilton.edu/oralcommunication/guides.html>

Readings

Reading 1: Theodora Poulidou and Susan J. Elliott, 2010, "Individual and socio-environmental determinants of overweight and obesity in urban Canada," *Health & Place* 16, 389-398

Reading 2: Block, J. P., et al., 2004, "Fast food, race/ethnicity, and income: A geographic analysis," *American Journal of Preventive Medicine*, 27(3): 211-217

Reading 3: Jessee McEntee and Julian Agyeman, 2010, "Towards the development of a GIS method for identifying rural food deserts: Geographic access in Vermont, USA," *Applied Geography* 30, 165-176.

Reading 4: Gordon, C., et al., 2011, "Measuring food deserts in New York City's low-income neighborhoods," *Health & Place*

Reading 5: Kathryn M. Neckerman and co-authors, 2009, "Disparities in urban neighborhood conditions: Evidence from GIS measures and field observation in New York City," *Journal of Public Health Policy*, 30, 264-285.

Reading 6: Paul Mohai and Robin Saha, 2006, "Reassessing racial and socioeconomic disparities in environmental justice research," *Demography*, 43(2): 383-39

Reading 7: D. Parisi, M. Taquino, S.M. Grice, and D. A. Gill, 2004, "Civic responsibility and the environment: Linking local conditions to community environmental activeness," *Society and Natural Resources*, 17: 97-112.

Reading 8: R. H. Bark, D. E. Osgood, B.G. Colby, G. Katz, and J. Stromberg, 2009, "Habitat preservation and restoration: Do homebuyers have preferences for quality habitat?" *Ecological Economics* 68, 1465-1475.

Schedule

Week	Dates	Concepts	Readings	Assignments
1	August 29-31	Introduction		Assignment Week 1 due Sept 2
2	Sept 5-7	Map design and GIS output	GIST1: Chapter 2 & Chapter 3	3-1, 2-2 due Sept 9
3	Sept 12-14	Geodatabases and Spatial data	GIST1: Chapter 4 & Chapter 5	4-1, 5-2 due Sept 16
4	Sept 19-21	Geoprocessing	GIST1: Chapter 8	8-1 due Sept 23
5	Sept 26-28	Spatial analysis	GIST1: Chapter 9	9-2 due Sept 30
6	Oct 3-5	Kernel density map Model builder	GIST1: Chapter 11	11-2 due Oct 7
7	Oct 10-12	Review of essential skills		
8	Oct 17-19	In-Class Test		
9	Oct 24-26	Geographic distributions <ul style="list-style-type: none"> • Mean center • Central feature • Standard distance • Standard deviational ellipse 	Reading 1 & 2	
10 & 11	Oct 31 – Nov 2 Nov 7-9	Global statistics <ul style="list-style-type: none"> • Average nearest neighbor • Getis-Ord General G • Global Moran's I 	Reading 3 & 4	Assignment Weeks 9-10 due Nov 4 th ; Assignment Week 11 due Nov 11 th
12	Nov 14-16	Local statistics <ul style="list-style-type: none"> • G_i^* • Local Moran's I 	Reading 5 & 6	Assignment Week 12 due Nov 18 th
13	Nov 28-30	Analyzing geographic relationships <ul style="list-style-type: none"> • GWR 	Reading 7 & 8	Assignment Week 11 due Dec 2 nd
14	Dec 5-7	Presentations		

Assignments

Email your complete assignment, maps and write-up, to me by 11 PM Friday of each week assignments are due.

Week 1:

Surf the Web and find examples of

1. One-to-one dot map
2. Many-to-one dot map
3. Kernel density map
4. Choropleth map

For each map, explain why we can classify it as choropleth, kernel, etc.

In each case, briefly explain and comment on:

- a) The area used
- b) The data used (is it appropriate for the map? Count? Ratio?...)
- c) Classification scheme (if appropriate)
- d) Overall effectiveness of the map (it is as interesting to find good maps as it is to find ineffective maps, as long as you identify them as such)

Tutorial Assignments

Week 2: GIS Tutorial 1: Chapter 2 & Chapter 3: Assignments 2-2, 3-1

Week 3: GIS Tutorial 1: Chapter 4 and Chapter 5: Assignments 4-1, 5-2

Week 4: GIS Tutorial 1: Chapter 8: Assignment 8-1

Week 5: GIS Tutorial 1: Chapter 9: Assignment 9-2

Week 6: GIS Tutorial 1: Chapter 11: Assignment 11-2

State Portfolio Assignments

The next set of assignments requires that you apply the tools we have learned to describe and analyze the spatial distribution of socio-economic variables, health outcomes, and environmental hazards for a given state in the U.S. The unit of analysis will be counties and census tracts. You will display the spatial distribution of these variables and also perform spatial analysis of their distributions and relationships. You will start with data collection and processing tools, generating maps to display the variables of interest. Then, you will perform statistical analyses of the spatial distribution of these variables and their relationships. Each assignment will consist of a set of relevant maps and a paper that includes the steps you have taken to geoprocess the data and an informed description of the results.

Weeks 9-10: Collecting and mapping socioeconomic variables and health outcomes

- Create two poverty risk indices for counties and census tracts. You will follow tutorial 11-6 to construct the index (but you will not create a kernel density map).
- Once you have created the index for counties and the index for tracts, identify counties and tracts with high values of the index (top 10-percentile of the distribution).
- Using the data available on Blackboard on health outcomes at the county level; map the distribution of average life expectancy, low birth weight, uninsured, and a fourth variable of your choice (to map the data you need to join Excel table to boundary file);
- Address the following issues in your paper (3-5 pages plus maps):

- What are the characteristics of counties and tracts with high values of the poverty index? For example, are they mostly urban or rural?
- How do health outcomes seem to relate to the poverty risk index?

Data:

- Health Outcomes (county level): Excel file (CountyHealth.xlsx) in Blackboard.
- Socio-economic data (county and census tract level): download from Census.
- Boundary data: download from Census web page, TIGER page.

Week 11: Mapping environmental hazards

- Start with the shapefile for census tracts (for contiguous 48 states) and csv file that includes latitude and longitude for TRI facilities across the U.S.
- Map hazards into census tracts maps and join (calculating sum of TRI facilities). Query to select tracts in the state you are studying and save your file.
- Repeat the process for brownfields.
- Generate a dot map indicating where TRI facilities are located and a choropleth map with the count of facilities. Repeat for brownfields.
- Address the following issues in your paper (3-5 pages plus maps):
 - Visually examine the relationship between the spatial distribution of hazards and the distribution of the poverty index you created for the previous assignment, and describe.

Data:

- Environmental hazards file (XY data): Excel files available in Blackboard: geodata_tri.xlsx and geodata_brownfield.xlsx)
- Boundary data: downloaded from Census web page, TIGER page
- Poverty index: created in previous assignment

Week 12: Spatial Analysis of poverty index and environmental hazards

You will use the files you created for the previous two assignments to apply spatial analysis tools to the data.

- Calculate, and display when appropriate, the following global and local statistics for the poverty index and count of hazards at the census tract level:
 - Getis-Ord General G
 - Global Moran's I
 - G_i^*
 - Anselin local Moran's I
- Address the following issues in your paper (3-5 pages plus maps):
 - Describe the results of your analysis; is there evidence that the distribution of the poverty index and the distribution of hazards are not randomly distributed over space? Explain
 - Describe the patterns and clustering, if any, of the poverty index and environmental hazards.
 - Do the pattern of clusters for the poverty index and hazards seem to coincide?

Data available:

- Poverty index data and environmental hazard data from previous assignments

Week 13: Spatial relationships: Environmental hazards and socio-economic variables

The goal of this assignment is to estimate linear regression models and GWR models to analyze the relationship between exposure to environmental hazards and health outcomes and socio-economic characteristics.

- Estimate a linear regression model with count of TRI facilities as the dependent variable and median household income, poverty index, and race/ethnicity shares as independent variables.
- Calculate Moran's I statistic on the model's residuals.
- Estimate a GWR model that follow the specification above and calculate Moran's I statistic on the residuals.
- Display the coefficient estimates.
- Address the following issues in your paper (3-5 pages plus maps):
 - Is the global model an appropriate relationship across your area of study?
 - Do local models explain environmental hazards equally well across all locations in your area of study?
 - Describe the spatial distribution of coefficients.

Boundary Files

To download shape files for census tracts boundaries:

1. Go to <http://www.census.gov/geo/www/tiger/tgrshp2010/usernotes.html>
2. Select Download Shapefiles
3. In Select a layer type, select Census Tracts, click Submit
4. In Census Tract (2010), select the state you are studying, click Submit
5. In box, select "All counties in one state-based file"
6. Save zip file and unzip in your class folder