

School of Public Policy and Leadership

PAF 780

Geographic Information System and Spatial Analysis for Public Affairs

Fall 2018

09:00-11:00 AM

Tuesdays & Thursdays

GUA 3202

Instructor:

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Or by Appointment
GUA 3117

Learning Outcome

Spatial Analysis for Population Geography provides graduate students the opportunity to learn the methods to perform explanatory spatial data analysis, in particular to describe the spatial structure of socioeconomic and demographic dynamics using GIS technologies. Students will also learn how to analyze and develop policy implications from spatial analysis.

Explanatory Spatial Data Analysis (ESDA, thereafter) is an extension to traditional explanatory data analysis (EDA, thereafter). Thanks to the rapid development of computer and visualization technologies, the ability to study spatial issues in social science with visualization techniques enhances dramatically. At the same time, the emerging importance of spatial data analysis is another factor which has stimulated the development of ESDA.

Classes will be held in a lecture/discussion format twice a week and help sessions will be organized as needed. In addition to attending class on a regular basis, taking an active role in class discussions and being prepared for class, students are required to complete a term project with a presentation and a term paper at the end of the semester, and weekly assignments to learn how to use GeoDa software throughout the semester.

Students are recommended to use own datasets for the weekly assignments and a term paper throughout the semester.

Some prior experience with census Summary Files and with GIS software is useful, but neither is a prerequisite. Students who do not have any experience with ESRI's suite of GIS software packages are encouraged to gain some facility with these during the course of this semester. We will also emphasize the utility of GeoDa (developed by Dr. Luc Anselin of The Center for Spatial Data Science at University of Chicago) exploratory spatial data analysis software and TerraSeer's SpaceStat regression software. Students familiar with other GIS and statistical software may use these tools – indeed will be encouraged to share their skills with the class.

Software and Class Materials

GeoDa is the latest incarnation in a long line of software tools. For the lab sessions of this class, students will use GeoDa software which is designed to implement techniques for exploratory spatial data analysis (ESDA) on lattice data (points and polygons). GeoDa is a freeware you can download from the following URL with the workbook tutorials:

<https://spatial.uchicago.edu/software> (software)
<http://geodacenter.github.io/documentation.html> (workbook)

All the other class materials including weekly readings and lecture notes will be available from the class web site.

Reading List

There is no required textbook for this class. A list of readings for lectures and labs is listed below and also available from the class web site.

Anselin, L. 1999. Interactive techniques and exploratory spatial data analysis. In P. Longley, M. Goodchild, D. Maguire and D. Rhind (Eds.), *Geographical Information Systems 2nd Ed.*, pp. 25-264. New York, Wiley. *

Anselin, L. 1999. The future of spatial analysis in the social sciences. *Geographical Information Sciences* 5 (2): 67-76

Anselin, L. 1988. *Spatial Econometrics*. Boston: Kluwer Academic, Ch. 3, pp. 16-26.

Anselin, Luc, and Anil Bera. 1998. "Spatial Dependence in Linear Regression Models with an Introduction to Spatial Econometrics." Chapter 7 (pp. 237-289) in Aman Ullah and David Giles (eds.) *Handbook of Applied Economic Statistics* (New York: Marcel Dekker.)

Anselin, L., Y-W Kim and I. Syabri. 2004. Web-based analytical tools for the exploration of spatial data. *Journal of Geographical Systems* 6, 197-218. *

Anselin, L., I. Syabri and O. Smirnov. 2002. Visualizing multivariate spatial correlation with dynamically linked windows. In L. Anselin and S. Rey (Eds.), *New Tools in Spatial Data*

Analysis, Proceedings of a Workshop. Center for Spatially Integrated Social Science, University of California, Santa Barbara (CD-ROM).

Assuncao, R. and E. Reis. 1999. A new proposal to adjust Moran's I for population density. *Statistics in Medicine* 18, 2147-2162.

Cliff, A. and J.K. Ord. 1981. *Spatial Processes*. London: Pion, pp. 17-19.

Fotheringham, A.S., C. Brunsdon and M. Charlton. 2002. *Geographically Weighted Regression*. West Sussex: John Wiley & Sons, Ltd.

Fotheringham, A.S., C. Brunsdon and M. Charlton. 2000. *Quantitative Geography, Perspectives on Spatial Data Analysis*. Sage Publications.

Goodchild, M.F., L. Anselin, R. Appelbaum and B. Harthorn. 2000. Toward spatially integrated social science. *International Regional Science Review* 23, 139-159.

Goodchild, M.F., and D.G. Janelle. 2004. Thinking spatially in the social sciences. In: Goodchild, M.F., Janelle, D.G (eds.) *Spatially Integrated Social Science*. Oxford University Press

Lance Waller and Carol Gotway (2004). *Applied Spatial Statistics for Public Health Data*. Wiley.

Longley, P., M.F. Goodchild, D. Maguire and D. Rhind. 2001. *Geographic Information Systems and Science*. Wiley.

Ormsby, T., E. Napoleon, R. Burke, C. Groessl, and L. Feaster. 2004. Getting to know ArcGIS desktop, 2nd Edition. ESRI Press

Upton, G. and B. Fingleton (1985). *Spatial Data Analysis by Example*. Chichester: Wiley, Chapter 3, pp. 151-158 and pp. 170-171. *

Course Policies

Attendance

Students are expected to attend all lectures and exams, and they are individually responsible for all materials presented. According to university policy, students missing more than two of our once-a-week classes may be automatically dropped from the course. For this reason, students are urged to notify the Professor when circumstances prohibit regular attendance (i.e., prolonged illness, collegiate activities, etc.). (Note: All holidays or special events observed by organized religions will be honored for those students who show affiliation with that particular religion. Absences pre-approved by the UA Dean of Students (or Dean's designee) will be honored).

Mandatory Final Examination

The final exam is required to receive a passing grade in the course. Any student not taking the final examination will receive a grade of "E" for the course or be granted an incomplete ("I") for the semester by **prior arrangement** due to extraordinary circumstances.

No Make-up Examinations

Students must take examinations during the regularly scheduled lecture period on the dates designated in the “Course Outline.”

Disabilities

Students with disabilities that may affect their learning need to alert instructors during the first two weeks of the class. Accommodations will be made for these individuals.

Grading

Final grades will be calculated as follows:

Class Participation	=	15%
Weekly Assignment	=	35%
Presentation	=	20%
Term Paper	=	30%

Term Project

You may work on this term project as an individual or a group. The number of students in a group should not exceed three. By the end of week 2, submit the dataset you will use for the term project. The dataset you choose will be also used for your weekly assignments. It is recommended to use the dataset related to the regional demographic characteristics such as population distribution by ethnic groups, education level, income level and etc. in the US. At the end of the semester, we will make a presentation with the ESDA on your spatial dataset and submit a term paper with the relevant maps and other results from the ESDA.

Weekly Assignment

There are ten weekly assignments throughout the semester. As noted above, you are recommended to use the dataset that you choose for the term project. By doing so, you will be able to utilize the analyses from the weekly assignments for your term project. You are supposed to submit the weekly assignment by the beginning of the next lab session. Late homework will be penalized 5% per day. Homework more than a week late will not be accepted.

University Policy

Academic Misconduct – Academic integrity is a legitimate concern for every member of the campus community; all share in upholding the fundamental values of honesty, trust, respect, fairness, responsibility and professionalism. By choosing to join the UNLV community, students accept the expectations of the Academic Misconduct Policy and are encouraged when faced with choices to always take the ethical path. Students enrolling in UNLV assume the obligation to conduct themselves in a manner compatible with UNLV's function as an educational institution.

An example of academic misconduct is plagiarism. Plagiarism is using the words or ideas of another, from the Internet or any source, without proper citation of the sources. See the *Student Academic Misconduct Policy* (approved December 9, 2005) located at: <http://studentconduct.unlv.edu/misconduct/policy.html>.

Copyright – The University requires all members of the University Community to familiarize themselves and to follow copyright and fair use requirements. **You are individually and solely responsible for violations of copyright and fair use laws. The university will neither protect nor defend you nor assume any responsibility for employee or student violations of fair use laws.** Violations of copyright laws could subject you to federal and state civil penalties and criminal liability, as well as disciplinary action under University policies. Additional information can be found at: <http://www.unlv.edu/committees/copyright/>.

Disability Resource Center (DRC) – It is important to know that over two-thirds of the students in the DRC reported that this syllabus statement, often read aloud by the faculty during class, directed them to the DRC office.

The Disability Resource Center (DRC) coordinates all academic accommodations for students with documented disabilities. The DRC is the official office to review and house disability documentation for students, and to provide them with an official Academic Accommodation Plan to present to the faculty if an accommodation is warranted. Faculty should not provide students accommodations without being in receipt of this plan.

UNLV complies with the provisions set forth in Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1990, offering reasonable accommodations to qualified students with documented disabilities. If you have a documented disability that may require accommodations, you will need to contact the DRC for the coordination of services. The DRC is located in the Student Services Complex (SSC-A), Room 143, and the contact numbers are: Voice (702) 895-0866, fax (702) 895-0651. For additional information, please visit: <http://drc.unlv.edu/>.

Religious Holidays Policy -- Any student missing class quizzes, examinations, or any other class or lab work because of observance of religious holidays shall be given an opportunity during that semester to make up missed work. The make-up will apply to the religious holiday absence only. It shall be the responsibility of the student to notify the instructor no later than the last day at late registration of his or her intention to participate in religious holidays which do not fall on state holidays or periods of class recess. This policy shall not apply in the event that administering the test or examination at an alternate time would impose an undue hardship on the instructor or the university which could not be avoided. For additional information, please visit: <http://catalog.unlv.acalog.com/content.php?catoid=1&navoid=44&bc=1>

Tutoring -- The Academic Success Center (ASC) provides tutoring and academic assistance for all UNLV students taking UNLV courses. Students are encouraged to stop by the ASC to learn more about subjects offered, tutoring times and other academic resources. The ASC is located across from the Student Services Complex, #22 on the current UNLV map. Students may learn more about tutoring services by calling (702) 895-3177 or visiting the tutoring web site at: <http://academicsuccess.unlv.edu/tutoring/>.

UNLV Writing Center – *The following statement is recommended for inclusion in course syllabi:*

One-on-one or small group assistance with writing is available free of charge to UNLV students at the Writing Center, located in CDC-3-301. Although walk-in consultations are sometimes available, students with appointments will receive priority assistance.

Appointments may be made in person or by calling 895-3908. The student's Rebel ID Card, a copy of the assignment (if possible), and two copies of any writing to be reviewed are requested for the consultation. More information can be found at: <http://writingcenter.unlv.edu/>

Rebelmail – By policy, faculty and staff should e-mail students' Rebelmail accounts only. Rebelmail is UNLV's Official e-mail system for students. It is one of the primary ways students receive official university communication such as information about deadlines, major campus events, and announcements. All UNLV students receive a Rebelmail account after they have been admitted to the university. Students' e-mail prefixes are listed on class rosters. The suffix is always @unlv.nevada.edu.

Any other class specific policies (e.g., absences, make-up exams, extra credit policies, plagiarism/cheating consequences, policy on pagers/mobile phones, specialized department or college tutoring programs, bringing children to class, policy on recording classroom lectures, etc.)

Course Schedule*

Week 1	<ul style="list-style-type: none"> ▪ Introduction
Week 2	<ul style="list-style-type: none"> ▪ Lecture: Spatial Analysis in Social Science <ul style="list-style-type: none"> ○ Scale Issues in Social Science ○ Importance of Space in Regional Science <p>Reading: Goodchild & Janelle (2004), Anselin (1999)</p>
Week 3	<ul style="list-style-type: none"> ▪ Lecture: Spatial Data and Data Management <p>Reading: Ch13. in Longley et al. and GoodChild et al. (2000)</p> <ul style="list-style-type: none"> ▪ Lab: Exploring ArcMap & Spatial Data Manipulation <p>Ch3. & Ch4. in Ormsby et al. and Ch4., Ch5. and Ch6. from GeoDa Workbook</p> <p>Assignment (1): Lab Exercises from GeoDa Workbook (Ch4.~Ch.6)</p>
Week 4	<ul style="list-style-type: none"> ▪ Lecture: Advanced Mapping and Statistical Maps <p>Reading: Ch12. in Longley et al. (2001)</p> <ul style="list-style-type: none"> ▪ Lab: ESDA & Geovisualization <p>Ch11.~Ch12. from GeoDa Workbook</p> <p>Assignment (2): Lab Exercises from GeoDa Workbook (Ch11, and 12)</p>
Week 5	<ul style="list-style-type: none"> ▪ Lecture: Explanatory Data Analysis with Spatial Data and Advanced Tools <p>Reading: Ch4. in Fotheringham et al. (2000)</p> <ul style="list-style-type: none"> ▪ Lab: EDA Basics, Linking & Brushing, Scatter Plots and Maps <p>Ch7.~Ch8. from GeoDa Workbook</p> <p>Assignment (3): Lab Exercises from GeoDa Workbook (Ch7, and 8)</p>
Week 6	<ul style="list-style-type: none"> ▪ Lecture: Multivariate Explanatory Data Analysis with Spatial Data <ul style="list-style-type: none"> ▪ Lab: Multivariate EDA Basics & Advanced Multivariate EDA <p>Ch9.~Ch10. from GeoDa Workbook</p> <p>Assignment (4): Lab Exercises from GeoDa Workbook (Ch9, and 10)</p>
Week 7	<ul style="list-style-type: none"> ▪ Lecture: Rate Smoothing <p>Reading: Anselin, Kim and Syabri (2004)., and Ch 4 in Waller and Gotway (2004).</p> <ul style="list-style-type: none"> ▪ Lab: Basic Rate Mapping & Rate Smoothing <p>Ch13.~Ch14. from GeoDa Workbook</p> <p>Assignment (5): Lab Exercises from GeoDa Workbook (Ch13, and 14)</p>
Week 8	<ul style="list-style-type: none"> ▪ Lecture: Spatial Autocorrelation and Spatial Weights <p>Reading: Ch. 3, pp. 16-26 in Anselin (1988) and Cliff and Ord (1981)</p> <ul style="list-style-type: none"> ▪ Lab: Constructing Spatial Weights & Spatially Lagged Variables <p>Ch15., Ch16. and Ch17. from GeoDa Workbooks</p> <p>Assignment (6): Lab Exercises from GeoDa Workbook (Ch15, 16 and 17)</p>
Week 9	<ul style="list-style-type: none"> ▪ Lecture: Spatial Autocorrelation – Global Statistics <p>Reading: Upton and Fingleton (1985) & Assuncao and Reis (1999)</p> <ul style="list-style-type: none"> ▪ Lab: Global Spatial Autocorrelation <p>Ch18. from GeoDa Workbooks</p> <p>Assignment (7): Lab Exercises from GeoDa Workbook (Ch18)</p>
Week 10	<ul style="list-style-type: none"> ▪ Lecture: Spatial Autocorrelation – Local Statistics <p>Reading: Anselin, Syabri and Smirnov (2002)</p> <ul style="list-style-type: none"> ▪ Lab: Local Spatial Autocorrelation <p>Ch19. from GeoDa Workbooks</p> <p>Assignment (8): Lab Exercises from GeoDa Workbook (Ch19)</p>

Week 11	<ul style="list-style-type: none"> ▪ Lecture: Spatial Analysis for Rates and Multivariate Spatial Autocorrelation Reading: Anselin, Syabri and Smirnov (2002) <ul style="list-style-type: none"> ▪ Lab: Rate Analysis & Bivariate Spatial Autocorrelation Ch20. and Ch21. from GeoDa Workbooks Assignment (9): Lab Exercises from GeoDa Workbook (Ch20 and 21)
Week 12	<ul style="list-style-type: none"> ▪ Lecture: Spatial Regression Basics Reading: Ch2. in Fotheringham et al. (2002) <ul style="list-style-type: none"> ▪ Lab: Regression Basics and Diagnostics Ch22. and Ch23. from GeoDa Workbooks Assignment (10): Lab Exercises from GeoDa Workbook (Ch22 and 23)
Week 13	<ul style="list-style-type: none"> ▪ Lecture: Model Specification in Spatial Regression Reading: Anselin and Bera (1998) <ul style="list-style-type: none"> ▪ Review for the Term Paper
Week 14	November 19 – November 23 Thanksgiving Break
Week 15	Student Presentation (I)
Week 16	Student Presentation (II) Term Paper due date

* Course schedule and contents are subject to change.