POS 6743: Geographic Tools for Political Science Research

Mondays 6:00pm – 8:50pm - HPH 310/Zoom - Fall 2020

Instructor: Konstantin Ash (Konstantin.Ash@ucf.edu) Office Hours: Mondays and Thursdays 3-5p or by appt. through Skype

Course Description

The manipulation and analysis of geographic data is an increasingly important skill in both academic political science and in private and public sector employment. The goal of this class is to provide an introduction to geographic data and various programs used to both create, examine, alter and analyze geographic data, including ArcGIS and R. Students will be introduced to ways of both creating data-sets with geographic components and extracting geographic data from existing geo-coded sources.

The course is divided into two parts: the first part will cover basic data manipulation in ArcGIS and then in R, while the second introduces R as a way of conducting statistical analysis through regression and accounting for space in regression analysis. No prior knowledge of any statistical or programming language or statistical analysis is required for the course and at least one week will be devoted to teaching each concept/program.

At the end of the course, there will be an inferential research component. You will be asked to gather your own geographic data and analyze it using statistical methods to test a relationship of your choice. There are deadlines throughout the course, ranging from submission and approval of the research topic to submission of the data to be used in the project in advance.

Mode of Administration

The course is currently listed as an RS – reduced seat time course. In-person attendance is purely optional for all courses. There will be a Zoom stream of all courses where students can participate remotely. The option to attend in-person is available primarily for the first four courses, where students who cannot install ArcGIS on their personal computers and may have issues with the UCF Apps option may find it beneficial to attend in-person classes in the computer lab. After the fourth class, my plan is to go fully remote for the rest of the semester.

Assignments

Homework Assignments

There are five homework assignments due throughout the semester, at the beginning of the class noted on the course schedule, unless stated otherwise. Each will be non-cumulative examinations of recently taught skills. Homework assignments will be assigned two weeks before they are due. Each assignment will be worth 10% of the final class grade.

Research Paper

The research paper will be a way of combining each of the three sections of the course into one cohesive project. The requirements are to 1) have a research question that can be answered through the use of geographic data, 2) include data obtained both through standard rasters and/or shapefiles and through remote sensing using Google Earth Engine 3) utilize inferential statistics covered in the last third of the class to test for a significant relationship using the geographic data and including methods to account for the geographic nature of the data in a statistical model.

The research paper does not need to be fully fleshed out and need not include an extensive literature review or theory section - there should just be enough to give the reader an idea of why the research question is important and needs to be answered and how this study differs from previous efforts to answer the question. However, it does need to clearly present a research design that shows understanding of statistical analysis, a justification of the data used in the statistical analysis with a clear narrative about how the data was obtained, and a clear presentation of the results of the analysis. Visualizations, including maps that illustrate either descriptive or inferential statistical findings should be included whenever possible. These visualizations should be clear and expand a reader's understanding of your subject and design. The paper will be graded on the extent to which these components are successfully executed. There is no maximum or minimum page limit.

In addition to the paper, students are required to submit replication code for any work they have done on the paper in R and Google Earth Engine, including data extraction and analysis, as a supplemental file to the paper submission.

A prospective research question for the paper and a description of relevant data to be extracted using ArcGIS/R is due on November 2 before the beginning of the day's class. The research paper is due on **Saturday, December 12, 2020 @ 12:00pm**.

Presentation

Students are required to present their research paper on the last day of class (November 30, 2018). The paper does not need to be written, but the bulk of data-gathering and statistical analysis should be completed by that time. The gap between the presentation and when the paper is due is designed so that students may receive feedback on their work and then address that feedback before the final paper is due

Plagiarism

There is a ZERO tolerance policy on plagiarism. If you are found having copied any substantial portion of your paper from other sources without having first accredited them, you will either have large amounts

of points deducted from your paper grade or will fail the class altogether. Please consult the UCF Office of Student Conduct's Rules of Conduct for more information.

Computer Programs

The readings for the class will be posted on WebCourses. There will be two required computer programs that you must either download to your personal computer or use in the computer labs. It will make your life a lot easier to get these on your personal computer.

- **R** - a statistical computing program, which can both visualize and analyze geographic data and maps. Download R here: https://cran.r-project.org/bin/windows/base/. Download R Studio, a very helpful wrapper for the R GUI here: https://www.rstudio.com/
- **ArcGIS** is our paid app. It is available in this computer lab and the one on the third floor. There may be others on campus. I have also already contacted you about a free student version that you can place on your personal computer for one year. Please talk to me if you have not heard anything.

There are several other mapping that we will not be using, but that may help you become more familiar with:

- **Google Earth Engine** - Google's means of analyzing geographic data through Google Earth, includes a large data-base of spatial maps from remote sensing sources. Access the explorer, which is a drop-down menu-type program, here: https://explorer.earthengine.google.com/#workspace and the Code Engine here https://code.earthengine.google.com/. You need to request access beforehand to use the code engine.
- **Google Earth Pro** - Google's visualization app for desktops. Available for free download here.
- **QGIS** - A free open-source and somewhat inferior version of ArcGIS. If your subscription to ArcGIS expires after taking this class, this may be a good alternative. Available here: https://qgis.org/en/site/
- **Python** - A statistical programming language embedded into ArcGIS. While we will not be using Python when using ArcGIS, it does expedite commands and allow for replication and more complex use of ArcGIS as compared to just using the menus.

Grade Breakdown

Research Paper – 40%
Five Homework Assignments – 10% each
Presentation – 10%

Course Schedule and Readings

Week 1 (August 24) - Introduction, Geographic Research and its use in political science

Topics Covered:

- Rationale for learning geographic data analysis

- Definitions: shapefiles, rasters, georeferencing
- Importing shapefiles, tabular data and rasters into ArcGIS
- Geocoding rasters from non-georeferenced image data

Reading:

- Wilpen L. Gorr and Kristen S. Kurland. GIS Tutorial 1 Basic Workbook. Ch. 1
- David W. Allen and Jeffery M. Coffey. GIS Tutorial 3 Adv. Workbook. Ch. 4

Week 2 (August 31) - Feature Analysis

Topics Covered:

- Creating features from raster data
- Feature Analysis: buffer, intersect, clip, project, dissolve, etc.

Reading:

- Wilpen L. Gorr and Kristen S. Kurland. GIS Tutorial 1 Basic Workbook. Chs. 8-9.

Homework 1 Assigned

Week 3 (September 14) - Zonal Statistics

Topics Covered:

- Extracting Zonal Statistics from rasters using shapefiles
- Raster analysis and manipulation

Reading:

- Wilpen L. Gorr and Kristen S. Kurland. GIS Tutorial 1 Basic Workbook. Ch. 11

Homework 1 Due before start of class

Homework 2 Assigned

Week 4 (September 21) - Raster Interpolation and Map Design

Topics Covered:

- Raster interpolation
- Designing informative maps in ArcGIS

Reading:

- David W. Allen and Jeffery M. Coffey. GIS Tutorial 3 Adv. Workbook. Ch. 9

Week 5 (September 28) - R Tutorial

Topics Covered:

- Basics of using R
- Variables: vectors, matrices; Functions, loops, data manipulation.

Reading:

- R is an open-sourced program that amalgamates many user-made packages. Because the help files are incoherent to the layman and non-layman alike. Many people have made tutorials. Utilize at your own discretion.

Homework 2 Due before start of class

Week 6 (October 5) - Geographic Data using R

Topics Covered:

- Inputing shapefiles and rasters into R; feature analysis in R

Reading:

- Roger S. Bivand, Edzer Pebesma, Virgilio Gomez-Rubio. 2013. Applied Spatial Data Analysis with R. Springer. 2nd ed. Chapters 3, 5.

Homework 3 Assigned

Week 7 (October 12) - Geographic Data using R Continuted

Topics Covered:

- Zonal statistics and making maps in R

Reading:

- Roger S. Bivand, Edzer Pebesma, Virgilio Gomez-Rubio. 2013. Applied Spatial Data Analysis with R. Springer. 2nd ed. Chapter 8.

Week 8 (October 19) - Statistics Tutorial

Topics Covered:

- Applications of regression analysis.
- BLUE, Least Squares, multivariate OLS regression.
- Violations of Regression Assumptions and what to do about it.

Reading:

- Allison, Paul D. Multiple Regression: A Primer. Pine Forge Press. 1998. Whole thing, but focus on Chs. 1, 6 and 9.

Homework 3 Due before start of class

Week 9 (October 26) - Statistics Tutorial Continued

Topics Covered:

- Interactions, fixed effects and clustered standard errors
- Non-Linear regression models.
- Statistics computing in R and practicum

Homework 4 Assigned

Week 10 (November 2) - Evaluating Spatial Dependence

Topics Covered:

- Methods of extracting neighbor information
- Creating spatially weighted matrices
- Methods of extracting neighbor information
- Evaluating dependence across data structures

Reading:

- Kristian Gleditsch and Michael Ward. 2007. An Introduction to Spatial Regression Models in the Social Sciences. Chapter 1.

Research Paper: research question and sources of data due before class

Week 11 (November 9) - Spatial Regression Models Part 1

Topics Covered:

- Moran's I statistic
- Spatially lagged regression models

Reading:

- Kristian Gleditsch and Michael Ward. 2007. An Introduction to Spatial Regression Models in the Social Sciences. Chapter 2.

Homework 4 Due before start of class

Homework 5 Assigned

Week 12 (November 16) - Spatial Regression Models Part 2

Topics Covered:

- Spatial error model
- Spatial dependence with panel data
- Lab to work on papers

Reading:

- Kristian Gleditsch and Michael Ward. 2007. An Introduction to Spatial Regression Models in the Social Sciences. Chapter 3.

Week 13 (November 23) - Lab to work on final papers

Homework 5 Due before lab session

Week 14 (November 30) - Video Presentations on Research Project

Final Paper Due on Saturday, December 12, 2017 @ 12:00pm