Instructor: Yuri M. Zhukov, GCIS E-207, Phone: 617-495-0989

Office Hours: 0:00-0:00 AM, TTh and by appointment.

Course Description: This course offers an introduction to two inter-related topics: (1) geographical information systems and (2) network analysis. Both topics are built on the proposition that the behavior and attributes of individual units (e.g. people, organizations, cities, countries) depend on their physical or social context. The goal of the course is to provide students with the background necessary to visualize, manipulate and analyze spatially-referenced or network data, evaluate literature that employs these methods, and apply these methods to their own research. Our focus will be on methods and topics of most direct relevance to political science, including voting, conflict, migration, organizational learning, and international political economy.

The course is organized into one 80-minute lecture/discussion per week, and one 80-minute software tutorial. The lectures will cover network theory and basic spatial/network statistics, with an emphasis on applications in the social sciences. After week 3, each lecture will be followed by 5-10 minute student presentations on assigned readings. The tutorials are designed to equip students with the practical tools needed to collect, manage and visualize geostatistical and network data, and implement basic statistical analyses and models.

Prerequisites: Students are expected to have a rudimentary background in statistics, up to and including linear regression. Experience with statistical computing (e.g. MATLAB, R, S-PLUS, SAS, SPSS, STATA) is also helpful. Students without this background must obtain the instructor’s permission prior to enrolling in the course. We will try to cover the main topics without using complex mathematics, but will provide pointers to students who want to explore them in more technical depth.

Software: We will use the R statistical programming language for all tutorials and problem sets. R is a free, cross-platform software environment for statistical computing and graphics. A background in R is helpful, but not required. Students who would like to get a head start are encouraged to download the software here (http://cran.us.r-project.org/), and consult the introductory tutorial (http://cran.r-project.org/doc/manuals/R-intro.pdf). Some students may prefer the slightly more user-friendly GUI, R Studio (http://www.rstudio.com/). Code and data for all tutorials will be made available through the course website. For additional background on statistical computing with R, see


Grade Policy: Grades will be based on 5 problem sets (40%), a final project (40%), and participation in classroom discussions (20%). The final project will be a term paper, 15-20 pp. (25-30 pp. for graduates). Paper topics – to be negotiated directly with the instructor – must involve an
application of spatial or network analysis to a substantive topic of interest. Collaboration within
study groups is permitted on problem sets, although students are required to submit individual
homeworks. Projects may be executed individually or in small (2-3 person) groups, with the under-
standing that higher expectations (i.e. tougher grading standards) will apply to group assignments.

Important Dates:

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<tr>
<th>Event</th>
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<tr>
<td>Drop Deadline</td>
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<td>Add Deadline</td>
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<td>PS1 Due</td>
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<td>Project Proposal Due</td>
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<td>PS4 Due</td>
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<td>PS5 Due</td>
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<td>Final Project Due</td>
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Class Schedule:

1. **Course introduction** .......................... Day, Month, Year

Theory:


Application:


Recommended:


**Tutorial: Introduction to R** .......................... Day, Month, Year
2. Basics of Geographic Analysis ................................. Day, Month, Year

Theory:


Application:

• Brady, Henry E. and John E. McNulty. “Turning out to vote: The costs of finding and getting to the polling place.” American Political Science Review, 105.


Recommended:


Tutorial: Working with Spatial Data ............................... Day, Month, Year

3. Basics of Network Analysis ................................. Day, Month, Year

Theory:


Application:


Recommended:


Tutorial: Working with Network Data ............................... Day, Month, Year

4. Spatial Dependence .................................. Day, Month, Year

Theory:


Application:


Recommended:


Tutorial: Measuring Spatial Dependence

5. Network Centrality

Theory:

• Wasserman and Faust, Social Network Analysis: chapter 5.

Applications:


Recommended:


Tutorial: Measuring Network Centrality

6. Point Processes and Geostatistics

Theory:

**Application**


**Recommended:**


**Tutorial: Point Processes**

7. **Spatial and Network Regression**


**Application:**


**Recommended:**


**Tutorial: Fitting spatial regressions**
8. *Exponential random graph models* ........................................ Day, Month, Year

Theory:


Application:


Recommended:


*Tutorial: Fitting ERGMs* ......................................................... Day, Month, Year

9. *Student Presentations I* ....................................................... Day, Month, Year

10. *Student Presentations II* ..................................................... Day, Month, Year