

# **Data Science Tools for Evidence-based Policy**

**UAPP 667-011**

Prof. Gregory Dobler

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Course website: TBD

Office hours: TBD

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## **Date and Time**

Winter 2020

Times: Mon/Wed/Fri, 3:00pm – 5:00pm

Location: TBD

## **Course Description**

As societal data has become increasingly ubiquitous and accessible, there has been a rapid growth in the opportunity to utilize evidence-based decision making in public policy for a variety of tasks including planning, performance evaluation, and comparative analysis. At the same time, the recently established field of Data Science is focused on developing methods and tools to extract insight, understanding, and evidence from diverse and often large data sets. This course will introduce students to those tools and techniques for working with data in the context of evidenced-based policy, focusing on how data is accessed, handled, analyzed, and visualized. Topics covered will include: an introduction to Python, R, and Data Science; accessing and working with policy-relevant data; data structures (including geospatial information); basic statistics and analysis; and data visualization.

## **Course Goals**

This course will:

- provide an overview of data science (DS) concepts that are important for evidence-based decision making in public policy including inferential reasoning with data,
- introduce students to a set of tools for acquiring and analyzing public/private/academic data that can be used to assess the impacts of policy decisions and guide policy design,
- present topics that are foundationally important to data use in society such as the open data and open source ethos, reproducibility, (un)certainty, and bias.

Upon successful completion the student will be able to:

- access, analyze, and visualize policy-relevant data in a variety of formats from a broad range of sources using DS methods,
- effectively use software tools such as Python and R to apply DS techniques to real-world problems,
- present the results of policy-focused, data-driven analysis through data visualizations.

## Course Format

For most weeks, the Monday session will consist of a lecture-style introduction of new tools and techniques from DS and will introduce an example application of those to a data problem that is related to evidence-based policy and decision making. The Wednesday and Friday sessions will be hands-on, focused on accessing and working with the data for that application (Wednesday) and analysis, interpretation, and visualization (Friday) with DS methods. All sessions will be interactive and students should bring an internet-connected device on which it is easy to type; i.e., a laptop (recommended) or tablet+keyboard. Throughout the course, students will be directly analyzing and applying DS methods to data using the Python language (expertise or previous exposure to Python is **not** required).

## Recommended Prerequisites

UAPP 691 or equivalent; basic statistics; experience working with data through an analysis platform (Python, R, STATA, SAS, SPSS, etc).

## Recommended Materials

There will be no textbook, slides and handouts from class will constitute the bulk of the material. Reading will be assigned every lecture from relevant articles and papers.

## Performance Evaluation

Class participation and engagement : 15%

Weekly assignments : 25%

Midterm : 25%

Final : 35%

## Weekly Schedule

Week 1 1/6–2/12	DATA SCIENCE OVERVIEW Data use in public policy, public administration, and decision making; Analysis tools, data types, and data use cases; Basic statistics; (Multi-)Linear Regression; Introduction to Python Use case: Sea-level Rise
Week 2 1/13–1/19	THE OPEN DATA ECOSYSTEM AND REPRODUCIBILITY Public/Private/Academic Sector data availability and access; URL handling, munging, cleaning, missing data; version control with GitHub Use case: Social Media and Public Sentiment
Week 3 1/20–1/26	DATA VISUALIZATION Visualization types including plotting choice and visual representation of data; Interactive and web-based graphics; Mapping and color schemes Use case: Social Factors Affecting Energy Consumption and Use
Week 4 1/27–2/2	TIME SERIES ANALYSIS Identifying and removing trends; Anomaly detection; Interpolation and

extrapolation; Correlation and structure functions; Introduction to R and Tableau  
Use case: Ride-hailing Apps, Taxis, and Public Transportation

Week 5      SIMULATION AND (UN)CERTAINTY IN DECISION MAKING  
2/3–2/9      Monte Carlo methods; Drawing from distributions; Independent and identically  
distributed samples; Error bars and weighted regression  
Use Case: Gerrymandering and redistricting

## **Course and UD Policies**

### *Attendance*

Absences on religious holidays listed in university calendars is recognized as an excused absence. Nevertheless, students are urged to remind the instructor of their intention to be absent on a particular upcoming holiday. Absences on religious holidays not listed in university calendars, as well as absences due to athletic participation or other extracurricular activities in which students are official representatives of the university, shall be recognized as excused absences when the student informs the instructor in writing during the first two weeks of the semester of these planned absences for the semester.

### *Academic Integrity*

Please familiarize yourself with UD policies regarding academic dishonesty. To falsify the results of one's research, to steal the words or ideas of another, to cheat on an assignment, to re-submit the same assignment for different classes, or to allow or assist another to commit these acts corrupts the educational process. Students are expected to do their own work and neither give nor receive unauthorized assistance. Complete details of the university's academic integrity policies and procedures can be found at <http://www1.udel.edu/studentconduct/policyref.html> Office of Student Conduct, 218 Hulliher Hall, (302) 831-2117. E-mail: [student-conduct@udel.edu](mailto:student-conduct@udel.edu)

### *Harassment and Discrimination*

The University of Delaware works to promote an academic and work environment that is free from all forms of discrimination, including harassment. As a member of the community, your rights, resource and responsibilities are reflected in the non-discrimination and sexual misconduct policies. Please familiarize yourself with these policies at [www.udel.edu/oei](http://www.udel.edu/oei) . You can report any concerns to the University's Office of Equity & Inclusion, at 305 Hulliher Hall, (302) 831-8063 or you can report anonymously through UD Police (302) 831-2222 or the EthicsPoint Compliance Hotline at [www1.udel.edu/compliance](http://www1.udel.edu/compliance). You can also report any violation of UD policy on harassment, discrimination, or abuse of any person at this site: [sites.udel.edu/sexualmisconduct/how-to-report/](http://sites.udel.edu/sexualmisconduct/how-to-report/)

### *Faculty Statement on Disclosures of Instances of Sexual Misconduct*

If, at any time during this course, I happen to be made aware that a student may have been the victim of sexual misconduct (including sexual harassment, sexual violence, domestic/dating violence, or stalking), I am obligated to inform the university's Title IX Coordinator. The

university needs to know information about such incidents in order to offer resources to victims and to ensure a safe campus environment for everyone. The Title IX Coordinator will decide if the incident should be examined further. If such a situation is disclosed to me in class, in a paper assignment, or in office hours, I promise to protect your privacy--I will not disclose the incident to anyone but the Title IX Coordinator. For more information on Sexual Misconduct policies, where to get help, and how to reporting information, please refer to [www.udel.edu/sexualmisconduct](http://www.udel.edu/sexualmisconduct). At UD, we provide 24-hour crisis assistance and victim advocacy and counseling. Contact 302-831-1001, UD Helpline 24/7/365, to get in touch with a sexual offense support advocate.

For information on various places you can turn for help, more information on Sexual Misconduct policies, where to get help, and reporting information please refer to [www.udel.edu/sexualmisconduct](http://www.udel.edu/sexualmisconduct)

### *Inclusion of Diverse Learning Needs*

Any student who thinks he/she may need an accommodation based on a disability should contact the Office of Disability Support Services (DSS) office as soon as possible. The DSS office is located at 240 Academy Street, Alison Hall Suite 130, Phone: 302-831-4643, fax: 302-831-3261, DSS website ([www.udel.edu/DSS/](http://www.udel.edu/DSS/)). You may contact DSS at [dssoffice@udel.edu](mailto:dssoffice@udel.edu)

### *Non-Discrimination*

The University of Delaware does not discriminate against any person on the basis of race, color, national origin, sex, gender identity or expression, sexual orientation, genetic information, marital status, disability, religion, age, veteran status or any other characteristic protected by applicable law in its employment, educational programs and activities, admissions policies, and scholarship and loan programs as required by Title IX of the Educational Amendments of 1972, the Americans with Disabilities Act of 1990, Section 504 of the Rehabilitation Act of 1973, Title VII of the Civil Rights Act of 1964, and other applicable statutes and University policies. The University of Delaware also prohibits unlawful harassment including sexual harassment and sexual violence.

For inquiries or complaints related to non-discrimination policies, please contact:

Interim Director, Institutional Equity & Title IX Coordinator - Fatimah Stone  
[titleixcoordinator@udel.edu](mailto:titleixcoordinator@udel.edu), 305 Hullihen Hall Newark, DE 19716 (302) 831-8063

For complaints related to Section 504 of the Rehabilitation Act of 1973 and/or the Americans with Disabilities Act, please contact: Director, Office of Disability Support Services, Anne L. Jannarone, M.Ed., Ed.S. - [ajannaro@udel.edu](mailto:ajannaro@udel.edu) Alison Hall, Suite 130, Newark, DE 19716 (302) 831-4643 OR contact the U.S. Department of Education - Office for Civil Rights ([wdcrobcolp01.ed.gov/CFAPPS/OCR/contactus.cfm](http://wdcrobcolp01.ed.gov/CFAPPS/OCR/contactus.cfm))