W

EVANS SCHOOL
OF PUBLIC POLICY & GOVERNANCE

UNIVERSITY *of* WASHINGTON

PUBPOL 542: COMPUTATIONAL THINKING
FOR GOVERNANCE ANALYTICS

Prof. José Manuel Magallanes, PhD.

Winter 2020

E-mail: **magajm@uw.edu**
Office Hours: 11:30 - 13:00 (Tuesdays)

Website: **https://canvas.uw.edu**
Class Hours: 8:30-11:20 (Tuesdays)
Class Room: Condon Hall (CDH) 135

Course Description

This course is an innovative combination of Data Science and Computational Social Science particularly structured for policy studies. It introduces algorithmic thinking to policy students to solve problems related to data pre-processing, optimization via linear programming, and the modeling of governance complexity via agent-based simulation.

The participants will also develop good practices in reproducibility for professional work in policy research. Every session of the course follows a hands-on approach (laptops needed). Tools to be taught and used include:

- Programming languages (Python/R/Netlogo).

- Version control apps (GitHub).

- Document preparation tools (markdown/latex)

- Advanced spreadsheet functionality.

- Computational representation of governance complexity.

There is no pre-requisite for the course.

Course Objectives

1. Carry-out analytic work following a reproducibility/replicability approach.

2. Master basic data management and analysis principles.

3. Become an effective user of programming languages (without becoming a programmer!).

4. Be a reflective user of data science in complex governance settings.

5. Use computational tools to aid complex decision-making.

Course Book

Magallanes Reyes, J. M. (2017). *Introducing to data science for social and policy research: collecting to organizing data with R and Python*. Cambridge University Press, Cambridge, United Kingdom New York, USA Port Melbourne, Australia Delhi, India Singapore. OCLC: 998518603.

Recommended Readings

- Python Language Documentation: **https://www.python.org/doc/**

- R Manuals: **https://cran.r-project.org/manuals.html**

Software installations required

Students have to install the following software in their computers:

- ANACONDA by Continuum Analytics (choose according to your Operating System):
  https://www.continuum.io/downloads

- R (choose according to your Operating System):
  https://cran.r-project.org/

- RStudio Desktop Personal License (choose according to your Operating System)
  https://www.rstudio.com/products/rstudio/download/

- NetLogo (choose according to your Operating System)
  https://ccl.northwestern.edu/netlogo/download.shtml

- LATEX:
  https://www.latex-project.org/get/.

- ZOTERO:
  https://www.zotero.org, and then download the desktop app.

- GITHUB:
  Get an account at https://github.com/, and then download the desktop app.

- OPENSOLVER: If you have a gmail account, we will use it from there, so do not install it.

Evans School Community Conversation Norms

This course has adopted the Evans School Community Conversation Norms. Please be aware of these norms in interactions with the instructor and other students. At the Evans School, we value the richness of our differences and how they can greatly enhance our conversations and learning. As a professional school, we also have a responsibility to communicate with each other–inside and outside of the classroom–in a manner consistent with conduct in today's increasingly diverse places of work. We hold ourselves individually and collectively responsible for our communication by:

- Listening carefully and respectfully

- Sharing and teaching each other generously

- Clarifying the intent and impact of our comments

- Giving and receiving feedback in a "relationship –building" manner

- Working together to expand our knowledge by using high standards for evidence and analysis

Changes to the Syllabus

The professor reserves the right to make changes to the syllabus during the quarter. The professor will notify students immediately by email and in class if any changes are made.

Grading Policy

Grades consider two elements:

- **Group Exercises**: Students prepare a project to be done in groups. The project is based on the use of Python and R.

- **Individual Exercises**: Each session has a set of exercises to be completed in class. Each Exercise submitted after class will reduce the grade by 5 / 100 points per day of delay.

These elements are graded like this:

- **30%** Individual Exercises.

- **20%** Group Exercise 1: present a problem of study with multiple variables on the same unit of analysis (countries, counties, and the like).

- **20%** Group Exercise 2: Present a clustering of the units of analysis and a regression (oral presentation)

- **20%** Group Exercise 3: Present a report from your group: format can be in a web page or paper-like format.

- **10%** Group Exercise 4: Present a member evaluation of member participation.

Working in groups

This course requires working in groups. You should have decided who will be in your group by the end of the **third** week of classes.

Course Schedule

<u>Part I</u>: PYTHON FOR DATA PRE PROCESSING

Week 01, 01/06 - 01/10: Data Pre Processing using Python: Data gathering

- The Data Frame.

- Opening files from different formats.

- Scraping tables from the web.

Week 02, 01/13 - 01/17: Data Pre Processing using Python: Data cleaning

- Removing or cleaning cell values using regular expressions.

- Creating simple functions.

Week 03, 01/20 - 01/24: Data Pre Processing using Python: Data Formatting.

- Operations on Data data frames.

- Setting values in the right measurement scale.

- Data reshaping.

Week 04, 01/27 - 01/31: Data Pre Processing using Python: Data Integration

- Merging and appending different data sets.

- Saving files.

<u>Part II</u>: INTRO TO MACHINE LEARNING IN R

Week 05, 02/03 - 02/07: Unsupervised Machine Learning

- Cluster analysis.

- Anomaly Detection.

Week 06, 02/10 - 02/14:   Supervised Machine Learning

- Linear regression.

- Logistic regression.

<u>Part III:</u> **ALGORITHMIC POLICY AND MANAGEMENT**

Week 07, 02/17 - 02/21:   Optimization for Decision Making

- Modeling problems in linear programming.

Week 08, 02/24 - 02/28:   Modeling Governance Complexity I

- Complexity and policy making.

- Agent based modeling in public policy using NetLogo I.

Week 09, 03/02 - 03/06:   Modeling Governance Complexity II

- Agent based modeling in public policy using NetLogo II.

<u>Part IV:</u> **CLOSING**

Week 10, 03/09 - 03/13:   Group Presentations.

Week 11, 03/16 - 03/20:   Final week: Submitting final report.

About religious accommodations

Washington state law requires that UW develop a policy for accommodation of student absences or significant hardship due to reasons of faith or conscience, or for organized religious activities. The UW's policy, including more information about how to request an accommodation, is available at Religious Accommodations Policy[1]. Accommodations must be requested within the first two weeks of this course using the Religious Accommodations Request form[2].

---

[1]https://registrar.washington.edu/staffandfaculty/religious-accommodations-policy/
[2]https://registrar.washington.edu/students/religious-accommodations-request/