PAF 540 Advanced Policy Analysis

Syllabus Version: November 4, 2021

Professor Spiro Maroulis
Office: UCENT 447 (Phoenix)
Email: Spiro.Maroulis@asu.edu
Office Hours: by appointment
Class Time: Wed, 6:00-8:45pm
Class Location: Wed, Dtphx UCENT 238

Course Website: Canvas

Course Overview

Data and information are essential to public agencies and other organizations in supporting decisions about government policies and programs. One crucial set of skills for policy analysts and managers in this environment involves being able to collect, manage, and analyze significant amounts of data to evaluate the effectiveness of a program. This was the focus of PAF 502 and PAF 573. In this course, we examine additional ways that data management, visualization, and modeling skills can be used to provide insight and products useful to policy analysts and managers. A large part of the course focuses on data science techniques used to gain insights from so-called "big data," including using machine learning to target messages and recommendations, detect outliers, and measure and predict public outcomes using social media. The course also introduces computational and social network models useful in understanding how to create contagions, identify influencers, and harness the wisdom of crowds. While familiarity with statistical modeling and computer programming will be helpful, no prior modeling or programming knowledge is required.

Teaching Approach and Class Attendance

This class relies heavily on interactive activities designed to introduce a conceptual approach, provide a setting for the topic being addressed, or integrate the class discussion and the subject matter. Consequently, attendance in every class is mandatory. If you have a conflict with class dates in advance, I must know as soon as possible. However, *if you are experiencing COVID-related symptoms or need to quarantine on account of a COVID exposure, please stay home.* I will work with you to figure out the best way to make up the material, which will vary depending on what we will be doing in class that particular day.

Please note that the contents of this course, including lectures and other instructional materials, are copyrighted materials. Students may not share outside the class, including uploading, selling or distributing course content or notes taken during the conduct of the course. Any recording of class sessions by students is prohibited, except as part of an accommodation approved by the Disability Resource Center.

Readings

1. I have linked 2 types of documents to the course website:

    a. Optional: Advanced or specialized material that is not required, but providing for those who want to delve further into the topic.
    b. Required: Must read before class. Unless explicitly marked as optional, a reading is required

I will continue to add relevant readings to the course website so please be sure to check every week for updates.

2. We will also be using a good portion of the following book:

    Foreman, J. W. (2014). *Data Smart*: *Using Data Science to Transform Information into Insight.* New York, NY: Wiley.

    The book provides an excellent and easy-to-follow introduction to key ideas and techniques in data science which we will be applying to public policy topics. Please purchase it online (should cost between $15-30).

Software

1. Please have copy a copy of MS Excel on your computer.
2. Download and install the statistical program R: https://cran.r-project.org.
3. After installing R, download and install RStudio. RStudio is a separate download that provides a useful environment through which to run R: https://rstudio.com/products/rstudio/download/

Course Requirements and Grading

Students are expected to master the content of the readings, to make constructive contributions to class discussions and online discussion boards, to make occasional presentations, and to perform adequately or better on examinations and class projects. Grades in the course will be based on the components outline below.

HOMEWORK ASSIGNMENTS (40%)

I will regularly assign problem sets, written policy memos, or short exercises that deepen and reinforce the topics covered in class. All homework assignments are due the day ***before*** the beginning of the class session in which it will be reviewed (see below for exact due dates and times). Understanding and completing these assignments are the key to succeeding in this class.

EXAMS (50%)
There will two exams you can take from home. You will be allowed to use any course readings or notes to complete these exams, but other materials are not allowed. Details will be discussed in class.

PARTICIPATION and ATTENDANCE (10%)
Attendance, preparation, and participation are essential for this class to be of value to you. Much of the learning in this course comes from class discussion of cases or homework assignments. Active and constructive participation in class and online discussion boards is expected.

Academic Integrity
Academic honesty is expected of all students in all examinations, papers, laboratory work, academic transactions, and records. All submissions by a student are expected to be the student's original work. Material that violates this requirement in any way, or that constitutes any form of dishonesty, cheating, fabrication, the facilitation of academic dishonesty, and/or plagiarism, may result in the student receiving sanctions that include, but are not limited to, appropriate grade penalties, course failure (indicated on the transcript as a grade of 'E'), course failure due to academic dishonesty (indicated on the transcript as a grade of 'XE'), loss of registration privileges, disqualification, suspension, and dismissal from the university. Please see the official ASU Policy on Cheating and Plagiarism (Policy Statement 08-02) for more details about the consequences of academic dishonesty. It is accessible online at: http://provost.asu.edu/academicintegrity

If students have questions about appropriate submissions or methods of citation or have extenuating circumstances, they should contact their instructor prior to submitting materials and prior to the assignment deadline.

Review this tutorial on Academic Integrity. Anyone in violation of these policies is subject to sanctions.

COURSE OUTLINE

Session	Date	Topics	Assignment Due
1	25-Aug	Introduction	
2	1-Sep	Optimization I	HW1 (9am, Aug 31)
3	8-Sep	Optimization II; R Intro	HW2 (9am, Sep 7)
4	15-Sep	Similarities and Differences I: Clustering	HW3 (9am, Sep 14)
5	22-Sep	Similarities and Differences II: Network Communities	HW4 (9am, Sep 21)
6	29-Sep	Similarities and Differences III: Outlier Detection	HW5 (9am, Sep 28)
7	6-Oct	Classification and Prediction I: Naïve Bayes	
8	13-Oct	Classification and Prediction II: Regression Viewed as Supervised Learning	HW6 (9am, Oct 12)
9	20-Oct	Exam 1	Exam
10	27-Oct	Classification and Prediction III: The Role of Diversity; Ensemble Models	
11	3-Nov	Classification and Prediction III: The Role of Diversity; Ensemble Models (cont.)	HW7 (9am, Nov 2)
12	10-Nov	Diffusion I: Epidemiological Models	
13	17-Nov	Diffusion II: Epidemiological Models	HW8 (9am, Nov 16)
14	24-Nov	Thanksgiving	
15	1-Dec	Diffusion III: Network Models; Class summary	
		Exam 2	TBD

COURSE READINGS

Note: The reading list below is not exhaustive. Please be sure to check the course website every week, as I will be adding readings to the list below as the class progresses. With the exception of the Data Smart book, you can find links to all readings on the course website.

Session 1 -- Introduction

1. Jennifer Robinson (2017). Ch. 7. Brilliant Analytics for Smart Cities. A Practical Guide to Analytics for Governments: Using Big Data for Good. Marie Lowman (ed.)
2. Keyonna Summers. Hacking the Way to Safer, Brighter City Streets. *UNLV* News
3. Data Smart. Introduction and Chapter 1.

Session 2 -- Optimization

1. Building a Smarter (and Cheaper) School Bus System: How a Boston-MIT Partnership Led to New Routes That Are 20% More Efficient and Saved the District $5 Million. *The 74*
2. What the Boston School Bus Schedule Can Teach Us About AI. *Wired Magazine*
3. Data Smart. Chapter 4. Optimization Modeling, p. 102-116
4. Stokey & Zeckhauser (1978). *A Primer for Policy Analysis*. Chapter 11: Linear Programming

Optional:

- Bertsimas, D., Delarue, A., & Martin, S. (2019). Optimizing schools' start time and bus routes. *Proceedings of the National Academy of Sciences*, *116*(13), 5943-5948.
- John Ausink et al (2002). "An Optimization Approach to Workforce Planning for the Information Technology Field": https://www.rand.org/pubs/monograph_reports/MR1484.html

Session 3 – Introduction to R

See Canvas for links

Session 4 – Similarities and Differences I

1. Data Smart. Chapter 2: K-means clustering

Optional:

- Ratkiewicz, Jacob, et al. "Truthy: mapping the spread of astroturf in microblog streams." *Proceedings of the 20th international conference companion on World wide web*. ACM, 2011. http://ramb.ethz.ch/CDstore/www2011/companion/p249.pdf

Session 5 – Similarities and Differences II

1. Data Smart. Chapter 5: Network Graphs and Community Detection, pp. 155-170

Optional:

- Sirer, I., Maroulis, S., Guimera, R, Wilensky, U., Amaral, L.A.N. (2015) "The Currents Beneath the 'Rising Tide' of School Choice: Student Enrollment Patterns in Chicago Public Schools," *Journal of Policy Analysis and Management*, Volume 32, Issue 2

Session 6 – Similarities and Differences III

1. Gerrymandering, or Geography? Computer-based techniques can prove that partisan advantage isn't an accident. *The Atlantic*
2. Data Smart. Chapter 9: Outlier Detection

Optional:

- Kim, Y., Zhong, W., & Chun, Y. (2013). Modeling sanction choices on fraudulent benefit exchanges in public service delivery. *Journal of Artificial Societies and Social Simulation, 16*(2)8, http://jasss.soc.surrey.ac.uk/16/2/8.html.

Session 7 – Classification and Prediction I: Naïve Bayes

1. Thompson, Derek. (2016). "Why Democrats and Republicans Literally Speak Different Languages." *The Atlantic*.
2. Oscar Bonilla. "Visualizing Bayes Theorem"
3. Data Smart. Chapter 3. Naïve Bayes

Session 8 -- Classification and Prediction II: Regression viewed as Supervised Learning

1. John Kleinberg, Jens Ludwig, and Sendhil Mullainathan. (2016). "A Guide to Solving Social Problems with Machine Learning." *Harvard Business Review*.
2. Hvistendahl, M. (2016). "Can 'predictive policing' prevent crime before it happens." *Science Magazine*, 28.
3. Data Smart. Chapter 6. The Granddaddy of Supervised Artificial Intelligence - Regression

Optional:

- Mullainathan, Sendhil, and Jann Spiess. (2017). "Machine Learning: An Applied Econometric Approach." Journal of Economic Perspectives 31 (2): 87–106.
- Anastasopoulos, L. Jason, and Andrew B. Whitford. "Machine learning for public administration research, with application to organizational reputation." *Journal of Public Administration Research and Theory* 29.3 (2019): 491-510.

Session 9 – Exam

Sessions 10 & 11 -- Classification and Prediction III: The Role of Diversity; Ensemble Models

1. Scott Page, "Making the Difference: Applying a Logic of Diversity," *The Academy of Management Perspectives,* 21(4): 6-20, 2007.
2. Data Smart. Chapter 7: Ensemble Models

Optional:

- March, J. G. (1991). Exploration and exploitation in organizational learning. *Organization Science*, 2(1), 71-87.
- Hong L, Page SE (2004) Groups of diverse problem solvers can outperform groups of high-ability problem solvers. *Proceeding of the National Academy of Sciences* http://www.pnas.org/content/101/46/16385.long

Session 12 – Diffusion I: Epidemiological Models

1. Lamberson, PJ. "What it takes to 'Go Viral'" http://social-dynamics.org/what-it-takes-to-go-viral/
2. Video: SIR Introduction, Brian Sullivan

Optional:

- Stokey & Zeckhauser (1978). *A Primer for Policy Analysis*. Chapter 4: Difference Equations

Session 13 – Diffusion II: Epidemiological Models

1. Hutson, Matthew (Sep 22, 2020) Why Modeling the Spread of COVID-19 Is So Damn Hard. IEEE Spectrum

Optional:

- Zhong, W., Kim, Y., & Jehn, M. (2013). Modeling dynamics of an influenza pandemic with heterogeneous coping behaviors: Case study of a 2009 H1N1 outbreak in Arizona. *Computational and Mathematical Organizational Theory, 19*(4), 622-645. https://link.springer.com/content/pdf/10.1007%2Fs10588-012-9146-6.pdf

Session 14 – Thanksgiving

Session 15 – Diffusion III: Network Models; Class Summary

1. 'Information gerrymandering' poses a threat to democratic decision making. Subtle features of social network structure can lead to biased outcomes in group decisions. *Penn Today*

   https://penntoday.upenn.edu/news/penn-study-information-gerrymandering-poses-threat-democratic-decision-making

Optional:

- Maroulis, S., Diermeier, D., & Nisar, M. A. (2020). Discovery, dissemination, and information diversity in networked groups. *Social Networks*, *61*, 67-77.
- Aral, Sinan, Lev Muchnik, and Arun Sundararajan. "Engineering social contagions: Optimal network seeding in the presence of homophily." *Network Science* 1.2 (2013): 125-153. http://ssrn.com/abstract=1770982
- Eytan Bakshy, Jake Hofman, Winter Mason, and Duncan Watts, "Everyone's an Influencer" Quantifying Influence on Twitter," *Proceedings of the fourth ACM international conference on Web search and data mining.* ACM, 2011. http://snap.stanford.edu/class/cs224w-readings/bakshy11influencers.pdf

- Stewart, Alexander J., et al. "Information gerrymandering and undemocratic decisions." *Nature* 573.7772 (2019): 117-121.

COMMUNITY OF CARE DURING COVID-19

ASU's Community of Care plan provides guidance regarding the many preventative measures that the university has implemented to help slow the spread of COVID-19 and create a safe and welcoming environment in which all students can live and learn. Prevention is key to protecting yourself, your peers and those who are most vulnerable in our community. It is important to remember that we need everyone to take personal responsibility for their actions and behavior. We remind all members of the ASU community to continue to adhere to public health protocols to mitigate the spread of COVID-19.

Respect the decision of others who are continuing to wear face coverings and/or physically distance, when possible. You may have friends, family members, and peers who have varying levels of comfort about how they wish to connect. During this time and always, it is important to not pressure people to connect socially in ways that may make them feel uncomfortable.

Vaccinations
Arizona State University strongly encourages all students to be vaccinated. Appointments for COVID-19 vaccines are available at all Health Services locations. Please make your appointment at myhealth.asu.edu. These vaccines are provided at no cost to you. You may also use vaccines.gov to find a location near you.

Face Coverings and Other On-Campus Protocols

All students and instructors are expected to follow ASU's Community of Care Policy that requires wearing face coverings while in certain indoor settings. Those settings include all classrooms and teaching or research labs. In addition, face coverings will be required in close-quarter environments where physical distancing may not be possible. These include the following:

All ASU clinical programs and centers that serve the general public, such as the ASU Health Centers, Child Development Laboratory, and Counselor Training Center (the "Programs"), whether on- or off-campus.

Meeting rooms, workshop, design or production studios, and other indoor settings where social distancing is not possible.

All other indoor areas designated by posted signage

Additionally, consistent with CDC guidance, face covers may be required in some crowded outdoor settings or activities that involve sustained close contact with other people. Arizona State University also strongly recommends that everyone on campus wear a face cover when inside a University building, even where they are not required. Consistent with the governor's executive order and the CDC guidelines, we are not making distinctions between the vaccinated and unvaccinated. This applies to all individuals regardless of their vaccination status.

Arizona State University also urgently recommends the following on-campus protocols for all students:

- Submit a daily health check (a moment to evaluate how you feel); and
- If you are experiencing COVID-19 symptoms, please stay home and get tested.

COVID-19 Testing
To assist individuals in monitoring their own health, we have testing available for anyone who wishes to know their health status related to COVID-19. You can participate in COVID-19 testing, free of charge, simply by spitting in a tube; no appointments are necessary.

Positive COVID-19 Test Results
If you test positive for COVID-10 and let me know, I am mandated to report your name and ASU ID number to the Dean of Students as soon as possible so we may provide support and care to you and your fellow students. We will share the information with ASU Health Services to assist in determining next steps and to assess your contact with others. Determinations about what should occur—including quarantine and follow-up testing—will begin immediately upon awareness of a positive case. Close contacts or high-risk exposures (e.g., less than 6-feet distance for a cumulative total of 15 minutes or more over a 24-hour period; physical contact with a person with COVID-19) may be asked to quarantine as a result of their possible exposure. The analysis of close contacts is done by ASU medical professionals based on information informed by the CDC and Maricopa County Public Health guidance, emerging science associated with transmission risk, and interviews with the positive/exposed student/staff/faculty.

Vulnerability to COVID-19 Infection
Students who are vulnerable to COVID-19 should contact Student Accessibility and Inclusive Learning Services (SAILS) to discuss possible accommodations.