Daniel Guth

dguth@caltech.edu | 443-875-7565 | 133 East Holly Street, Unit #208, Pasadena, CA

Education

California Institute of Technology, Pasadena, CA

Doctor of Philosophy, Social Science — Expected June 2022

Master of Science, Social Science — June 2019

Bachelor of Science, Mathematics — September 2012 - June 2016

Research Interests

- Health Outcomes, Machine Learning, Public Health, Computer Vision

Skills

- **Languages**: R, Python
- **Libraries**: TensorFlow, Keras, Pytorch, Scikit-Learn, Numpy, Pandas, Jupyter

Experience

Member of Benjamin Xu's Lab at USC — Pasadena, CA

Medical Imaging — *June 2019 - Present*

- **Costs of Preventative Care**: Leading a cost study analysis of newly diagnosed PACG patients.
- **Predicting Angle-Closure Glaucoma**: Helped implement a convolutional neural network (CNN) to predict primary angle-closure glaucoma (PACG) at an accuracy rivalling expert ophthalmologists.
- **Generative Adversarial Networks**: Implemented a generative adversarial network (GAN) to create synthetic eye images, and in a blinded-test some of them were predicted to be real by Dr. Xu.

Graduate Research Assistant for Mike Alvarez — Pasadena, CA

Political Science — *November 2018 - September 2020*

- **North Carolina Voting Data**: Implemented Machine Learning and GIS methods to predict vote outcomes from voter registration files and election results
  - Got 5th place out of 80 teams in CS 155 Kaggle Competition on Voting
- **Pollwatching**: Observed elections in Orange County in November of 2018 and helped write a report for the Registrar of Voters
- **Election Audit Summit**: Helped to organize the Election Audit Summit at MIT in December of 2018 through the Caltech/MIT Voting Technology Project

Seminar Course with Matilde Marcolli — Pasadena, CA

Computational Linguistics — *Spring 2015*

- **Data Collection**: Processed syntactic parameters of world languages and collected data on language family links
- **Topological Data Analysis**: Helped used Perseus software and PCA to compute persistent homologies between languages
  - We showed that connected language families had persistent homological generators, but random clusters of languages had no such structure

Teaching Experience

- Gave recitations on game theory and political models, and created problem and solution sets for **PS 12** in the Fall of 2018 and 2020.
- Helped design a new data methods course **SS224** for graduate students, and was the teaching assistant who ran the computational labs in Fall 2019 and Winter 2020.

Key Coursework

- Ma 144ab: Probability and Stochastic Differential Equations
- CS 156a: Learning Systems
- CS 155: Machine Learning and Data Mining
- CS 159: Special Topics in Machine Learning - Deep Probabilistic Models
- EE/CS 148: Selected Topics in Computational Vision

Publications

Chiang, M., **Guth, D.**, Pardeshi, A., Randhawa, J., Shen, A., Shan, M., Dredge, J., Nguyen, A., Gokoffki, K., Wong, B., Song, B., Lin, S., Varma, R., Xu, B. (2021) Glaucoma Expert-level Detection of Angle Closure in Goniophotographs with Convolutional Neural Networks: The Chinese American Eye Study, Forthcoming at *American Journal of Ophthalmology*

Port, A., Gheorghita, I., **Guth, D.**, Clark, J. M., Liang, C., Dasu, S., & Marcolli, M. (2018). Persistent topology of syntax. *Mathematics in Computer Science*, 12(1), 33-50.

Working Papers

Geographic Spillover Effects of Prescription Drug Monitoring Programs (PDMPs), Link Here.

Abstract: Prescription Drug Monitoring Programs (PDMPs) seek to potentially reduce opioid misuse by restricting the sale of opioids in a state. We examine discontinuities along state borders, where one side may have a PDMP and the other side may not. We find that electronic PDMP implementation, whereby doctors and pharmacists can observe a patient's opioid purchase history, reduces a state's opioid sales but increases opioid sales in neighboring counties on the other side of the state border. We also find systematic differences in opioid sales and mortality between border counties and interior counties. These differences decrease when neighboring states both have ePDMPs, which is consistent with the hypothesis that individuals cross state lines to purchase opioids. Our work highlights the importance of understanding the opioid market as connected across counties or states, as we show that states are affected by the opioid policies of their neighbors.

The OxyContin Reformulation Revisited: New Evidence From Improved Definitions of Markets and Substitutes, Link Here.

Abstract: The opioid epidemic began with prescription pain relievers. In 2010 Purdue Pharma reformulated OxyContin to make it more difficult to abuse. OxyContin misuse fell dramatically, and concurrently heroin deaths began to rise. Previous research overlooked generic oxycodone and argued that the reformulation induced OxyContin users to switch directly to heroin. Using a novel and fine-grained source of all oxycodone sales from 2006-2014, we show that the reformulation led users to substitute from OxyContin to generic oxycodone, and the reformulation had no overall impact on opioid or heroin mortality. In fact, generic oxycodone, instead of OxyContin, was the driving factor in the transition to heroin. Finally, we show that by omitting generic oxycodone we recover the results of the literature. These findings highlight the important role generic oxycodone played in the opioid epidemic and the limited effectiveness of a partial supply-side intervention.