Aditya Dhar

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Education

Ph.D. in Finance, University of Chicago (2023-present)

A.B. in Applied Mathematics, Harvard University, *with Honors* (2022)

Secondary Field: Computer Science and Economics

Research

Works in Progress

"Designing Differentially Private Estimators in High Dimensions", with Jason Huang
Course Project for CS 226 (Adaptive Data Analysis and Privacy) with Cynthia Dwork
We study differentially private mean estimation in a high-dimensional setting. Incorporating resent advances in high-dimensional robust statistics, we construct a bound on the sensitivity of robust mean estimation, yielding a computationally tractable algorithm for differentially private mean estimation in high dimensions with dimension-independent privacy loss. We test our algorithm on synthetic data, showing that it outperforms classic differential privacy methods and overcomes potential barriers to high-dimensional differential privacy.

Presented at the ICML 2020 Workshop on Economics of Privacy and Data Labor
[talk] [slides]

Selected Course Projects

"Inference for high-dimensional logistic regression: a review", with Asher Spector
Course Project for Stat 244 (Linear and Generalized Linear Models) with Mark Glickman
We focus on recent developments in the space of high dimensional logistic regression that show that in mid-to-high dimensional settings, the classical theory of generalized linear models breaks down spectacularly. We review that line of research to both elucidate the failings of classical research, and also describe practical methods for performing valid inference in high dimensions, conducting simulations and analyzing a high dimensional open-source dataset.

"Models of Intermediation in Tri-Party Repo Markets"
Course Project for Econ 2727 (Empirical Methods in Financial Research) with Sam Hanson and Adi Sunderam
I design a demand model of the repo market, in which firms can choose between different types of collateral, as well as a game theoretic competition model on the supply side to capture the oligopolistic nature of the repo market. By estimating a structural demand model and linking it to Federal Reserve data, I show that dealer concentration has a meaningful impact on increasing prices and spreads, up to 159 bps for the 90th percentile of investors. In addition, I develop a useful entropy-based measure of uncertainty for collateral price, and show how that can function both as a product characteristic as well as an overall measure of repo system fragility and a predictor of liquidity crunches.

"Monetary Policy and Asset Bubbles", with Lucy Li
Course Project for Econ 1499 (Low Interest Rates, Secular Stagnation, and Macroeconomic Policy) with Larry Summers and Sir Paul Tucker
We show that reinforcement learning can be used by participants in financial markets to better trade over time. In this setting, we show that bubbles arise often with agents employing various trading strategies, including noise traders, fundamental traders, and reinforcement learning trades, conforming to known economic theory. We then show that reinforcement learning can be used with varying degrees of success to train social planners, representing the central bank, in setting interest rate policy to 'pop' asset bubbles. We finally show that deep learning is useful in detecting asset bubbles, and that we achieve comparable results to classical methods of bubble detection. Our work suggests that these are useful areas of exploration for simulating economic policy in the future, and that there is room for reinforcement learning in improving government policy.

"Two Americas and One Central Bank: Did QE Work?", with Carissa Chen
Course Project for Econ 1499 (Low Interest Rates, Secular Stagnation, and Macroeconomic Policy) with Larry Summers and Sir Paul Tucker
We estimate a causal effect of QE1 on quarterly wage income in every county in the U.S including Puerto Rico. For each of the 3,195 counties, we run difference-in-differences regressions with controls for county-level American Recovery and Reinvestment Act transfers, the local tax rate, manufacturing employment shares, population, and time fixed-effects. We use these estimates to (a) construct a national index of the geography of ZLB-constrained monetary policy effectiveness in the United States, (b) construct regressions with county-characteristics related to industry, education, inequality, and political preference, and (c) check the robustness of our findings by building VAR models for every county, state, and region in the United States to estimate whether monetary policy has become more or less effective over time, and characterize the types of counties where QE1 was more effective. Ultimately, this paper suggests that monetary policy constrained by the zero-lower bound is significantly less effective at stimulating wage income for some regions in the United States than others, and these distributional impacts can and already have exacerbated the growing divide within our country.

"Reinforcement Learning for Multi-Agent Semi-Cooperative Games", with Bill Zhang, David Zhu, and Daniel Bodea
Course Project for CS 281 (Graduate Machine Learning) with Jean-Baptiste Tristan and Michael Wick
We examine the space of "semi-cooperative" games, in which agents are placed in long-term competition that requires some level of collusion within stages of the game. We establish a series of mechanisms to approximate the environment of the game in order to engender semi-cooperative behavior, focusing on "Finding Friends" specifically. We implement generative and DQN models for reinforcement learning agents to play the games under these mechanisms, and analyze insights gained from the complex game environment.

"Space-Time Efficiency Tradeoffs in Randomized Algorithms for Subset Sum", with David Zhu
Course Project for CS 223 (Graduate Randomized Algorithms) with Michael Mitzenmacher
We focus on a recent developments in solving a specific NP-complete problem, SubsetSum. We provide an overview of recent research in applying randomized protocls to improve both asymptotic space and time bounds, and survey the relative merits of trade-offs that these advances make in developing random algorithms to solve the problem. We also identify areas in each paper where the methods are cross-applicable and hold the potential for theoretic further improvement in solving the space-time tradeoff.

Teaching

Course Assistant for Econ 1499 (Macroeconomics in the COVID-19 Era, with Lawrence H. Summers and Paul Tucker), Fall 2021

Course Assistant for Ec 1011A (Advanced Microeconomics with Edward Glaeser), Fall 2019-2021

Course Assistant for CS 286 (Multi-Robot Systems: Control, Communication, and Security with Stephanie Gil), Fall 2020

Course Assistant for Math 22A (Multivariable Calculus and Linear Algebra with Oliver Knill), Fall 2018

Other Employment

Associate Consultant, Bain & Company (October 2022 - July 2023)

Research Intern, Council of Economic Advisers (January 2022 - September 2022)

Investment Associate Intern, Bridgewater Associates (Summer 2020)

Economic Design Fellow, Center for Mathematical Sciences and Applications, Summer 2019

Research Assistant for Scott Kominers, John Campbell, Neil Shephard, Larry Summers (June 2019 - December 2021)

Misc. Awards

American Parliamentary Debate Association 2019-2020 Team of the Year

Top 10 Speaker, 2020 World Universities Debating Championship

Coach, 2023 USA Debate Team (Champions of the 2023 World Schools Debating Championship)

Kate and Max Greenman Prize (2019, 2020)

Coolidge Debating Prize (2020)

Wendell Phillips Memorial Prize (2019)

Programming Languages

Experience with C, Python, R, Stata, Matlab