Abstract:

**Smooth Contextual Bandits: Bridging the Parametric and Non-differentiable Regret Regimes**

We study a nonparametric contextual bandit problem in which the expected reward functions belong to a Hölder class with smoothness parameter $\beta$. We show how this interpolates between two extremes that were previously studied in isolation: nondifferentiable bandits ($\beta$ at most 1), with which rate-optimal regret is achieved by running separate non contextual bandits in different context regions, and parametric-response bandits (infinite $\beta$), with which rate-optimal regret can be achieved with minimal or no exploration because of infinite extrapolatability. We develop a novel algorithm that carefully adjusts to all smoothness settings, and we prove its regret is rate-optimal by establishing matching upper and lower bounds, recovering the existing results at the two extremes. In this sense, our work bridges the gap between the existing literature on parametric and non-differentiable contextual bandit problems and between bandit algorithms that exclusively use global or local information, shedding light on the crucial interplay of complexity and regret in contextual bandits.

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I am currently a PhD student in Economics at MIT. Previously I was a Research Fellow at the Stanford Graduate School of Business, and I graduated from the University of Chicago in 2017 with degrees in Economics and Statistics. I am interested in machine learning and causal inference, and topics that I'm excited about include semiparametric and nonparametric estimation of continuous treatment effects and panel data.

Abstract:

**Estimating Continuous Treatment Effects in Panel Data using Machine Learning with an Agricultural Application**

Sylvia Klosin, MIT
Max Vilgalys, MIT
This paper introduces and proves asymptotic normality for a new semi-parametric estimator of continuous treatment effects in panel data. Specifically, we estimate an average derivative of the regression function. Our estimator uses the panel structure of data to account for unobservable time-invariant heterogeneity and machine learning methods to flexibly estimate functions of high-dimensional inputs. We construct our estimator using tools from double de-biased machine learning (DML) literature. We show the performance of our method in Monte Carlo simulations and also apply our estimator to real-world data and measure the impact of extreme heat in United States (U.S.) agriculture. We use the estimator on a county-level dataset of corn yields and weather variation, measuring the elasticity of yield with respect to a marginal increase in extreme heat exposure. In our preferred specification, the difference between the estimates from OLS and our method is statistically significant and economically significant. We find a significantly higher degree of impact, corresponding to an additional $1.18 billion in annual damages by the year 2050 under median climate scenarios. We find little evidence that this elasticity is changing over time.

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**Abstract:**

**Exchange Rate Supervised Topic Modeling**

This paper shows how to use a hybrid of supervised and unsupervised learning models to go from text from news articles to an FX news index that can be used to enhance traditional models from the FX literature. To do so we rely on Supervised Latent Dirichlet Allocation (sLDA) (Blei and McAuliffe and (2008)) which combines information about a supervising variable with topic extraction over a corpus of text in a single-stage estimation. Although this estimation can be done in two stages, we document with a Monte Carlo simulation that there are efficiency gains from a single-stage approach. The empirical application we suggest is centered around the Monex Market, the main Costa Rican platform for FX trade; accordingly news articles are gathered from the main Costa Rican newspapers. The exchange rate of interest is the Costa Rican Colón (CRC), the local currency, and the United States dollar (USD). Using the CRC/USD exchange rate as the supervising variable we suggest using sLDA to extract the topics from the news article corpus that are relevant as covariates for the exchange rate over short frequencies.

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Yuexi is a fifth-year Ph.D. student in the Econometrics and Statistics group at the University of Chicago Booth School of Business, advised by professor Veronika Rockova and professor Nick Polson. Her research interests are at the intersection of machine learning, Bayesian computation, and optimization. In particular, her recent work examines approximate Bayesian inference with adversarial learning techniques. Before Booth, she received her B.S. in mathematics from Zhejiang University (China) and M.S. in statistics from the University of Chicago. She received the 2022
Arnold Zellner Doctoral Prize for applications of Bayesian methodology in finance.

Abstract:

**Adversarial Bayesian Simulation**
Yuexi Wang, University of Chicago Booth School of Business
Veronika Rockova, University of Chicago Booth School of Business

In the absence of explicit or tractable likelihoods, Bayesians often resort to approximate Bayesian computation (ABC) for inference. Our work bridges ABC with deep neural implicit samplers based on generative adversarial networks (GANs) and adversarial variational Bayes. Both ABC and GANs compare aspects of observed and fake data to simulate from posteriors and likelihoods, respectively. We develop a Bayesian GAN (B-GAN) sampler that directly targets the posterior by solving an adversarial optimization problem. B-GAN is driven by a deterministic mapping learned on the ABC reference by conditional GANs. Once the mapping has been trained, iid posterior samples are obtained by filtering noise at a negligible additional cost. We propose two post-processing local refinements using (1) data-driven proposals with importance reweighting, and (2) variational Bayes. We support our findings with frequentist-Bayesian results, showing that the typical total variation distance between the true and approximate posteriors converges to zero for certain neural network generators and discriminators. Our findings on simulated data show highly competitive performance relative to some of the most recent likelihood-free posterior simulators.