Christopher Michael Rytting

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Research Interests

- Natural language processing, language models, interpretability, alignment, algorithmic bias, ethics and policy

Education

PhD Computer Science — Expected Apr 2023
Brigham Young University — *Provo, UT*

MS Computer Science — Dec 2020
Brigham Young University — *Provo, UT*

BS Applied and Computational Mathematics — Apr 2017
Brigham Young University — *Provo, UT*

BS Economics — Apr 2017
Brigham Young University — *Provo, UT*

Skills

Python, PyTorch, Tensorflow, Slurm, Git, Unix/Bash, Pandas, LaTeX

Publications and Presentations

Peer-reviewed Publications

- **Christopher Michael Rytting** and David Wingate. "Leveraging the Inductive Bias of Large Language Models for Abstract Textual Reasoning." *Advances in Neural Information Processing Systems* 34 (2021).
- Taylor Sorensen*, Josh Robinson*, **Christopher Michael Rytting***, Alex Shaw, Kyle Rogers, Lexi Delorey, Mahmoud Khalil, Nancy Fulda, and David Wingate. "Coding for the Social Sciences with GPT-3." *ACL 2022.*
- Lisa P. Argyle*, Ethan C. Busby*, Nancy Fulda*, Joshua Gubler*, **Christopher Michael Rytting***, and David Wingate*. "Out of One, Many: Using Language Models to Simulate Human Samples." *Political Analysis.* (*Forthcoming*; Pre-print here)

Pre-prints

- Joshua Robinson, **Christopher Michael Rytting**, David Wingate. "Leveraging Large Language Models for Multiple Choice Question Answering." *Under review for ICLR 2023.* https://arxiv.org/abs/2210.12353

Working Papers

- **Christopher Michael Rytting**, Taylor Sorensen, Lisa P. Argyle, Ethan C. Busby, Nancy Fulda, Joshua Gubler, and David Wingate. "Coding for the Social Sciences with GPT-3."

Presentations

- ML Collective, Nov 4, 2022. "Can we use large language models to simulate human beings for social science?"
- PaCSS (Politics and Computational Social Science), Jun 18, 2022. Joint with Lisa P. Argyle. "Coding for the Social Sciences with GPT-3."
- TADA (Text as Data), Oct 28, 2021. Joint with Lisa P. Argyle. "Coding for the Social Sciences with GPT-3."
- APSA (American Political Science Assocation), Sep 30, 2021. Joint with Ethan C. Busby. "Out of One, Many: Using Language Models to Simulate Human Samples."
- PaCSS (Politics and Computational Social Science), Aug 12, 2021. Joint with Lisa P. Argyle. "Out of One, Many: Using Language Models to Simulate Human Samples."
- ISPP (International Society of Political Psychology), July 13, 2021. Joint with Joshua Gubler. "Harnessing Accurate Bias in Large-Scale Language Models to Further the Study of Human Psychology."
- Master's thesis defense and PhD qualifying exam, November 18, 2020. "Leveraging the Inductive Bias of Large Language Models for Abstract Textual Reasoning."

Challenges

- *Strengthening Democracy Challenge* (Oct 2021): In consultation with political science theory, used large language models to identify (via human simulation) promising interventions for decreasing Americans' political violence, political polarization, and anti-democratic attitudes. Submitted several such interventions.

Research Experience

NVIDIA - Research Intern May 2022 - Aug 2022

- Used large, pre-trained language models (LLMs) containing 1e11 parameters to generate augmented datasets for improving performance in downstream tasks.
- Finetuned LLMs on synthetically-generated data, performing model and data parallelism across clusters of GPUs with slurm.

Perception, Cognition, and Control Laboratory - Research Assistant May 2018 - Present

- Studied the knowledge contained in LLMs , including their ability to perform abstract textual reasoning and to simulate humans for social science study. All papers coauthored here.

Open Source Policy Center, AEI - Research Associate May 2015 - 2018
& BYU Macroeconomic & Computational Laboratory - Research Assistant

- Fit various functional forms to large sets of tax data using OLS and numerical minimizers.
- Helped code up a dynamic general equilibrium economics model in Python with stochastic processes for use in dynamic scoring of policy decisions.
- Integrated results of a tax model with rich heterogeneity into said dynamic general equilibrium model.
- This research resulted in a publication in *Public Finance Review*.
- Organization's portfolio of projects supported users including White Houses from both parties, Congress, national and local newspapers, presidential campaigns in primary and general elections, academic and policy researchers, and private industry.

Federal Reserve Bank of NY, Macroeconomic Research - Summer Analyst Jun - Aug 2016

- Implemented sequential monte carlo algorithm in the Julia programming language to replace the FRBNY's official method for posterior distribution sampling (Metropolis-Hastings implemented in Matlab).
- This change allowed sampling of mass-separated and multi-modal posteriors and resulted in a $\sim$10x speedup.
- Helped conduct Bayesian inference on the FRBNY's dynamic stochastic general equilibrium model (via a kalman filter and SMC), the results of which were used to brief the Federal Reserve Board of Governors.

Leadership

Founder and President, BYU Artificial Intelligence Club Aug 2019 - May 2021

- Conceptualized, recruited for, and formed club to draw together interdisciplinary coalition of students from computer science, maths, philosophy, statistics, neuroscience, etc. to collaborate on and learn about artificial intelligence.
- Raised $1K for and organized lecture and workshop series hosting professors and graduate students from a diversity of fields.

Vice President of Academics, BYU Economics Student Association Aug 2014 - 2016

- Took charge of preparing students for graduate work in economics by organizing monthly mentorship opportunities between students and visiting/resident faculty.

Vice President of Academics, BYU Pi Sigma Alpha (Political Science Honor Society) 2014

- Helped prepare students for graduate work in political science by coordinating lectures, panels, and other local events given by visiting scholars.

Teaching

Instructor, BYU Computer Science Department Aug 2022 - Dec 2022

- Taught a semester-long course "Introduction to Computer Programming" to ~ 70 students at BYU.

Guest Lecturer at University of Chicago, Becker Friedman Institute Jul 2018

- Invited to give 2 weeks of instruction on linear and nonlinear optimization to $\sim$30 graduate and undergraduate students from University of Chicago, Harvard, NYU, Notre Dame, and other schools.

Teaching Assistant, BYU Economics Department Aug 2014 - May 2015

- Prepared and delivered weekly auxiliary lectures, gave office hours and review sessions, decided grades for homework, finals, and course.

Awards, Grants, & Honors

NSF Grant 2214708, Major Research Instrumentation (MRI): Acquisition of the LanguageLens for Large-Scale Language Modeling, 2022-2025: Although not PI, helped significantly to shape and write grant proposal. The focus of this grant is to acquire infrastructure for training and using very large language models.

NSF Grant 2141680, EAGER: Harnessing Accurate Bias in Large-Scale Language Models, 2021-2023: Although not PI, helped significantly to shape and write grant proposal. The focus of this grant is to study how large language models can be used to study specific sub-populations of the humans who generated training data.

Runner-up in Three Minute Thesis Competition: Took **2nd** place in the College of Physical and Mathematical Sciences (8 departments) for summarizing dissertation work in just three minutes.

Wheatley Student Scholar and Author: Through academic and extracurricular excellence, earned nomination by faculty and eventual acceptance for scholarship covering 130% of tuition through undergraduate education and one year of graduate education. Published several articles in the Wheatley publication.

Media

New York Times *Hard Fork* Podcast: Discussion of "Out of One, Many: Using Language Models to Simulate Human Samples"

Jack Clark's *Import AI* Newsletter: Discussion of "Out of One, Many: Using Language Models to Simulate Human Samples", which called it "a paper which I think is among the most significant things I've ever covered in this newsletter."

References

David Wingate wingated@cs.byu.edu

- Associate Professor, Department of Computer Science, BYU

Joshua Gubler jgub@byu.edu

- Associate Professor of Political Science, BYU

Tyler Jarvis jarvis@math.byu.edu

- Professor of Mathematics, BYU