

Beau Coker

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ABOUT

I am a PhD candidate at Harvard University, working with Finale Doshi-Velez and Brent Coull. I study theoretical properties of Bayesian models that impact model performance on downstream tasks — for example, designing priors that encode task-relevant functional properties or evaluating deep Bayesian models for uncertainty quantification.

EDUCATION

HARVARD UNIVERSITY | CAMBRIDGE, MA

PhD in Biostatistics

Fall 2018 - Spring 2023 (expected)

- Advisors: Finale Doshi-Velez, Brent Coull.

DUKE UNIVERSITY | DURHAM, NC

MS in Statistical Science

Fall 2016 - Spring 2018

- Thesis: *A Theory of Statistical Inference for Ensuring the Robustness of Scientific Results* (Advisor: Cynthia Rudin).

TUFTS UNIVERSITY | MEDFORD, MA

BS in Engineering Science | Magna Cum Laude with Highest Thesis Honors

Fall 2009 - Spring 2013

- Thesis: *Do Physical Analogs of Stock Market Crashes Make Sense?* (Advisor: Tim Atherton).
- Completed second major in Mathematics and minor in Economics.

RESEARCH EXPERIENCE

DATA TO ACTIONABLE KNOWLEDGE LAB (DTAK)

Graduate Research Assistant | Harvard University

Spring 2019 - Present

- Advisor: Finale Doshi-Velez.
- Proved wide, mean-field Bayesian neural networks converge to their own prior regardless of the data.
- Proposed a prior over radial basis function networks that enables an input-dependent (or independent) lengthscale.

ENVIRONMENTAL HEALTH

Graduate Research Assistant | Harvard University

Fall 2019 - Present

- Advisor: Brent Coull.
- Explored variable importance measures in scalable Gaussian processes.
- Currently researching models that incorporate measurement uncertainty.

PREDICTION ANALYSIS LAB

Graduate Research Assistant | Duke University

Spring 2017 - Summer 2018

- Advisor: Cynthia Rudin.
- Proposed the “hacking interval” as a new type of confidence interval that accounts for researcher choices made during a study (e.g., data cleaning, hyperparameter choice).
- Investigated the need for transparency in recidivism prediction by partially reverse engineering the COMPAS risk assessment tool.

SOFT MATTER THEORY

Undergraduate Research Assistant | Tufts University

Summer 2012 - Spring 2013

- Advisor: Tim Atherton.
- Scrutinized various physical analogs based on Ising systems of stock market crashes.

PUBLICATIONS

An Empirical Analysis of the Advantages of Finite v.s. Infinite Width Bayesian Neural Networks. Jiayu Yao, Yaniv Yacoby, **Beau Coker**, Weiwei Pan, Finale Doshi-Velez. NeurIPS Workshop on Gaussian Processes, Spatiotemporal Modeling, and Decision-making Systems, 2022.

Towards a Unified Framework for Uncertainty-aware Nonlinear Variable Importance Estimation with Theoretical Guarantees. Wenying Deng, **Beau Coker**, Rajarshi Mukherjee, Jeremiah Zhe Liu, and Brent A. Coull. Advances in Neural Information Processing Systems (NeurIPS), 2022.

Wide Mean-Field Variational Bayesian Neural Networks Ignore the Data. **Beau Coker***, David R. Burt*, Wessel P. Bruinsma*, Weiwei Pan, Finale Doshi-Velez. Proceedings of The 25th International Conference on Artificial Intelligence and Statistics (AISTATS), 2022.

- Previous version by Beau Coker, Weiwei Pan, and Finale Doshi-Velez appeared in the 2021 ICML Workshop on Uncertainty & Robustness in Deep Learning (UDL), where it was one of 6 papers (out of 108 accepted papers) selected for a contributed talk.

PoRB-Nets: Poisson Process Radial Basis Function Networks. **Beau Coker**, Melanie F. Pradier, Finale Doshi-Velez. Proceedings of the 36th Conference on Uncertainty in Artificial Intelligence (UAI), 2020.

The Age of Secrecy and Unfairness in Recidivism Prediction. Cynthia Rudin, Caroline Wang, **Beau Coker**. Harvard Data Science Review, (HDSR), 2020.

- A rejoinder titled *Broader Issues Surrounding Model Transparency in Criminal Justice Risk Scoring* by the same authors was also published in HDSR in response to six invited commentaries.

Learning a Latent Space of Highly Multidimensional Cancer Data. Ben Kompa, **Beau Coker**. Pacific Symposium on Biocomputing, 25, 2020.

A Theory of Statistical Inference for Ensuring the Robustness of Scientific Results. **Beau Coker**, Cynthia Rudin, Gary King. Management Science, 67, 2021.

* equal contribution

TEACHING

TEACHING FELLOW | HARVARD UNIVERSITY

Reproducible Data Science | Biostatistics 270 (graduate course) Winter 2022

Applied Bayesian Analysis | Biostatistics 228 (graduate course) Fall 2020, 2021

- Taught lecture on Bayesian neural networks, taught lab section (weekly), graded homework.

Data Science II | Biostatistics 261 (graduate course) Spring 2021, 2022

- Taught lab section (bi-weekly), held office hours, graded homework.

Applied Regression Analysis | Biostatistics 210 (graduate course) Fall 2019, Spring 2020

- Taught lab section (weekly), held office hours, graded homework/exams.

TEACHING ASSISTANT | DUKE UNIVERSITY

Probabilistic Machine Learning | Statistical Science 561 (graduate course) Spring 2018

- Wrote homework on decision trees and random forests, helped write lab materials, taught two lab sections (weekly).

Data Analysis and Statistical Inference | Statistical Science 101 (undergraduate course) Spring 2017

- Taught lab section (weekly), held office hours, graded homework/exams.

PRESENTATIONS

Center for Basic Machine Learning Research in Life Science (MLLS) | Virtual 2022

AISTATS 2022 (poster talk) | Virtual 2022

Yingzhen Li's group meeting (Imperial College London) | Virtual 2021

ICML Workshop on Uncertainty & Robustness in Deep Learning (contributed talk) Virtual	2021
HughesLab group meeting (PI Mike Hughes, Tufts University) Virtual	2020
12th International Conference on Bayesian Nonparametrics (poster) Oxford, UK	2019
Triangle Machine Learning Day (poster) Durham, NC	2018

INDUSTRY EXPERIENCE

STATE STREET GLOBAL MARKETS | BOSTON, MA

Assistant Vice President | State Street Associates July 2014 - June 2016

- Researched how market turbulence, systemic risk, illiquidity, and currency movements impact portfolio management.
- Lead analyst on the Liquid Private Equity Index, a proprietary product that tracks private equity with publicly traded securities.

Senior Associate July 2013 - July 2014

- Completed three 4-month rotations through onboarding processes flows, currency hedging, and macro strategy (currency trading).

Intern | State Street Associates Summer 2012

- Worked on portfolio optimization by minimizing transaction costs.