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

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 (with 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.

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 — Winter 2022

Applied Bayesian Analysis | Biostatistics 228 — Fall 2020, 2021

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

Data Science II | Biostatistics 261 — Spring 2021, 2022

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

Applied Regression Analysis | Biostatistics 210 — Fall 2019, Spring 2020

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

TEACHING ASSISTANT | Duke University

Probabilistic Machine Learning | Statistical Science 561 — 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 — 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.