Beau Coker

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EDUCATION

HARVARD UNIVERSITY | Cambridge, MA
PhD in Biostatistics | Advisors: Finale Doshi-Velez, Brent Coull — Fall 2018 - Spring 2023
- Thesis: *Misspecification, Nonstationarity, and Approx. Inference in Gaussian Processes and Bayesian Neural Networks.*

DUKE UNIVERSITY | Durham, NC
MS in Statistical Science | Advisors: Cynthia Rudin, Sayan Mukherjee — Fall 2016 - Spring 2018
- Thesis: *A Theory of Statistical Inference for Ensuring the Robustness of Scientific Results.*

TUFTS UNIVERSITY | Medford, MA
BS in Engineering Science | Advisor: Tim Atherton — Fall 2009 - Spring 2013
- Thesis: *Do Physical Analogs of Stock Market Crashes Make Sense?*
- Second major in Mathematics, minor in Economics, and thesis in Physics (with Highest Honors).

RESEARCH EXPERIENCE

CENTER FOR THEORETICAL NEUROSCIENCE
Postdoc | Zuckerman Institute, Columbia University — Fall 2023 - Present
- PI: John Cunningham.
- Introduced a new perspective on uncertainty quantification in deep learning based on implicit regularization, justified by proofs and experiments (up to Tiny Imagenet).

DATA TO ACTIONABLE KNOWLEDGE LAB (DTAK)
Graduate Research Assistant | Harvard University — Spring 2019 - Spring 2023
- PI: 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
- PI: 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
- PI: 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
- PI: Tim Atherton.
- Scrutinized various physical analogs based on Ising systems of stock market crashes.

PUBLICATIONS

Variational Deep Learning via Implicit Regularization. Jonathan Wenger*, **Beau Coker***, Juraj Marusic, John P. Cunningham. Pending review, 2025.

Implications of Gaussian process kernel mismatch for out-of-distribution data. **Beau Coker**, Finale Doshi-Velez. ICML Workshop on Workshop on Structured Probabilistic Inference & Generative Modeling, 2023.

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, 2023

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, 2023

- 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.

Received Certificate of Distinction in Teaching in 2020-2021 and 2022-2022.

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

JSM session on Advances in Inference and Theory for Bayesian Neural Networks | Portland, OR 2024
NSF AI Institute for Artificial and Natural Intelligence Visit Day | New York, NY 2024
Center for Basic Machine Learning Research in Life Science (MLLS) in Copenhagen | 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.