Blake Bullwinkel

Contact Information

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Education

Harvard University, Cambridge, MA — May 2022
M.S. in Data Science. GPA: 3.95/4
Advisor: Pavlos Protopapas
Thesis: *Generative Adversarial Network Methods for Solving Differential Equations*

Williams College, Williamstown, MA — June 2020
B.A. in Mathematics, Chinese. GPA: 3.83/4 (*cum laude*)

University of Oxford, Oxford, UK — June 2019
Attended as part of the selective, year-long Williams-Exeter Program at Oxford.

Publications

R Pellegrin*, **B Bullwinkel***, M Mattheakis, P Protopapas. *Transfer Learning with Physics-Informed Neural Networks for Efficient Simulation of Branched Flows.* NeurIPS Workshop on Machine Learning and the Physical Sciences, 2022.

B Bullwinkel*, D Randle*, P Protopapas, D Sondak. *DEQGAN: Learning the Loss Function for PINNs with Generative Adversarial Networks.* ICML Workshop on AI for Science (AI4Science), 2022.

B Bullwinkel, K Grabarz, L Ke, Sc Gong, C Tanner, J Allen. *Evaluating the Fairness Impact of Differentially Private Synthetic Data.* ICML Workshop on Theory and Practice of Differential Privacy (TPDP), 2022.

Research Experience

Physics-Informed Neural Networks, Harvard University — Feb 2021–May 2022
Master's Thesis. Advisors: Pavlos Protopapas, David Sondak

- Researched methods to improve the training stability of DEQGAN, a generative adversarial network for obtaining accurate solutions to a wide range of ordinary and partial differential equations.
- Developed multi-head architectures and transfer learning algorithms to more efficiently simulate branched flows, a universal wave phenomenon.
- Maintained research code in a user-friendly PyTorch package.

Interpretable Machine Learning, Harvard University — Feb 2022–May 2022
Spring Research Course. Advisors: Weiwei Pan, Yaniv Yacoby

- Investigated how non-identifiability in additive models can cause misleading model interpretations in the healthcare domain.
- Characterized a particular form of non-identifiability that arises when generalized additive models are trained on data with interaction effects.

Differential Privacy and Fairness, Microsoft — Sept 2021–Dec 2021
IACS Capstone Project. Advisor: Joshua Allen

- Led a collaboration among graduate students and Microsoft researchers to understand the fairness impact of training machine learning models on differentially private synthetic data.
- Proposed a simple pre-processing technique to synthesize data that promote more fair outcomes without degrading accuracy.

Epidemiological Modeling, Williams College — Feb 2020
Senior Mathematics Colloquium. Advisor: Julie Blackwood

- Applied compartmental models to early COVID-19 data published by the Chinese National Health Commission to estimate key disease parameters and simulate an outbreak on a college campus with a quarantine policy.

Professional Experience

Microsoft, Redmond, WA — Aug 2022–Present
Data & Applied Scientist

- Deployed an LLM-powered app that answers questions about internal documentation using retrieval augmented generation (LangChain, Azure OpenAI Service, Azure Cognitive Search).
- Created a vector database of text embeddings to correlate performance bugs and identify common root causes.
- Built a pipeline to detect kernel-mode memory leaks across the Azure fleet and collaborated with OS engineers to mitigate the highest impact leaks, saving around 2TB of memory per day.
- Trained ML models that help deployment teams assess the risk of Azure Host OS updates.

PepsiCo R&D, Valhalla, NY — Summer 2021
Data Science & Analytics Intern

- Developed a Python package for anomaly detection of water usage time series data.
- Trained models (ARIMA, Facebook Prophet, LSTM) to forecast water usage efficiency, lowering the mean validation RMSE by 43% in comparison to a moving average baseline.
- Developed an automated data pipeline with actionable insights in Power BI, adopted by beverage plants nationwide.

Marble — June 2020–Jan 2022
Co-Founder

- Led the development of an iOS mobile app that provides carbon footprint estimates for grocery products.
- Built Google Firebase backend with 150,000+ products scraped from supermarket websites.
- Accepted into the Harvard i-lab Venture Program for three consecutive semesters.

Zola Electric, Amsterdam, Netherlands — Summer 2019
Digital Platforms Intern

- Performed time series analysis to identify and explain transaction delays in solar electricity startup's software platform.

Teaching Experience

Graduate Teaching Fellow, Harvard University — Feb 2022–May 2022

- CS 109b: Advanced Topics in Data Science
- Prepared teaching materials and held office hours for students studying non-linear statistical methods and deep learning models, including CNNs, RNNs, LSTMs, autoencoders, GANs, and transformers.

Undergraduate Teaching Assistant, Williams College — 2017–2020

- CHIN 201: Intermediate Chinese I (Fall 2017)
- CHIN 202: Intermediate Chinese II (Spring 2018)
- CHIN 301: Upper-Intermediate Chinese I (Fall 2019)
- CHIN 302: Upper-Intermediate Chinese II (Spring 2020)
- In 1:1 sessions, met weekly with students for casual discussions to practice spoken language, review vocabulary, and learn grammar structures.

Service & Outreach

IACS ComputeFest, Harvard University — Jan 2022
Volunteer Teaching Assistant

- Worked alongside professors to run workshop focused on teaching fundamental data science skills, including Python programming, probability theory, linear algebra, and statistics.

Honors & Awards

Certificate of Distinction in Teaching, Harvard University — 2022
Awarded based on student ratings (mean 4.67/5) for teaching of CS 109b.

IACS Student Scholarship, Harvard University — 2021
Awarded to support data science thesis research at IACS ($20,000 award).

Goldberg Prize in Mathematics, Williams College — 2020
Awarded to the graduating senior who delivers the best mathematics colloquium.

Linen Senior Prize in Chinese, Williams College — 2020
Awarded to the top graduating Chinese major.

Putnam Competition, MAA 2019
Scored 18, ranking fifth at Williams and in the top 15% of all participants.

Carolyn Altes Scholarship, AWCA 2019
Awarded on the basis of academics and potential to contribute to society.

Linen Grant, Williams College 2017
Awarded on the basis of academics to support summer study in China.

Davis UWC Scholar, Davis United World College Scholars Program 2016
Awarded to recognize commitment to building cross-cultural understanding.

Class of '16 Student Speaker, UWCSEA East 2016
Elected by peers to deliver the Class of '16 graduation student address.

Skills & Interests

Programming: Python (NumPy, pandas, sklearn, TensorFLow, PyTorch), R, SQL, KQL, HTML/CSS, JavaScript

Tools/Platforms: Conda, Jupyter, Git, Docker, Kubernetes, Azure, AWS

Language: Working proficiency in written and spoken Chinese (Mandarin)

Interests: Running, rowing, piano, writing (Medium blog), Rubik's cube solving (WCA profile)

References

Dr. **Pavlos Protopapas**
Harvard University
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Dr. **Weiwei Pan**
Harvard University
Email: weiweipan@g.harvard.edu

Dr. **Mihai Stoiciu**
Williams College
Email: mstoiciu@williams.edu

Dr. **Julie Blackwood**
Williams College
Email: jcb5@williams.edu