Nathaniel Monson, PhD

13305 Collingwood Terrace, Silver Spring, MD 20904

(330) 366-2891 nmonson1@gmail.com

EDUCATION

University of Maryland, College Park *08/2022*

PhD in Mathematics. Advisors: Wojciech Czaja, Patrick Brosnan

Thesis: ***Topological Data Analysis, Dimension Reduction, and Computational Efficiency***

- Dissertation featured a novel result on the stability of persistent homology, useful for dimension reduction methods in computational topology, together with numerical experiments measuring practical impact
- Teaching assistant nominated for 3 Excellence in Teaching awards
- Dean's Fellow (2010-2012) and recipient of Academic Excellence Award (2010-2011)

Swarthmore College *06/2008*

Bachelor of the Arts

- B.A. with High Honors, Mathematics major and Economics minor
- McDiarmid & Ivins Scholar of Note for academic achievement 2007-2008

PROFESSIONAL EXPERIENCE

Garoux, LLC *2/2023-present*

AI consultant

- Worked with Michael Kriesel on questions involving data featurization for neural nets
- Identified SotA architectures and methods for various problem types

Stanford Existential Risks Initiative *11/2022-12/2022*

ML/Alignment Theory Scholars Program (SERI-MATS)

- Worked with John Wentworth studying AI agent foundations questions
- Curriculum includes a wide variety of ML subjects, especially focused on robustness, distribution shift, and interpretability (e.g., Neel Nanda's work on mechanistic interpretability)

Pacific Northwest National Laboratory *03/2022-10/2022*

National Security Intern Program

- Investigated uses of topological data analysis for object detection and vessel identification in image data
- Used PyTorch to create and train bespoke convolutional neural nets and investigated novel data augmentation techniques for topological data

University of Maryland, College Park *08/2010-12/2021*

Lecturer and Teaching Assistant

- Taught courses ranging from high school algebra to real analysis as a sole contact instructor, a teaching assistant, and a tutor
- Explained technical mathematical concepts to non-technical audiences

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LECG, LLC *08/2008-07/2010*

Associate – Promoted from Research Analyst

- Applied and interpreted financial models using economic principles and theories
- Performed economic analyses and summarized data-sets with SQL
- Scrutinized economic arguments of plaintiffs and defendants for weaknesses and logical fallacies
- Assisted in the preparation of expert witness reports and supporting materials for multi-billion dollar cases in diverse industries

Swarthmore College *05/2007-08/2007*

Joel Dean Research Fellow

- Read, abstracted, and summarized law review articles
- Identified critical points of the Congressional Record

Brigham Young University *06/2006-08/2006*

Mathematics Researcher

- Worked under Professors Michael Dorff, Denise Halverson, and Gary Lawlor on a research experience for undergraduates (REU) funded in part by the NSF
- Researched geometrical optimization with a focus on a variant of the isoperimetric problem

Smart Documents, Inc. *07/2002-05/2006*

Programmer

- Automated documents, including credit agreements, mortgage and deed of trust agreements, lockbox agreements, requests for interrogatories, and protective orders
- Used technical software to create automated templates for legal documents, allowing clients to adapt model documents to specific situations

SKILLS AND INTERESTS

- Math: Placed in top 400 in the 2006 William Lowell Putnam Competition in mathematics
- Proficiency with Matlab, Ripser, SQL, and Python, including numpy, scipy, scikit-learn, sympy, pandas, etc.
- Experience with deep learning and convolutional neural networks, especially PyTorch

PUBLICATIONS

- Monson, Nathaniel. *Topological Data Analysis, Dimension Reduction, and Computational Efficiency*. 2022. University of Maryland, PhD dissertation.
- Monson, Nathaniel. “Data Augmentation for Topological Data Inputs in Convolutional Neural Nets.” 2022. (In progress).
- Monson, Nathaniel. “A Generalization of a Classic Stability Result in Persistent Homology.” 2022. (In progress).
- Fowl, Liam and Monson, Nathaniel. “Using Diffusion Techniques for Graph Neural Nets to Improve Convolutional Neural Nets.” 2022. (In progress).
- Kochersberger, Kevin, et al. "Unmanned Aircraft Applications in Radiological Surveys." 2018 IEEE International Symposium on Technologies for Homeland Security (HST). IEEE, 2018.