Derek Onken

Philomath, Polymath, BS in Math

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Current Research Interests

I view myself as a data scientist working in the interdisciplinary overlap of mathematics, computer science, and statistics. I value leveraging theory from these fields to develop models for practical applications that mostly fall in the physical and biological realms.

Machine Learning for Pharmaceutical Applications

- Developing and deploying machine learning tools for use in clinical trials
- Leveraging neural networks to increase pharmaceutical product manufacturing yield
- Applying machine learning for accelerating drug development

Education

Ph.D. in Computer Science & Informatics, Emory University
Advisor: Lars Ruthotto
Dissertation: Optimal Control Approaches for Designing Neural Ordinary Differential Equations

M.S. in Computer Science, Emory University

B.S. in Mathematics and Computer Science, Honors College, University of Georgia
Minors: Physics and Classical Culture
Honors: Graduated High Honors with Capstone
Advisor: Juan B. Gutierrez

Computational Skills

Comfortable in	Python, PyTorch, Matlab, SQL
Familiar with	AWS, Julia, TensorFlow, `C`, `C++`, Java, R
Exposed to	MPI, x86, OpenCL, CUDA, HTML, Mathematica

Work Experience

Sr. Research Scientist, Eli Lilly, Advanced Analytics and Data Science (AADS)	2023-present
Research Scientist, Eli Lilly, Advanced Analytics and Data Science	2021-2023
Data Scientist Intern, UnitedHealth Group, R&D	2019, 2020
High Performance Computing Intern, Air Force Research Labs, UES Inc.	2018
Teaching Assistant, Emory University	2016-2018
Tutor, University of Georgia Athletic Department	2016
Undergraduate Researcher, University of Georgia Mathematics Department	2014
Piano Teacher	2013-2014
Summer League Swim Coach	2009, 2010

Leadership & Service

External Reviewer for several entities, including:

- Mathematical Sciences of Machine Learning Conference

- Cell *Patterns*
- Springer *International Journal of Dynamics and Control*
- IEEE *Transactions on Neural Networks and Learning Systems*

Mentor Polygence 2021-present
Member Emory Society for Industrial and Applied Mathematics (SIAM) 2016-2021
Volunteer Atlanta Science Festival 2016-2019
University of Georgia Men's Swimming & Diving Team 2011-2015

- Captain & NCAA Division I Varsity Athlete
- Competed at the Southeastern Conference Championships
- Qualified and competed at the 2016 U.S. Olympic Trials
- NCAA Academic All-American Honorable Mention 2013, 2014, 2015
- Awarded Dick Bestwick Scholar-Athlete Award, UGA Athletic Dept 2015
- Awarded Ramsey Scholarship for Academic and Athletic Excellence 2014-2015
- Awarded Peter O'Sullivan Hardest Worker Award, UGA Men's Swimming 2014, 2015
- Awarded Alex Patterson Scholar-Athlete Award , UGA Men's Swimming 2014
- College Swim Coaches of America Association Scholar All-American Team 2013, 2014, 2015

Student-Athlete Advisory Committee Team Representative 2014-2015

Honors & Awards

Eli Lilly Chief Information & Digital Officer Finalist (Immunology, Rising Star) 2022
Eli Lilly Chief Information & Digital Officer Award (Manufacturing) 2021
Eli Lilly Top 100 Innovator Award (Immunology, x2) 2021,2023
Eli Lilly Innovator Award (x6) 2021-2023
Phi Beta Kappa 2015
University of Georgia Presidential Scholar 2014
University of Georgia Athletic Director's Honor Roll 2012-2015
Southeastern Conference Academic Honor Roll 2012-2015
University of Georgia Dean's List 2012-2015

Publications

Title is a clickable link to access manuscript pdf.
For conferences and posters, presenter is underlined.
* denotes co-first authors

Preprints

[P.1] **D. Onken**, L. Ruthotto
Discretize-Optimize vs. Optimize-Discretize for Time-Series Regression and Continuous Normalizing Flows
arXiv:2005.13420, 2020
| code | videos |

Peer-Reviewed Journal Articles

[J.2] **D. Onken**, L. Nurbekyan, X. Li, S. W. Fung, S. Osher, L. Ruthotto
A Neural Network Approach for High-Dimensional Optimal Control Applied to Multi-Agent Path Finding
IEEE Transactions on Control Systems Technology, June 2022
| code | videos | doi |

[J.1] Y. Vigfusson*, T. Karlsson*, **D. Onken***, *et al.*
Cell-Phone Traces Reveal Infection-Associated Behavioral Change
Proceedings of the National Academy of Sciences (PNAS), Feb 2021, 118 (6) e2005241118
| code | doi |

Peer-Reviewed Conference Proceedings

[C.2] **D. Onken**, L. Nurbekyan, X. Li, S. W. Fung, S. Osher, L. Ruthotto
A Neural Network Approach Applied to Multi-Agent Optimal Control
European Control Conference (ECC), 1036–1041, 2021
| code | videos | doi | talk slides | talk recording |

[C.1] **D. Onken**, S. W. Fung, X. Li, L. Ruthotto
OT-Flow: Fast and Accurate Continuous Normalizing Flows via Optimal Transport.
AAAI Conference on Artificial Intelligence, 35(10), 9223-9232, 2021
| code | url | talk slides | talk recording | poster |

Invited Talks

A Neural Network Approach for High-Dimensional Optimal Control, presented at

[T.5] Applied Mathematics and Statistics Colloquium, Colorado School of Mines, Oct 2021
| slides |

[T.4] Optimal Transport and Mean Field Games Seminar, University of South Carolina, Mar 2021
| slides |

[T.3] Applied Mathematics Seminar, UCLA, Mar 2021
| slides |

[T.2] Virtual Informal Systems Seminar (VISS) at Centre for Intelligent Machines (CIM) at McGill and the Groupe d'études et de Recherche en Analyse des Décisions (GERAD), Feb 2021
| slides | recording |

Efficient and Accurate Discretize-Optimize Approaches for Training Deep Residual Networks, presented at

[T.1] SIAM Mathematics of Data Science, Jun 2020
| slides |

Peer-Reviewed Poster Presentations

[R.2] **D. Onken**, S. W. Fung, X. Li, L. Ruthotto
Normalizing Flows Via Mean Field Games and Hamilton-Jacobi-Bellman Equations
SIAM/CAIMS AN2020

[R.1] **D. Onken**, R. Jennings, S. Garth, E. Haber, E. Treister, S. Novikov, L. Ruthotto

Using PDE-Based Neural Networks for Classifying 3-D LDCT Images for Lung Cancer Detection
IPAM Deep Learning for Medical Applications 2020

Selected Presentations & Posters

[12] *talk*, Clinical Imaging, *Lilly AADS: Winning with AI Symposium*, Mar 2023

[11] *demo*, Utilizing Amazon Web Services EC2 Bursting in High-Performance Computing environment, *Lilly AADS Tutorial*, Dec 2022

[10] *talk*, Deep Learning for Manufacturing, *Game-Changers: Lilly Board of Directors*, Oct 2022

[9] *talk*, Optimal Transport Primer, *Lilly AADS ML/AI Team Meeting*, Sep 2022

[8] *demo*, Training Neural Networks in Amazon Web Services, *Lilly Technical Seminar Series*, Jun 2022

[7] *talk*, Deep Learning Primer: The Truth Behind the Buzzword, *Lilly Technical Seminar Series*, Mar 2022

[6] *talk*, Image Transformers, *Lilly AADS Image Capability Meeting*, Aug 2021

[5] *talk*, Image Classification For Lung Cancer Via Neural Networks Based On Partial Differential Equations, *UnitedHealth Group Internship Presentation*, Aug 2019

[4] *talk*, PDE-based Neural Networks, *UnitedHealth Group Brown Bag Lecture Series*, Jul 2019

[3] *talk*, Applying Higher-Order Runge-Kutta Methods To Neural Networks, *Emory Scientific Computing Seminar*, Apr 2019

[2] *poster*, Applying Higher-Order Runge-Kutta Methods To Neural Networks, *Georgia Scientific Computing Symposium*, Feb 2019

[1] *poster & talk*, Cell Segmentation via Convolutional Neural Networks, *High Performance Computing and Modernization Program*, Aug 2018

[0] *poster*, Tracking Behavioral Alterations via Cell Phone Data, *Amazon Graduate Research Symposium*, Oct 2017

Selected Relevant Coursework

Coursework at Emory University:

- Numerical Optimization
- Deep Learning Numerics
- Numerical Analysis II
- Numerical Analysis I
- Data Mining
- Machine Learning
- Biostatistical Methods
- Algorithms
- Systems Programming
- Distributed Processing
- Database Systems
- Computer Security (Hacking)

Graduate-level coursework at the University of Georgia:

- Bivariate Splines
- Complex Analysis
- Automata
- Algorithms
- Software Engineering
- Thermodynamics