Michael McCabe

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Education

University of Colorado Boulder Boulder, CO
Ph.D. in Machine Learning and Scientific Computing, Advisor: Jed Brown 2019–Current
M.S. in Applied Mathematics 2019–2022

Northwestern University Evanston, IL
B.A. in Economics and International Studies 2009–2013

- Capstone: "Analyzing the Impact of *Growth in a Time of Debt* on the Public Discourse on Austerity with Document Similarity Methods"

GRE: 170 Verbal/169 Quantitative/5.5 Writing

COURSEWORK: Statistical Learning, Machine Learning, Theoretical Machine Learning, Deep Learning, Design and Analysis of Algorithms, Parallel Programming, Deterministic Optimization, Cvx Optimization, Online Cvx Optimization, Numerical PDEs, Computational Bayesian Statistics

Work Experience

University of Colorado Boulder, Boulder, CO, *Research Assistant* 8/2019-Current
- Performs research at the intersection of Machine Learning and Scientific Computing. Current projects focus on (1) integrating prior knowledge in the form of ODEs/PDEs, conservation laws, and invariances into scientific deep learning methods to improve data efficiency and extrapolation capabilities and (2) developing improved optimization methods for scientific machine learning.

Lawrence Berkeley National Lab, Berkeley, CA, *Graduate Researcher* 5/2022-1/2023
- Examined the failure scenarios in deep learning based global weather models from the perspective of numerical methods and spectral analysis. Identified several key modes of failure and developed architectural improvements to address them resulting in significantly more stable forecasts enabling architectures originally designed for medium-range forecasts (10 days) to be used coherently for seasonal forecasts (3 months) or longer without significant computational cost increases.

Argonne National Lab, Lemont, IL, *Givens Associate* 5/2020-7/2020
- Developed multi-device RL-based framework for learning to optimize in mixed-precision in JAX.

Ayasdi, Menlo Park, CA, *Data Scientist* 11/2016-7/2019
- Designed and implemented Machine Learning and Topological Data Analysis pipelines for healthcare, government, and financial services clients using both Ayasdi software and the scientific Python ecosystem.
- Collaborated with product and engineering teams in research and development capacity to develop new platfom capabilities and prioritize candidate features for development.
- Developed an improved optimization framework for a non-convex unsupervised learning problem that exploited the structure of the problem to reduce run-time of a widely used software component to a quarter of the original execution time.

Eccella, New York, NY, *Senior Consultant* 2/2015-11/2016
- Architected large scale data integration projects involving 30+ heterogeneous systems and multiple business organizations from scoping through design, development, testing, and production support.
- Developed automation tools in Python and Java to integrate with enterprise ETL platforms in order to reduce development time on certain data flow mappings by approximately 80%.

Siemens Healthcare, Malvern, PA, *Consultant*   7/2013-2/2015

- Implemented custom C# solutions to tailor software to specific customer needs, particularly with regard to Health Information Exchange integration and cross-enterprise secure messaging.
- Completed more than twenty projects as a lead consultant within first year including managing product betas at multiple hospitals working closely with engineering team to identify potential defects and enable clients to hit Meaningful Use metrics with minimal disruption of existing workflows.

Publications

[1] **M. McCabe**, B. R.-S. Blancard, L. H. Parker, R. Ohana, M. Cranmer, A. Bietti, M. Eickenberg, S. Golkar, G. Krawezik, F. Lanusse, M. Pettee, T. Tesileanu, K. Cho, and S. Ho, *Multiple physics pretraining for physical surrogate models*, 2023. arXiv: 2310.02994 `[cs.LG]`.

[2] **M. McCabe**, P. Harrington, S. Subramanian, and J. Brown, *Towards stability of autoregressive neural operators*, 2023. arXiv: 2306.10619 `[cs.LG]`.

[3] R. Koki, A. Sheehan, E. Bradley, **M. McCabe**, and J. Brown, "Improving deep learning seismic arrival pickers using wavelet transforms", in *Fall Meeting 2022*, AGU, 2022.

[4] R. Koki, J. Stewart, C. Kumler, and **M. McCabe**, "A deep learning approach for detection, semantic segmentation and density classification of smoke in satellite imagery", in *Fall Meeting 2022*, AGU, 2022.

[5] **M. McCabe** and J. Brown, "Learning to assimilate in chaotic dynamical systems", in *Thirty-Fifth Conference on Neural Information Processing Systems*, 2021.

[6] **M. McCabe** and J. Brown, "Using Differentiable Physics for Self-Supervised Assimilation of Chaotic Dynamical Systems", presented at the 2020 Workshop on Differentiable Vision, Graphics, and Physics in Machine Learning at NeurIPS, 2020.

[7] **M. McCabe**, *Mapper Comparison with Wasserstein Metrics*, 2018. arXiv: 1812.06232 `[cs.CG]`.

Presentations

- **Data Science in the Healthcare Industry** at Colorado State University   February 2020
  CSU Data Science Seminar
- **Graph Neural Networks in the Physical Sciences** at University of Colorado Boulder   November 2019
  CU Optimization and ML Seminar
- **Fine-grained Segmentation for Population Risk** at HIMSS 2018   March 2018
  HIMSS Solutions Lab

Teaching

- **Graduate Student Staff** at University of Colorado Boulder   Fall 2019
  Data Science Projects (4831/7000)

Technical Skills

Languages: Python, SQL, C++, Java, Scala, Matlab
Frameworks: PyTorch, JAX, TensorFlow, SciPy Ecosystem, Spark
Databases: Oracle, MySQL, MS SQL Server, SQLite, Postgres, HDFS

Scholarships and Awards

- CU Boulder CS Early Career Professional Development Fellowship   2019
- Ayasdi "Flare" Performance Award   2018
- Ayasdi "Hero" Recognition   2017
- Eccella "Eccelarator" Performance Award   2015
- Siemens "You Answered" Recognition   2014
- Nominated for Guetzkow Prize for Outstanding Senior Research Paper in International Studies   2013
- Design Award for Engineering Design and Communication   2009
- Siemens Foundation Merit Scholarship   2009–2013

Service

- Reviewer at NeurIPS 2021   Summer 2021
- CU Boulder Numerical Computing Reading Group Coordinator   2020–Current
- CU Boulder CS Department Peer Mentor   2020–Current
- CU Boulder CS Department Application Feedback Mentor   Fall 2020, 2021
- Volunteer at NeurIPS 2020   Winter 2020
- Volunteer at ICML 2020   Summer 2020
- Volunteer at ICLR 2020   Spring 2020