COOPER SIMPSON

Computational and Mathematical Scientist

RS-Coop · rs-coop.github.io · Google Scholar · rscooper@uw.edu · Seattle, WA

September 13, 2024

EDUCATION

Applied Mathematics Ph.D
University of Washington Seattle

📅 2024 – Present   🎓 GPA: N.A.
Advisor: N.A.

Applied Mathematics M.S.
University of Colorado Boulder

📅 2020 – 2022   🎓 GPA: 3.863
Advisor: Stephen Becker

Applied Mathematics B.S.
University of Colorado Boulder

📅 2017 – 2020   🎓 GPA: 3.933
Minor: Computer Science

SKILLS

Python · PyTorch · Julia · LaTex
Linux · Git · HPC · German · French

COURSES

Machine/Deep Learning · Numerics
Optimization · Mathematical Analysis
Differential Eqs. · Linear Algebra
Probability · Statistics · Algorithms

SOFTWARE*

.jl SFN Lead
Julia package for non-convex Newton-type optimization algorithms.

.jl RandNLA Lead
Julia package for randomized numerical linear algebra.

AWARDS*

Wan Fellowship
Prestigious two-year UW Applied Math departmental fellowship.

WORK & TEACHING EXPERIENCE*

Professional Research Assistant
Aerospace Mechanics Research Center   📅 May 2022–Sep 2024   📍 CU, Boulder

- Investigated non-linear compression techniques, such as autoencoding and implicit representation neural networks, for large-scale scientific simulations
- Developed QuadConv, a quadrature-based convolution operator for use in deep learning
- Developed a sketching-based paradigm for online training of neural compressors
- Working with supercomputer systems through Argonne Leadership Computing Facility (Polaris & Theta) and CU Boulder (Alpine & Blanca)

Development Intern
Electro Magnetic Applications (EMA3D)   📅 June–Aug 2021   📍 Denver, CO

- Developed production software for Charge and Cable – electromagnetic simulation tools
- Implemented generalized barycentric interpolation for arbitrary convex polyhedra
- Built post-processing functionality for complex unstructured 3D meshes

Teaching & Course Assistantships
College of Engineering   📅 Variable 2018–2023   📍 CU, Boulder

- Taught recitations and ran office hours teaching students fundamental mathematical skills
- Worked independently and with faculty members to develop course materials

Applied Deep Learning (Lecturer) · Differential Eqs. & Linear Algebra (TA) · Calculus 1 (TA)
Applied Probability (CA) · Data Structures (CA) · Starting Computing (CA)

PROJECTS & PUBLICATIONS*

Regularized Saddle-Free Newton   Independent, Master's Thesis

R-SFN is a novel second-order Newton-type method for non-convex optimization. A non-linear transformation to the Hessian ensures global convergence to second-order stationary points and an efficient matrix-free implementation.

- Cooper Simpson and Stephen Becker. *Regularized Saddle-Free Newton: Saddle Avoidance and Efficient Implementation*. 2023
- Cooper Simpson. "Regularized Saddle-Free Newton: Saddle Avoidance and Efficient Implementation". M.S. Thesis. Dept. of Applied Mathematics, CU Boulder, 2022

Quadrature-Based Convolutions   CU AMReC

QuadConv is a quadrature-based discrete convolution operator for use in training deep neural networks on non-uniform data.

- Kevin Doherty, Cooper Simpson, et al. "QuadConv: Quadrature-Based Convolutions with Applications to Non-Uniform PDE Data Compression". In: *Journal of Computational Physics* (2023)

Neural Networks for Microcontrollers   Correll Robotics Lab

A Python package for translating trained neural networks into C code for use in embedded systems.

- S. Aguasvivas, D. Hughes, C. Simpson, et al. "Embedded Neural Networks for Robot Autonomy". In: *Robotics Research*. Cham: Springer International Publishing, 2022

＊Visit the links in the header for complete lists.