COOPER SIMPSON

Computational and Mathematical Scientist



EDUCATION

Applied Mathematics M.S.

University of Colorado Boulder

= 2020 - 2022

GPA: 3.863

Applied Mathematics B.S.

University of Colorado Boulder

= 2017 - 2020

@ GPA: 3.933

Minor: Computer Science

SKILLS

Python (PyTorch) (Julia) (C++) (C#)

C LaTex (Linux) Git (HPC) CAD German

COURSES

Deep Learning Optimization

Functional Analysis | Real Analysis

Complex Analysis Differential Eqs.

Machine Learning | Linear Algebra

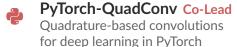
Probability (Statistics) (Algorithms

Numerics | Algorithmic Economics

${\sf SOFTWARE}^*$

RSFN Lead

Julia implementation of R-SFN optimization algorithm



PyTorch-ARC Lead

PyTorch implementation of the Adaptive Regularization with Cubics optimization algorithm

CERTIFICATIONS

Solidworks Associate

Certified with a perfect score on the CSWA exam in May 2019.

WORK EXPERIENCE*

Staff Scientist

Aerospace Mechanics Research Center

may 2022-Present

O CU, Boulder

- Investigating large-scale compression of PDE simulation data via autoencoding neural networks
- Developed QuadConv, a quadrature-based convolution operator for use in deep learning on unstructured and non-uniform meshes
- · Working with multiple supercomputer systems through Argonne Leadership Computing Facility (Polaris & Theta) and CU Boulder (Alpine & Blanca)

Development Intern

Electro Magnetic Applications (EMA3D)

描 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 2018-2021

OCU, Boulder

- Ran recitations and office hours helping to teach students fundamental skills in mathematics
- · Developed course material, and worked with faculty members to maintain an organized and effective teaching environment

Differential Eqs. & Linear Algebra (TA) (Calculus 1 (TA)) (Applied Probability (CA))

Data Structures (CA) Starting Computing (CA)

PROJECTS & PUBLICATIONS*

Regularized Saddle-Free Newton Master's Thesis

Presents R-SFN: a novel second-order method for non-convex optimization. A non-linear transformation to the Hessian in Newton's method provides provable saddle-avoidance and an efficient matrix-free implementation.

• 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 Research

Introduces QuadConv, a quadrature-based discrete convolution operator suitable for non-uniform data. We show it can match the effectiveness of traditional discrete convolutions for autoencoder based data compression, and it can achieve similar performance when the data exists on a non-uniform mesh.

• Kevin Doherty, Cooper Simpson, et al. "QuadConv: Quadrature-Based Convolutions with Applications to Non-Uniform PDE Data Compression". In: arXiv (2022). DOI: 10.48550/ARXIV.2211.05151

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, pp. 242-257. DOI: 10.1007/978-3-030-95459-8 15