COOPER SIMPSON

Computational and Mathematical Scientist





EDUCATION

Applied Mathematics M.S.

University of Colorado Boulder

2020 - 2022

GPA: 3.863

Thesis: Second-Order Optimization

Applied Mathematics B.S.

University of Colorado Boulder

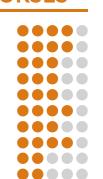
2017 - 2020

GPA: 3.933

Minor: Computer Science

SKILLS & COURSES

Python
Julia
C++/C#/C
Linux
Git
PyTorch
HPC
LaTex
CAD
German



Deep Learning Numerics Analysis

Differential Eqs. Machine Learning

Linear Algebra | Optimization

Probability Statistics Algorithms

Algorithmic Economics

ACHIEVEMENTS



Solidworks Associate

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



CRA Honorable Mention

2020 Computing Research Association Outstanding Undergraduate Researcher.



Gateway to Space

Received best in option award at spring 2018 ITLL Design Expo for balloon satellite kinetic energy generation experiment.

WORK EXPERIENCE

Temporary Researcher

Aerospace Mechanics Research Center

May 2022-Present

OCU. Boulder

- Investigating large scale compression of PDE simulation data on unstructured meshes
- Built a framework for deep learning research and experimentation on high-performance computing systems using PyTorch and PyTorch Lightning

Development Intern

Electro Magnetic Applications (EMA3D)

₩ June-Aug 2021

Oenver, CO

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

Research Assistant

Correll Robotics Lab

m Dec 2018-May 2021

CU, Boulder

- Aided in the development of nn4mc, a software which allows users the ability to embed complex neural networks on microcontrollers
- Investigated methods and tools for embedding complex distributed robotic behaviour through compiled high level primitives

Teaching & Course Assistantships

College of Engineering

₩ Variable through 2021

OCU, Boulder

- Ran recitations and held office hours helping to teach students fundamental skills
- 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

We present a novel second-order method for non-convex optimization dubbed R-SFN. A non-linear transformation to the Hessian 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

We introduce a quadrature based discrete convolution operator suitable for use on spatially unstructured data. We show this operator can match the effectiveness of traditional discrete convolutions for autoencoder based data compression, and it can achieve similar performance when the data exists on an unstructured mesh.

• Kevin Doherty et al. "QCNN: Quadrature Convolutional Neural Network with Application to Unstructured Data Compression". In: (2022). arXiv: 2 [cs.LG]. Submitted

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 et al. "Embedded Neural Networks for Robot Autonomy". In: *Robotics Research*. Cham: Springer International Publishing, 2022, pp. 242–257