

Tim Whitaker, PhD

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Website · <https://deadneuron.com>

Scholar · <https://scholar.google.com/citations?user=Rb-16TYAAAAJ>

Github · <https://github.com/tjwhitaker>

Professional Statement

I'm a computer scientist, researcher, and engineer with over a decade of combined experience building maintainable software and conducting original academic research. I am deeply engaged in exploring the evolving paradigms of artificial intelligence and machine learning with a keen interest in algorithms to improve the performance of deep neural networks. My expertise is grounded in the landscape of modern deep learning methodologies with a focus on neural network optimization, efficient ensemble learning methods, and model compression techniques. I am reliable and driven with a passion for pursuing novel ideas and solving challenging problems.

Education

Doctor of Philosophy in Computer Science **Fall 2023**

Colorado State University

Dissertation: *Subnetwork Ensembles*

Committee: Darrell Whitley, Charles Anderson, Michael Kirby, Nikhil Krishnaswamy

Master of Science in Computer Science **Fall 2021**

Colorado State University

Thesis: *Reinforcement Learning with Sparse Reconfigurable Neural Networks*

Committee: Darrell Whitley, Charles Anderson, Michael Kirby

Bachelor of Science in Computer Science **Fall 2015**

California State University, Chico

Capstone Project: *Real Time Web Performance Analysis*

Advisor: Tyson Henry

Relevant Coursework

Artificial Intelligence, Machine Learning, Embedded Machine Learning, Image Computation, Natural Language Processing, Quantum Computing, High Performance Computing, Software Engineering, System Architecture, Algorithmic Language Compilers, Computational Theory, Stochastic Processes

Associations and Honors

- Recipient of The Artificial Intelligence and Evolutionary Computation Fellowship at Colorado State University
- Presenter and Technical Committee Member: AAAI, IJCNN, and GECCO
- Presenter at The Computer Science Research Seminar at Colorado State University (2020, 2021, 2022)
- Session Chair for IJCNN Neural Network Models (2023)
- Member of IEEE, ACM, INNS
- Member of The Artificial Intelligence and Evolutionary Computation Lab at Colorado State University
- Member of The Pattern Analysis Lab at Colorado State University

Certifications

- Human Subjects Protection - Colorado State University
- Responsible Conduct for Research - Colorado State University

Experience

Graduate Research Assistant

1/2020 · Present

Colorado State University, Department of Computer Science

- Designed, implemented, and collaborated on a wide variety of experiments grounded in the modern deep learning landscape. Includes novel network architectures, optimization algorithms, and theoretical analysis for applications in computer vision, reinforcement learning, and natural language processing.
- Led, mentored, and assisted junior graduate students working in The Artificial Intelligence and Evolutionary Computation Lab.
- First authored several papers accepted to prominent international conferences.
- Funded by NSF Grant 1908866: "Sparse reconfigurable artificial neural networks: optimal neuron selection and generalization."

Software Engineer

1/2015 · 8/2021

Kettle, LLC. Design and Development Firm

- Designed, developed, and maintained web applications and ecommerce sites for Google, Disney, Namecheap, Boosted Boards, LifeBeam, Peleton, MyxFitness, and Show Imaging.
- Led and managed a team overseeing the migration of a large API management project to Google's infrastructure.
- Day of coordination and management for a real time interactive feed at Disney's 2016 Upfront event in Anaheim, California.
- Implemented a wide variety of both backend and frontend applications across many tech stacks including: React, Angular, Vue, Django, Rails, Shopify, and Wordpress.

Web Developer

10/2012 · 10/2013

Navigation North Learning Solutions

- Maintained, troubleshooted, and implemented style guides for web applications at The United States Department of Educational Technology, The California Department of Education, and The Smithsonian Center of Learning and Digital Access.

Web Development Intern

4/2012 · 9/2012

Marketfleet

- Managed the design and development of a Magento ecommerce store and the integration of a custom marketplace widget/plugin.

Publications

Prune and Tune Ensembles

February 2022

Low-Cost Ensemble Learning with Sparse Independent Subnetworks
AAAI 2022

Quantum Neuron Selection

July 2022

Finding Performant Subnetworks with Quantum Algorithms
GECCO 2022 Quantum Optimization Workshop

Low-Cost Ensemble Learning

December 2022

Surveying Efficient Methods for Training Multiple Deep Neural Networks
PhD Preliminary Exam

Interpretable Diversity Analysis

June 2023

Visualizing Feature Representations in Low-Cost Ensembles
IJCNN 2023

Synaptic Stripping

June 2023

How Pruning Can Bring Dead Neurons Back To Life
IJCNN 2023

Sparse Mutation Decompositions

July 2023

Fine Tuning Deep Neural Networks with Subspace Evolution
GECCO 2023

Stochastic Subnetwork Annealing

In Review

A Regularization Technique for Fine Tuning Pruned Subnetworks
WCCI 2024

Subnetwork Ensembles

December 2023

Theoretical Insights and Empirical Investigations
PhD Dissertation

Open Source

Prune and Tune Ensembles

An accurate, efficient, and generalized low-cost ensemble learning framework. Contains benchmark code to reproduce results from experiments reported in the research paper.

<https://github.com/tjwhitaker/prune-and-tune-ensembles>

Synaptic Stripping

Selectively pruning Vision Transformers to regenerate dead neurons and increase model capacity. Contains benchmark code to reproduce results from experiments reported in the research paper.

<https://github.com/tjwhitaker/synaptic-stripping>

Dueling MIDI

Codebase for an embedded machine learning audio effect pedal implemented on an Nvidia Jetson Nano. Trained several sequence based models (1D CNN, LSTM, GRU) to play an interactive dueling duet that is conditioned on what you play in real time.

<https://github.com/tjwhitaker/dueling-midi>

WorldGAN

3D environment generation using deep conditional generative adversarial networks. Draw a segmentation map using predefined brushes (mountains, hills, terraces, plains, rivers, trees, etc.) to generate terrain maps for use with Unreal, Unity, and Blender. Models trained on USGS, NASA, and NGA elevation data sources.

<https://github.com/tjwhitaker/worldgan>

Procgen

My submissions for the 2020 NeurIPS Procgen competition. I took 1st, 8th, and 11th place out of 545 competitors in each of the three respective rounds. My solution incorporated a lot of experimentation. Effective strategies included sparse and noisy pseudo-ensembling, reward shaping, action masking, entropy based exploration strategies, curiosity bonuses, framestacking, continuous life accumulation, episode checkpointing, and network hyperparameter tuning.

<https://github.com/tjwhitaker/procgen>

Dead Neuron

Source code for my personal website. Static site generator built from scratch entirely in Scheme. Pandoc markdown/org/jupyter integration, homoiconic templating, and gulp build pipelines.

<https://github.com/tjwhitaker/deadneuron>

Paper Implementations, Exploratory Data Analysis, and Other Experiments

My github contains a variety of other work worth exploring, including implementations of popular machine learning papers, exploratory data science articles, and interactive web applications.