

AIDAN SWOPE

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RESEARCH

CircuitVAE: Efficient and Scalable Latent Circuit Optimization (2023)

First-author paper on reinforcement learning for black-box circuit optimization. Under review at NeurIPS 2023.

LeanDojo: Theorem Proving with Retrieval-Augmented Language Models (2023)

Second-author paper on automated theorem proving with large language models. Under review at NeurIPS 2023.

Representation Learning for Remote Sensing: An Unsupervised Sensor Fusion Approach (2020)

First-author paper on using contrastive unsupervised learning to train many-sensor geospatial models.

EDUCATION

California Institute of Technology (Caltech)

2016 – 2020

B.S. in Computer Science. GPA: 3.8.

Pasadena, CA

EXPERIENCE

NVIDIA

February 2021 - Present

Research scientist

Santa Clara, CA

- **Language model alignment:** Conducting research on aligning large language models to human preferences through reinforcement learning. Collecting human preferences and experimenting with model-generated training data.
- **Reinforcement learning for chip design:** Led a research project on training a reinforcement learning agent to design arithmetic circuits. Our new adder designs outperformed commercial tools and were incorporated into the GPU.
- **Automated theorem proving:** Designed an automated theorem prover using retrieval-augmented language models. Conducted research on retrieval mechanisms and reinforcement learning methods.

Caltech & NVIDIA

June 2020 - February 2021

Machine learning research intern – Anima Anandkumar's AI + Science Lab

Remote

- **Generalization research:** Investigated why transformers sometimes generalize better than tree- and graph-structured neural networks despite broader inductive bias. Ran experiments and co-authored a paper.

Descartes Labs

Summer 2019

Machine learning research intern – unsupervised learning

San Francisco, CA

- **Unsupervised learning research:** Developed a new algorithm for training convolutional neural networks unsupervised on many sensors at once. Paper described under “Research” above.
- **Geospatial foundation model:** Trained a large unsupervised model on 20 TB of geospatial data. Transfer learning from this model is the basis for Descartes Labs' current vision models, improving performance on multiple tasks.

Caltech

Spring 2019 - Spring 2020

Student lecturer

Pasadena, CA

- **Deep learning class:** Led a class on applied deep learning. Wrote lectures and assignments and managed class.

Descartes Labs

Summer 2018

Machine learning intern – computer vision

Santa Fe, NM

- **Tree segmentation model:** Developed a convolutional neural network to segment trees in overhead imagery. Deployed this model across California and urban areas worldwide, creating 15 TB of product data.
- **Pointcloud ingest pipeline:** Developed and deployed a point cloud data pipeline to preprocess and ingest over 100 TB of LIDAR heightmap data. Data used as ground truth for training multiple models since.

PERSONAL PROJECTS AND TECHNICAL SKILLS

Differentiable fluid simulator: A GPU-accelerated fluid simulator supporting backpropagating through simulation.

AlphaZero Othello bot: A strong game-playing bot trained with model-based reinforcement learning.

Reinforcement learning with binary neural networks: Applies gradient-free optimization to train binary neural networks with reinforcement learning. Implements fast binary neural networks with Cython on CPU and CUDA on GPU.

Selected technologies: PyTorch, Jax, TensorFlow (1 & 2), NumPy, Python, C, Haskell, CUDA (basics), SQL (basics)