Thomas Lu

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Education

University of California, Berkeley — Berkeley, CA
Bachelor of Arts in Computer Science and Physics (GPA 4.0/4.0) — *Aug. 2022 – May 2026*

Relevant Coursework

- Data Structures
- Advanced Linear Algebra
- Mechanics & Relativity
- Electromagnetism & Optics
- Computer Architecture
- Artificial Intelligence
- Advanced Algorithms
- Real Analysis
- Complex Analysis

Experience

Lawrence Berkeley National Laboratory — August 2023 – Present
Undergraduate Researcher — *Berkeley, CA*

- Designed a pipeline to apply redshift corrections to DESI quasar observations, reducing dispersion by 30%.
- Incorporated multiprocessing using JobLib and the NERSC High-Performance Computing cluster to visualize and analyze datasets as large as 200GB, delivering up to a 70x speedup on certain analysis tasks.

Speech and Computation Lab at UC Berkeley — August 2022 – Present
Undergraduate Research Fellow — *Berkeley, CA*

- Collaborated with researchers from Stanford, MIT, and JHU to deliver original work in leading NLP conferences.
- Implemented spoken language models in PyTorch and prototyped architectural and performance improvements.
- Developed portable applets in Google Colab to share results with other academics and in classroom settings.

Combat Robotics at Berkeley (Glitch on the Battlebots TV Show) — August 2022 – Present
Electronics Engineer — *Berkeley, CA*

- Designed a compact redundant 915MHz receiver module using a custom PCB, increasing signal range by 40% and greatly reducing the frequency of disconnections compared to off-the-shelf solutions.
- Implemented sensorless high-frequency injection on weapon motors using the VESC platform, producing spin-up performance comparable to sensored motors in a simpler and more reliable package.

Multi Physics and Circuit Lab at San Jose State University — May 2021 – December 2022
Student Researcher — *San Jose, CA*

- Designed deep learning tools for developing integrated circuits, extracting hidden device properties from empirically measured data and enabling inverse design based on desired device characteristics.
- Combined variational autoencoders implemented in Tensorflow with shallow regression algorithms to approximate highly nonlinear semiconductor voltage transfer curves with $R^2 = 0.98$ accuracy, at much lower computational cost.

Selected Projects and Publications

Unsupervised Articulatory Learning in GANs | *ICASSP 2024 (under review)*

- Using a pretrained ema2wav model, demonstrated that GANs could learn to generate speech by moving vocal articulators with only indirect feedback, paving the way for more realistic models of human language acquisition.
- Greatly reduced noise in the model by adjusting kernel sizes and adding a low-pass convolutional filter, producing clearer and more interpretable results.
- Adapted the model to use the AWS Trainium accelerator for a 4x speedup compared to GPU training.

Syntax from Speech in GANs | *arxiv.org/abs/2305.01626*

- Discovered that GANs trained on single-word inputs would spontaneously generate multi-word outputs at extreme latent value inputs, and quantified this behavior using a logistic regression model with $p < 0.0001$.
- Implemented a fine-tuned Whisper model to automatically transcribe data, allowing for 100x increase in total data analyzed. Produced a 30% accuracy increase and 4x cost reduction compared to the off-the-shelf OpenAI solution.

Sentiment Analysis with QRNN | *UC Berkeley Deep Tech Conference 2023 (oral presentation)*

- Developed a Quantum Recurrent Neural Network (QRNN) for use in sentiment analysis tasks and implemented a classical small-scale simulation with 5 input qubits using PyTorch.
- Achieved a 15% accuracy increase compared to a naive Variational Quantum Eigensolver implemented in Qiskit, and a 20% accuracy increase compared to a classical RNN implemented in PyTorch with equal parameter count.

Technical Skills

Languages: Java, Python, C/C++, R, RISC-V
Developer Tools: Git, Vim, SSH, AWS EC2
Frameworks: Tensorflow, PyTorch, QisKit, OpenMP, OpenMPI
Hardware Skills: PCB Design, Fusion360, 3D printing