RICHARD GAO

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EDUCATION

UC SANTA BARBARA *Santa Barbara, CA*

B.S. in Computer Science • GPA: 3.95/4.0 *Sept. 2021 – Dec. 2024*

- **Relevant Coursework:** Network Modeling and Graph Machine Learning (graduate), Uncertainty Quantification and Scientific Machine Learning (graduate), Deep Learning, Natural Language Processing, Machine Learning, Artificial Intelligence, Discrete Math
- **Activities & Honors:** Dean's Honors (all quarters), Graduated with High Honors (top 8.5%), SB Hacks, Coders SB, Chinese Student Union, Poker Club

EXPERIENCE

UCSB ECE *Santa Barbara, CA*

Undergraduate Researcher *May 2024 – present*

- Conducting research on sustainable training advised by Prof. Zheng Zhang
- Researched meta-learning approaches to zeroth-order backpropagation-free training.
- Independently investigating task-agnostic knowledge distillation-based compression on LLMs.
- Collaborating with lab members to benchmark results on tensor-train factored transformer models.
- Attend weekly seminars and lab meetings to present findings and discuss energy-efficient training research.

TECHLENT *San Francisco, CA*

Software Engineer Intern *July 2021 – Oct. 2021*

- Implemented a backend database system for admins to manage 200+ clients and programs using PostgreSQL.
- Created a web app for admins using Flask to edit their database through a graphical interface.
- Attended weekly standup meetings to report progress to team members.

JOBSTER.IO *Toronto, CAN (Remote)*

Software Engineer Intern *June 2021 – Oct. 2021*

- Designed a resume parser tool to extract the years of experience to automate applicant registration.
- Implemented named-entity recognition and optical character recognition to parse PDF format resumes.
- Tested implementation on a 1000+ resume dataset, achieving high accuracy.
- Attended weekly remote meetings to report progress to team members.

PROJECTS

KAN We Tensorize GraphSAGE *November 2024*

- Explored the use of Kolmogorov-Arnold Networks (KANs) as an alternative to multilayer perceptrons in GraphSAGE.
- Investigated compression using tensor-train decomposition on learnable weights of GraphSAGE.
- Implemented modified aggregators in PyTorch and performed experiments on protein-protein interactions, scientific paper network citations, and a synthetic dataset.
- Demonstrated effectiveness of KAN layers and compressibility of the linear layers of GraphSAGE.
- Completed a 10-page report detailing background, motivation, methods, and results.

ZEROTH-ORDER SPIKING NEURAL NETWORK TRAINING *May 2024*

- Developed an end-to-end training framework for non-differentiable spiking neural networks via meta-learning for neuromorphic computing.
- Used local zeroth-order gradient with an LSTM meta-optimizer for variance reduction from conference papers.
- Implemented training algorithm in PyTorch and performed experiments on the MNIST dataset.
- Demonstrated transferability of the learned optimizer to different spiking neural network architectures.
- Achieved fast convergence and high accuracy against SoTA optimizers on a network of ~300k parameters.

MICROCYLINDER CLOTH RENDERER *March 2024*

- C++ implementation of "A Practical Microcylinder Appearance Model for Cloth Rendering."
- Coded path-tracing w/ Russian roulette, bidirectional scattering distribution function, importance sampling, masking, and parallel processing.

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- Demonstrated implementation by rendering different sets of parameters on a custom scene

KNOWLEDGE NAVIGATOR *January 2024*

- App for semantic document search with natural language queries on user-uploaded PDF files
- Used Google Cloud DocumentAI Optical Character Recognition API to identify text on uploaded documents
- Implemented pre-trained transformer encoder-only network to obtain dense text and query embedding vectors
- Designed reranking and cosine similarity-based comparison to display relevant text to the user

3D ENVIRONMENT GENERATOR *March 2023*

- Web app to procedurally generate custom 3D environments through a graphical interface by uploading custom 3D building blocks; used React.js, Firebase, Flask, AWS EC2, MongoDB
- Generates up to 20x20x20 block environments using the Wavefunction Collapse algorithm.
- Designed the block-adjacency labeling algorithm for mesh matching.
- Implemented Python code for automatic 3D block labeling and adjacency rule generation for the Wavefunction Collapse algorithm, allowing for automatic constraint for user-uploaded meshes.

SKILLS & INTERESTS

Programming Languages: C++, C, Python, Java, JavaScript, SQL, HTML, CSS
Languages: English (fluent), Mandarin (fluent), Spanish (conversational)
Interests: Piano, botany, basketball, running, poker