David Haolong Lee

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Education

University of Southern California (USC) Los Angeles, California

Master of Science in Computer Science • GPA: 3.92/4.0 Aug 2024 – May 2025

Bachelor of Science in Computer Science (Engineering Honors) • GPA: 3.84/4.0 Aug 2020 – May 2024

Technical Skills

Ph.D. Coursework Theoretical Machine Learning, Algorithm Design, Convex & Combinatorial Optimization

Programming Languages Python, C/C++, Java, Bash

Tools & Frameworks PyTorch, JAX, Pandas, matplotlib, scikit-learn, Git, Linux

Professional Experience

Research Assistant *Interactive and Collaborative Autonomous Robotics Lab* Jun 2022 – Present

- Engineered an open-source **Python** library to modularize quality diversity algorithms into reusable, object-oriented components, improving code reusability and streamlining their implementation and comparison.
- Devised a novel gradient-based feature diversification algorithm that uncovered 4x more unique features in high-dimensional spaces compared to state-of-the-art methods.
- Accelerated density estimation by 150% and neural network evaluation by 200% using **PyTorch** and **JAX** optimization techniques.

Teaching Assistant (Discrete Math & Algorithms) *USC* Jan 2023 – May 2024

- Built an open-source **Python** library for dynamic programming visualization, boosting student comprehension through real-time feedback, interactive learning, and iterative practices.
- Assessed assignments and mentored 150+ students during office hours on algorithm design, proofs, and mathematical reasoning.

Co-founder *Licon Graphics* May 2022 – May 2023

- Finetuned **Stable Diffusion** model in **PyTorch** to generate high-fidelity and high-novelty subject-driven images.
- Deployed scalable generative pipelines on **Google Cloud**, reducing inference latency and enabling real-time image delivery.
- Led weekly strategy meetings to define market research goals, identify target customers, and plan the product prototype roadmap.

Projects

dpvis (dpvis.readthedocs.io) Jan 2024 – Aug 2024

- Developed an open-source Python library that features auto-generated, interactive visualizations for dynamic programming algorithms, including self-testing features that prompt users with interactive questions about the algorithm's steps.
- Managed a team of five in monthly sprints and weekly stand-ups to gather stakeholder feedback and drive iterative development.
- Designed a decoupled, event-driven architecture (**Plotly Dash + Python**) to support modular feature expansion and maintainability.
- Implemented industry-standard development practices: **GitHub Automation** for code reviews, **pytest** for comprehensive unit testing, and **mkdocs** for professional documentation, drastically reducing manual overhead.

pyribs (pyribs.org) Jun 2022 – Dec 2023

- Maintained an open-source **Python** library for implementing quality diversity algorithms, earning 200+ stars on GitHub.
- Addressed 15+ bug reports and feature requests on GitHub to improve API consistency and reduce redundancy across modules.
- Extended the library with gradient-based optimizers under object-oriented patterns, maintaining backwards compatibility and improving efficiency for differentiable tasks by 100%.
- Authored detailed **Jupyter Notebook** tutorials on upgrading legacy algorithms with modern threshold adaptation techniques.

USC DoorDrink Jan 2022 – May 2022

- Built an **Android** application enabling coffee shop discovery and mobile ordering, using **Java**, **Firebase**, and **Google Maps API**.
- Engineered map integration with real-time routing and location-based filtering to enhance user experience.
- Structured a real-time database with event-driven updates for live order tracking and restaurant availability.
- Revamped the UI using **Jetpack Compose** and **XML** to modernize app visuals and improve accessibility.
- Developed robust test suite using **Espresso** and **JUnit** to ensure fault tolerance and UI responsiveness.

University Simple C Compiler Jan 2022 – May 2022

- Built a custom compiler in C++ supporting SSA form, optimization passes, and register allocation.
- Implemented recursive descent parser, semantics analysis with symbol tables, and LLVM intermediate representation generation.

Low-Rank Matrix Completion via Convex Optimization Apr 2022 – May 2022

- Scraped NBA statistics using **Selenium** and **BeautifulSoup** for evaluating matrix completion in real-world prediction tasks.
- Applied convex optimization techniques (nuclear norm minimization) to predict NBA game outcomes using offensive rating and pace statistics, achieving RMSE trends aligned with theoretical expectations.
- Extended methods to reconstruct 3D tensors representing color voxel grids with up to 80% missing data, reaching RMSE < 37.

PUBLICATIONS/MANUSCRIPTS

dpvis: A Visual and Interactive Learning Tool for Dynamic Programming Feb 2025
David H. Lee, Aditya Prasad, Ramiro Deo-Campo Vuong, Tianyu Wang, Eric Han, David Kempe
ACM Technical Symposium on Computer Science Education (SIGCSE TS 2025) (arxiv.org/abs/2411.07705)

Density Descent for Diversity Optimization Jul 2024
David H. Lee, Anishalakshmi V. Palaparthi, Matthew C. Fontaine, Bryon Tjanaka, Stefanos Nikolaidis
Genetic and Evolutionary Computation Conference (GECCO 2024) (arxiv.org/abs/2312.11331)

Quality Diversity Optimization: A Modular Framework and Continuous Density Estimation May 2024
David H. Lee, Stefanos Nikolaidis (Research Advisor), Sandeep Gupta (Honors Advisor)
Bachelor's Thesis

Training Diverse High-Dimensional Controllers by Scaling Covariance Matrix Adaptation MAP-Annealing Oct 2023
Bryon Tjanaka, Matthew C. Fontaine, David H. Lee, Aniruddha Kalkar, Stefanos Nikolaidis
IEEE Robotics and Automation Letters (RA-L 2023) (arxiv.org/abs/2210.02622)

pyribs: A Bare-Bones Python Library for Quality Diversity Optimization Jul 2023
Bryon Tjanaka, Matthew C. Fontaine, David H. Lee, Yulun Zhang, ..., Stefanos Nikolaidis
Genetic and Evolutionary Computation Conference (GECCO 2023) (arxiv.org/abs/2303.00191)

PRESENTATIONS

dpvis: A Visual and Interactive Learning Tool for Dynamic Programming Oct 2024
Theory Lunch, USC Theory Group *Los Angeles, California*

Density Descent Search for Diversity Optimization Jul 2024
The Genetic and Evolutionary Computation Conference *Melbourne, Australia*

Quality Diversity Optimization: A Modular Framework and Continuous Density Estimation May 2024
Bachelor's Thesis Presentation *Los Angeles, California*

Quality Diversity Optimization Sep 2023
Theory Lunch, USC Theory Group *Los Angeles, California*

HONORS & AWARDS

W.V.T. Rusch Undergraduate Engineering Honors 2024
USC Provost's Undergraduate Research Fellowship 2022
USC Academic Achievement Award 2021
USC Dean's List 2020 – 2024