

CALDER KATYAL

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EDUCATION

Yale University - New Haven, CT **September 2022-May 2026**
Major: Bachelor of Science (B.S.) in Applied Mathematics **GPA: 3.84/4.0**
Minor: Computer Programming (Certificate)

- *Relevant Coursework:* Bayesian Statistics, Data Analysis, Recursive Prog., Data Structures & Prog. Techniques in C/C++, Linear Algebra, Real + Vector Analysis, Discrete Math, Differential Equations, Intermediate Machine Learning, Deep Learning on Graph-Structured Data, Optimization & Computation (*Upcoming:* Reinforcement Learning, Advanced Optimization)

Sidwell Friends School - Washington, D.C. **September 2018-June 2022**

EXPERIENCE AND PROJECTS

Original Research in Geometric Learning and Convex Optimization **September 2024-December 2024**

- Proposed and implemented a novel heterogeneous graph neural network architecture for graduate-level ML class. Model implements an original attention-based mechanism to extract features from semantically meaningful relations (“metapaths”) inside a graph. Derived key results and conducted extensive testing of the model, documented in a detailed report.
- Created a ~15-page report surveying the new approach of integrating differentiable convex optimization layers in neural architectures; report deconstructed the background, theoretical foundations, and emerging applications of this technology.

Machine Learning Intern at Palo Alto-based Startup CloudChef, Inc. **Summer 2024**

- Used advanced computer vision techniques and frameworks (PyTorch) to find a scale-invariant, Markovian state space representation of cooking. Synthesized a massive dataset with thousands of multimodal data points augmented with auto-generated labels via LLMs, trained a state-of-the-art visual classifier for food using transfer learning and contrastive learning techniques. Developed GPU and RAM optimized code to train model given limited compute; adapted real-world data (blurry and disorganized unlabeled video footage, incomprehensible machine-generated cooking logs, etc.) to structured formats using data augmentation and preprocessing techniques. Developed novel model architectures incorporating CNN and transformer-based components. Discussed ideas with CloudChef engineers (top IIT graduates) and implemented the solutions independently.

Stanford CS 229 & CS 231; Self-Study with Peter Brown, CEO Renaissance Technologies **Summer 2024**

- Completed all publicly available materials relating to Stanford graduate level courses in Machine Learning (CS 229) and Deep Learning for Computer Vision (CS 231n). Mastered fundamentals in supervised (regression, classification, SVMs, NNs) and unsupervised (clustering, dimensionality reduction) learning as well as CNN architecture, learning and evaluation techniques, RNNs, and other methods for various tasks in computer vision.
- Independent Study of Machine Learning with Peter Brown, CEO of Renaissance Technologies. Peter proposed an in-depth study into Bishop’s *Deep Learning* textbook. Established a study routine including readings, detailed email discussions, and phone calls to dissect advanced concepts. Enhanced understanding of ML under the guidance of a leading industry expert.

Research Assistant at Yale Vision Laboratory **January 2024-May 2024**

- Worked as research assistant at Yale (Computer) Vision Laboratory under Prof. Alex Wong; was involved in a PyTorch project involving tracking a robot performing an anastomosis surgery using convolutional neural architectures.

Analyst Intern at Appian Corporation **Summer 2023**

- Interned at Appian (a multibillion-dollar public cloud-computing and enterprise software company) directly for founder Marc Wilson. Conducted interviews and leveraged tools such as Salesforce to develop a data-driven executive engagement program for the company. Participated in company-critical meetings at Appian and performed financial analysis on key Appian accounts. Designed a program that is now fully implemented across the entire 2,500-employee company and has led to a new Office of Executive Engagement. Received offer to return to employment at Appian.

Personal Projects: Bayesian A/B Testing Web App, Original Cross-Platform Arcade Game & More **Spring 2022-Present**

- Built a web application that leverages Bayesian methods, Flask, Python, and PyMC3 for Bayesian statistical analysis. Also created an original Pandemic-themed video game in C# employing Microsoft XNA framework; game is compatible with Windows and Xbox and took three months to code. More projects in the works.

Research Intern at EqualAI **Summer 2020-January 2022**

- Researched and documented sources of bias in artificial intelligence and wrote about them in public newsletters, worked on a podcast, and collaborated directly with the CEO to further their mission.

SKILLS

- *Beginner:* JavaScript (~5000 LOC), Java (~10000 LOC), C# (~10000 LOC), Reinforcement Learning, TensorFlow
- *Intermediate:* PyTorch, C (~10000 LOC), C++ (~10000 LOC), HTML/CSS (~10000 LOC), R (~20000 LOC), Supervised + Unsupervised Learning, Data Structures and Algorithms, Mandarin, Contrastive Learning, Bash + Unix, GCP, GPU Computing, Graph Machine Learning, Optimization Methods, Numpy, Pandas
- *Advanced:* Math (Discrete and Continuous), Python (~100000+ LOC), (Bayesian) Statistics, Machine Learning, Graph ML

PUBLICATIONS

“Differentiable Convex Optimization Layers in Neural Architectures: Foundations and Perspectives.” <https://arxiv.org/abs/2412.20679>.

“Attention-Driven Metapath Encoding in Heterogeneous Graphs.” <https://arxiv.org/abs/2412.20678>.

“Schools Need to Undo the Damage of Pods,” *The Atlantic* (October 1, 2021)

“Racist Algorithms: How Code is Written Can Reinforce Systematic Racism,” *Teen Vogue* (October 6, 2020)

EXTRACURRICULARS

Clubs: Yale Chess Club, Yale Diversified Investments

Other: Alpha Epsilon Pi Fraternity, Classical Piano, Yale Vision Laboratory, Weightlifting, Downhill Skiing