Ryan R. Hu

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Education

California Institute of Technology (Caltech) Pasadena, CA

B.S. Computer Science, Minor in Mathematics - *GPA: 4.2/4.0* *Graduation Date: Jun 2027*

Relevant Coursework: Computer Programming, Programming Methods, Software Design, Deep Learning, Learning Systems, Machine Learning & Data Mining, Algorithms, Computing Systems, Differential Equations, Mathematical Foundations of Computer Science (Discrete Mathematics), Probability and Statistics, Calculus of One and Several Variables and Linear Algebra

Teaching Assistant: Decidability and Tractability (Jan 2025 - Present)

Experience

Software Engineer Intern Apr 2025 – Present

Tracevision - Math Team *Los Angeles, CA*

- Improved ptools, a full-stack internal tool for object tracking and annotation review, by optimizing frontend and backend components to boost efficiency, reduce latency, and enhance usability. Built with Python, MySQL, HTML/CSS, and JavaScript.
- Automated components of the geospatial API pipeline using a combination of custom scripts and AWS infrastructure (EC2, S3, Lambda), streamlining integration and deployment workflows in security and retail sectors.

Machine Learning Researcher Feb 2025 – Present

Caltech - Alvarez Lab *Pasadena, CA*

- Developed a custom autoencoder architecture to detect anomalous player behavior by analyzing reconstruction error as a proxy for behavioral deviation from typical gameplay patterns in Activision's Call of Duty (COD) games.
- Utilized SQL queries and implemented Python scripts to clean raw gameplay logs and extract additional input features, expanding autoencoder representation space and improving anomaly sensitivity.
- Developed a verification pipeline combining clustering techniques with time-based segmentation to evaluate autoencoder performance and assess how different types of anomalous behavior affect player engagement and retention.

Undergraduate Researcher Apr 2024 – Dec 2024

Caltech - Alvarez Lab *Pasadena, CA*

- Leveraged causal machine learning models and gradient-boosting trees to analyze the role of socioeconomic and epigenetic factors in the aging of people living with HIV from patient data collected by the Multicenter AIDS Cohort Study (MACS).
- Built data preprocessing pipeline for cleaning and transforming inputs for efficiency in machine learning tasks downstream.
- Research conducted as part of Caltech's Summer Undergraduate Research Fellowship (SURF) program in collaboration with UCLA Epigenetics. Currently authoring a manuscript based on findings.

Undergraduate Researcher Jun 2023 – Sep 2023

Caltech - GALCIT Lab *Pasadena, CA*

- Developed a visual anemometry framework in MATLAB combining YOLOv3 object detection and optical flow mapping techniques to estimate wind speed and direction from canopy motion, enabling contact-free environmental sensing.
- Conducted a quantitative analysis linking vegetation displacement variance to wind standard deviation, achieving explainable correlation patterns across different tree species and wind conditions.

Selected Projects

Agentic Stock Trader | *Python*

- Built a multi-agent stock trading framework where LLM-driven agents ingest financial news, debate with each other, and output explainable decisions.
- Designed a recursive agent debate architecture with static personas, dynamic leaf agents, and hierarchical clustering.
- Developed an evaluation pipeline to calculate execution slippage, enabling benchmarking in messy, highly volatile environments.

Endless Runner Video Game | *C, HTML/CSS, SDL*

- Developed Google Dino Run-inspired endless runner game with obstacles, powerups, and progressive difficulty scaling. Written entirely in C using standard libraries.
- Implemented unit tests for physics engine. Reduced collision computation overhead by restricting hitbox checks only active screen segments with runtime bounds culling.

Activities

NCAA Division III Men's Basketball Sep 2023 – April 2025

Technical Skills

Languages: Python, C, C++, Java, JavaScript/TypeScript, HTML/CSS, MATLAB, LaTeX
Developer Tools: Git, VS Code, AWS, Github, Linux, Docker, Kubernetes, Figma
Frameworks/Libraries: React.js, Node.js, Pandas, OpenCV, PyTorch, Keras, TensorFlow, Scikit, Tailwind, Flask, Plotly
Skills: CI/CD, Machine Learning, Full Stack, Software Engineering, Data Analysis