Andrew Liu

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Education

Massachusetts Institute of Technology *May 2026*
Candidate for B.S. Computer Science, B.S. Mathematics *GPA: 5.0/5.0*

Coursework: Machine Learning (6.790), Advanced NLP (6.861), Inference (6.780), Reinforcement Learning (6.820), Non-Asymptotic Statistics (18.656), Software Performance Eng (6.106), Operating Systems (6.181), Computation Structures (6.191), Stochastic Processes (18.615), Design and Analysis of Algorithms (6.122), Abstract Algebra (18.701). **Course notes available here**.

Research

Contextual AI • MIT CSAIL Improbable AI Lab *Feb 2024 – Present*
Under Pulkit Agrawal, developing methods for composing multimodal foundation models in concept graphs, 3D scene graphs that enables a wide range of capabilities in embodied agents.

Graph Pattern Mining • MIT CSAIL Computation Structures Group *Feb 2023 – Sep 2023*
Under Xuhao Chen, researched and designed graph algorithms to count subgraph isomorphisms in large scale network graphs. Emphasis on methods of Matrix Multiplication and performance optimizations with caching heuristics and the OpenBLAS library.

Data Analysis of Stellar Spectra • MIT Kavli Institute for Astrophysics *Sep 2022 – Feb 2023*
Under Ben Rackham, analyzed the stellar spectra of Ultra-cool dwarf stars to determine constraints on exoplanet activity. Devised a Monte Carlo pipeline to extract radial velocity data from reduced spectra, used in DOI:2307.05368 published in A&A.

Mathematics Researcher • College of Lake County *Jun 2020 – Jun 2022*
Under Jeffrey Mudrock, conducted multiple research projects involving open questions in Algebraic Graph Theory over 3 years. Studied long-run behaviors of the DP-color function and list color function threshold, resulting in papers DOI:2012.12897 and DOI:2207.04831.

Projects

Image-to-Image Translation • website • code *Jan 2024*
Implemented stable diffusion from scratch, including CLIP, DDPM/DDIM, and VAE modules. Built an accompanying website visualizer and deployed model on serverless inference server with modelbit. PyTorch, React, Flask stack.

Pigeon • website • code *Jan 2024*
Built an end-to-end Retrieval Augmented Generation (RAG) emailing client for optimizing help email workflows. Document embeddings powered by Redis vector database. React and Flask stack.

6.790 Final Project • paper • code *Dec 2023*
Fine-tuned deep convolutional neural nets VGG19, ResNet50 and implemented a diffusion model classifier from scratch, comparing model performance of all three architectures on a classification task of the ArtBench dataset. Utilized Neural Style Transfer and Principal Component Analysis to create visual heuristics supporting findings.

6.191 Processor *May 2023*
Designed the 5th fastest processor in MIT's 6.1910 design competition out of 200 students. Implemented bypassed four-stage pipeline with direct-mapped instruction cache and 2-way set-associative data cache. Optimized data prefetching; branch target buffer for dynamic branch prediction; special pipelined SIMD instructions; kogge-stone adders; wallace tree multiplication.

Experience

Quant Research Intern • Citadel Securities *Jun 2024 – Aug 2024*
Incoming Summer 2024.

Software Engineering Intern • Belvedere Trading *Jun 2023 – Aug 2023*
Expanded Belvedere's internal trade execution testing service by implementing a new engine to handle client mass quote requests in C++. Utilized Google protobuf for cross-language communication between algo and client. I also improved the client interface by resolving open tickets that "annoyed QA testers for years".

Development Co-Head • HackMIT *Oct 2023 – Present*
Leading the dev team (15 members) for HackMIT. We're a tight-knit student group working on building and shipping apps that power the hackathon. Selected projects open sourced here.

6.191 Lab Assistant • MIT EECS *Sep 2023 – Dec 2023*
Held office hours (10 hrs/week), evaluated class labs, and debugged student code. Covered topics ranging from pipelined processors to operating systems for MITs core computer architecture class.

Web Lab Instructor • MIT EECS *Jan 2024*
Taught a web development class to 300 MIT students on topics ranging from authentication to LLMs and Retrieval Augmented Generation. Prepared lectures, advised projects, debugged code. MongoDB, Express, React, NodeJS stack.

Selected Awards

International Olympiad on Astronomy and Astrophysics Silver medal, rank 32 individual (2022); Putnam Mathematical Competition top 270 (2023); USA National Astronomy Olympiad rank 6 individual (2022); US Physics Olympiad Medalist, top 150 individual (2022); 2x MathWorks Math Modeling Challenge Finalist, top 6 team (2021-2022); Spirit of Ramanujan Research Fellow (2022)