Tony Cui

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EDUCATION

Massachusetts Institute of Technology, Cambridge MA

Master's of Engineering (MEng) Computer Science — Expected May 2025

Bachelor's of Science (B.S) in Computer Science and Engineering (6-3) | GPA 4.8/5.0 — Expected May 2024

Relevant Coursework:

Machine Learning & Artificial Intelligence

- 6.5940 TinyML and Efficient Deep Computing (G)
- 6.8300 Advances in Computer Vision (G)
- 6.8200 Sensorimotor Learning (G)
- 6.8611 Quantitative Methods for Natural Language Processing

Mathematics and Algorithms

- 6.5320 Geometric Computing (G)
- 18.C06 Linear Algebra & Optimization
- 18.600 Probability and Random Variables
- 6.1200 Mathematics for Computer Science

SKILLS

- **Programming**: Python, C/C++, TypeScript, JavaScript, PyTorch, OpenAI Gym, OpenCV, NumPy, LangChain, Flask, ExpressJS, NodeJS, Firebase, MongoDB, Azure, ReactJs, HTML5, CSS, SCSS, Twilio
- **Technologies**: Git/GitHub, UNIX/Linux, Docker, Mac OS, Windows, Arduino, Microsoft Office (PowerPoint, Excel, Word)

EXPERIENCE

MIT Computer Science and Artificial Intelligence Lab (CSAIL) | *Researcher* | Cambridge, MA — Feb. 2024 - Present

- Architecting agents and reading papers for the black box optimization problem and locating global optimum.
- Running experiments with varying architectures with PPO using OpenAI Gym, NumPy, and PyTorch.
- Implementing and integrating black box optimization optimization benchmarks as OpenAI Gym environments.

Microsoft | *Software Engineer Intern* | Redmond, WA — May 2023 – Aug. 2023

- Developed end to end AI document retrieval service using Flask, Python, Azure ML, React, and Typescript
- Designed backend REST API endpoints to update database systems, query AI models and stack overflow, and functionality to upload, parse, tokenize, and normalize text data with Pandas, NumPy, and LangChain.
- Engineered efficient top-k semantic filtering and ranking algorithm through customized heaps of heaps data structure and containerized vector databases through docker, retrieval time from 10 seconds to 0.5 seconds
- Utilized batch embeddings to increase vector database upload speed by 4x.

Microsoft | *Software Engineer Intern* | Redmond, WA — May 2022 – Aug. 2022

- Reduced Containerization and SharePoint workflow from 2-6 hours to 30 seconds through Developing command line suite to automate integration testing between SharePoint and containerized images.
- Pioneered efforts to construct and streamline the dev inner loop experience (build, deploy, debugging) for microservice engineers in OneDrive/SharePoint organization.
- Designed modules to configure remote SharePoint connections on Azure Sandbox and XML/hosts files in microservice repositories.

MIT Digital Humanities Lab | *Software Developer* | Cambridge, MA (Virtual) — Mar. 2021 – May 2021

- Utilized Natural Language Processing library in Python to auto-generate multiple-choice options based on common homophone and punctuation errors for language exams.
- Developed selection and edit interface to allow instructors to alter various definitions, parts of speech, and example sentences of English words.
- Remodeled user interface to improve page navigation and user experience for instructor using ReactJS.

MIT STEP Lab | *Software Developer* | Cambridge, MA (Virtual) — Jan. 2021 – Feb. 2021

- Managed back-end architecture for a mobile web application and learning participatory simulation for adolescents using Firebase.
- Refactored and repaired game logic code for updating and removing animals across different planets.
- Redesigned home page and planet page interface to display dynamic planet information and promote a more intuitive user experience using ReactJS.

Developer Projects & Teachings found below.

DEVELOPER PROJECTS

Survey of Proximity Graph Algorithms | *Geometric Computing Final Project* | Cambridge, MA *May 2024*
- Surveyed the development of state-of-the-art proximity graph algorithms for information retrieval systems, including HNSW, NSG, and Vamana Indexing Algorithms.
- Analyzed systems-based improvements including but not limited to vector quantization and sharding
- Evaluated varying advantages and use cases across various algorithms.

Using a Synthetic Intermediary for HMER | *MIT Computer Vision Final Project* | Cambridge, MA May. 2023
- Introduced a new approach for the Handwritten Mathematical Expression Recognition problem using a synthetic intermediary using OpenCV, Pytorch, CNN, and Transformer models.
- Segmented each mathematical symbol into bounding boxes using OpenCV to be classified by a fine-tuned model.
- Finetuned resnet18 image classification model on grayscale CROHME dataset to .99 test accuracy.

Using Multitask Learning to Generate Poetry | *MIT NLP Final Project* | Cambridge, MA Dec. 2023
- Experimented with Multitask training technique: fine-tined generative transformer models with phonemes (syllables), their respective graphemes (plaintext), and specialized translation tokens between the inputs.
- Developed new Depth First Search based algorithm to find the largest connected components of oblique rhyming words, a new way to measure the rhyme score of generated poetry.

Campfire | *MIT Web Lab Programming Competition* | Cambridge, MA (Virtual) Jan. 2021
- Developed an live-updating interactive storytelling platform with ReactJS and NodeJS.
- Created and improved API Endpoints utilizing ExpressJS to retrieve and publish stories, and edit user information in MongoDB database.
- Designed a gallery page, both UI and API endpoints, for users to post, like, share, and comment stories made by one another.

COVID Text Update | *LA Hacks 2020* | Los Angeles, CA (Virtual) Mar. 2020
- Integrated Twilio API to send text updates of coronavirus cases by state directly to user mobile devices.
- Created an interactive web application using Flask to retrieve live data on the COVID-19 outbreak.

TEACHING

MIT Web Lab | *Lecturer & Co-Academic Chair* | Cambridge, MA Jan 2023 – Feb. 2023
- Organized and structured curriculum for web programming class and competition, guiding over 300 students to build a full end-to-end full-stack web application.
- Developed and taught lecture material for vector similarity search, retrieval augmented generation, client/server model, ReactJs, Promises + Asynchronous Javascript, and version control with Git.
- Managed and coordinated 32 hours of lectures across 13 instructors

GTL Israel: Digital Tent | *Instructor & Curriculum Developer* | Be'er Sheva, Israel Jan 2023 – Feb. 2023
- Pioneered first iteration of GTL Israel's Digital Tent program in the Negev, introducing a class of 20 high school sophomores across 7 villages in the Negev to computer science.
- Utilized the principle of backwards design to develop a 4-week computer science curriculum including Python fundamentals, hardware and circuitry, web development.
- Developed lesson plans, test cases, homework assignments, projects of varying difficulty from scratch.

MIT 6.1210 Introduction to Algorithms | *Problem Set Grader* | Cambridge, MA Sep. 2022 - Present
- Provide student feedback on problem sets on data structures & algorithms design, runtime analysis, and rigorous correctness arguments.
- Reinforce student understanding of important algorithms concepts, including proof by induction, strong induction, graph algorithms, and dynamic programming.

HackMIT 2022 | *Beginner Hack Workshop Lead* | Cambridge, MA Sep. 2022 – Mar. 2023
- Co-lead HackMIT's beginner hack workshop; taught students the use cases and foundations of git and the need for version control and collaboration
- Coordinated and scheduled MIT Blueprint's guest tech-talks across Blueprint Week.

MIT 6.100A Introduction to Programming in Python | *Lecture Assistant* | Cambridge, MA *Sep. 2022* - Present
- Hosted Office hours twice a week for MIT Introductory programming class 6.100A.
- Assisted students with classic computer science topics such as binary search, cryptography, and object oriented programming.
- Reinforced student understanding of Python fundamentals, including floats, integers, lists, and dictionaries to students without prior programming experience.
- Participated in assessment development through testing and providing feedback of problem sets.

Organizations/Interests: Asian Christian Fellowship, HackMIT Corporate Relations & Dev, Asian Dance Team, Volleyball, DynaMIT