MICHAEL LU

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Education

Massachusetts Institute of Technology, Cambridge, MA *Class of 2023*

- Candidate for B.S. in Computer Science and Electrical Engineering
- Candidate for B.S. in Mechanical Engineering with Robotics Concentration
- GPA: 5.0/5.0
- Coursework: Robotics Science and Systems, Circuits and Electronics, Electromagnetic Waves and Applications, Embedded Systems, Intro to Machine Learning, Toy Product Design, Mechanics and Materials, Dynamics and Control, Design and Manufacturing

Work Experience

Undergraduate Researcher, MIT Biomimetics Lab, Cambridge, MA *October 2022 - Current*

- Building an omnidirectional robot to test perception algorithms.
- Writing C++ firmware to enable speed-control of the robot's drive system.
- Designed chassis in CAD (Solidworks) and ran FEA analysis to pinpoint stress concentrations.

Electrical Engineering Intern, Milwaukee Tool, Brookfield, WI *Jan - Feb 2023*

- Wrote circular saw firmware in C to prevent current spikes in gate driver circuits.
- Simulated sensor behavior in LTSpice and confirmed results with oscilloscope captures.
- Designed validation procedures with test engineers to ensure functionality of various firmware features.
- Automated calibration process with Python and MATLAB to reduce calibration time by 73%.

Software Development Intern, Amazon, New York City, NY *May - Aug 2022*

- Designed a scheduled database cleaner with AWS Glue ETL Python, reducing DynamoDB database storage of Amazon ad information by 23%.
- Automated the backfill process for Amazon ad information DynamoDB databases in Java using AWS S3, Lambda, and Glue ETL.
- Set up deployment pipelines for AWS services using AWS CDK in Typescript.
- Created unit tests using Python boto3 to test the functionality of backfill software.

Undergraduate Researcher, MIT CSAIL HCIE Lab, Cambridge, MA *Feb - Dec 2021*

- Assembled an infrared camera module with a Raspberry Pi Zero W, NoIR V2 camera, and Micro-USB power bank that could read QR codes hidden behind infrared-transparent plastic.
- Designed a phone case and detachable 9mm-thick infrared camera module housing in CAD (Autodesk Inventor) and 3D printed them with TPU and PLA filament.
- Wrote a Python script to stream the infrared camera output to a Kivy phone application, which would run OpenCV image-processing algorithms (CLAHE and Otsu) to preprocess and decipher QR codes.
- Constructed a 6DOF robot arm with a NoIR V2 camera that used ROS to track objects with QR codes.

Software Engineering Intern, SpaceX, Redmond, WA Jun - Aug 2021

- Developed WiFi mesh software in C, Lua, and Golang to improve WiFi signal strength over large areas by using a network of connected SpaceX Starlink routers.
- Created extensive unit test suites with Bazel to ensure good software performance and modified router driver code to speed up access point network scans by 20 seconds.
- Implemented gRPC API commands with Google Protobuf and automated Linux OpenWRT WiFi router configuration with Bash scripts to set up a hidden network over which Starlink routers could communicate.
- Coordinated with chipset vendors in Taiwan and SpaceX hardware teams to test WiFi mesh software.
- Designed 12V battery packs for Starlink routers to enable portable WiFi mesh access points.
- Organized biweekly meetings with software, hardware, and sales teams to refine the technical and business visions for Starlink WiFi mesh products.

Founding Team Member and Full Stack Software Engineer, Toppings, Cambridge, MA *Jan - May 2021*

- Developed a cost-effective food delivery service that leveraged existing social networks between friends.
- Built an intuitive restaurant vendor portal using ReactJS, GraphQL, AWS Amplify, AppSync, Cognito, and DynamoDB that allowed restaurants to receive and handle incoming food orders in real time.
- Pitched the vendor portal to restaurants around Harvard Square and worked with restaurants to test and improve the application.
- Monitored key performance indicators and organized user feedback to reorient business strategy.

Electrical and Software Engineering Intern, ABB, Richmond, VA *Jun - Aug 2020*

Work Experience (continued)

- Collaborated with electrical engineers to create a cross-platform computer application with Qt (C++) to configure and read data from ABB's Power Distribution Unit (PDU) logic boards.
- Implemented a dynamic queue to store Modbus RTU communication queries between the application and the PDU logic boards, which sped up communication speeds and data refresh rates by 53%.
- Created a graphical user interface to generate configuration script files for the PDU logic board.

Lead Full Stack Software Engineer (Part Time), Build-It-Yourself (Remote) *Mar - Aug 2020*

- Created a space-themed web game where users would upload and share technology project portfolios.
- Designed and implemented a navigation system in ReactJS where users would travel in a spaceship between galaxies and star systems to find other user's project portfolios, which were hosted on planets.
- Integrated AWS Amplify, Cognito, S3 and DynamoDB functionality with the app frontend to store user data.
- Led the standardization of software version control, reliability testing, and bug reporting among team developers and beta testers, accelerating the project workflow.
- Organized weekly assignments, development sessions, and software tech talks to meet tight deadlines.
- Worked with teachers to brainstorm and develop new features for students.
- Pitched software to schools and investors in Mexico, China, and the United States.

Full Stack Software Engineering Intern, IBM Research, Cambridge, MA *Jan 2020*

- Developed an online word association game where users played against a Natural Language Processing AI.
- Created a dynamic landing page with ReactJS, Flask, and PostgreSQL that displayed a user's gameplay.
- Collaborated with UI designers to create wireframes and paper prototypes for the dynamic landing page.
- Conducted several rounds of user testing to refine the dynamic landing page designs.
- Integrated the Twitter and Facebook API into the game for users to share their experience on Facebook and Twitter with social media cards that displayed an image of their gameplay.

Contracted Product Designer, 10XBeta, Brooklyn, NY *Oct - Jun 2019*

- Collaborated with mechanical engineers and product designers to develop a prototype for an autonomous robotic car that would pace long-distance runners.
- Integrated electronic sensors, custom 3D-printed parts, and an Arduino microcontroller for autonomous control of an RC car chassis.
- Improved the robot's PID line-following algorithm.
- Designed custom sensor mounts for the robot on Solidworks and 3D printed them with an SLA printer.
- Documented the software and hardware (CAD files, electronics schematic, materials, assembly instructions) for future development of the project.
- Reduced the weight of the company's original prototype by 34% and size by 40%.

Contracted Electronics Developer, Greenberg Cosmetic Surgery, Great Neck, NY *Feb - May 2019*

- Designed small disposable vibrating medical devices for plastic surgeons that reduced pain during cosmetic surgery through vibrations.
- Tested vibration magnitudes and frequencies with different button cell batteries from 1.5V - 3V.
- Contacted electronics manufacturers to source parts that reduced the device's cost from $3.54 to $0.63.
- Patent pending for the medical device.

Machine Learning Researcher, Department of Energy Brookhaven National Lab, Upton, NY *Jul - Aug 2018*

- Wrote a data analysis program in Python to pinpoint and graphically visualize bottlenecks in Uber's distributed deep learning framework, Horovod.
- Analyzed the performance of the deep learning frameworks Apache MXNet and TensorFlow by running deep learning algorithms (Resnet-110) on the lab's supercomputer cluster.
- Co-authored a research paper that discussed methods to improve the performance and scalability of deep learning algorithms running on large GPU clusters. Paper accepted at the New York Scientific Data Summit.

Technical Projects

Software Projects

- Trained a TensorFlow Transformer deep learning model on personal text messages to build a Facebook chatbot to converse with friends using my speech habits.
- Programmed a vocoder on a Xilinx FPGA in SystemVerilog to adjust the pitch of a human voice in real time.
- Coded an Android app that used machine learning for facial detection (OpenCV) and speech processing (CMU PocketSphinx). Presented the app at local elementary schools, resulting in a local news article.

Hardware Projects

- Built a 6DOF robot arm with a solenoid at the end effector that used ROS MoveIt to type on a computer keyboard.
- Assembled a 6DOF robot arm with a compliant gripper that used ROS MoveIt to assemble giant Lego bricks.

- Created a quadruped robot that walked using inverse kinematics computed on a Raspberry Pi 3 and could be controlled remotely over WiFi from a laptop command line.
- Made an IoT version of Wii boxing with the ESP32 WiFi MCU that used WebSockets to send real-time punch accelerometer data processed in C to an online 3D boxing game built with Cannon.js and Three.js.

Skills & Interests

Programming: Python (TensorFlow, Flask, Raspberry Pi, Beautiful Soup, Selenium, ROS), JavaScript (React Native, ReactJS, Node.js, Three.js), C, C++ (Qt, Arduino, ROS), Golang, Java (Android), C# (Unity), SQL, HTML, CSS, Lua, Bash, SystemVerilog, MATLAB
Computer-Aided Design/Manufacturing: Solidworks and Autodesk (Inventor, Fusion 360), Altium, LTSpice
Volunteer Firefighting/EMS: Firefighter/EMT for the Manhasset-Lakeville Fire Department, EMT for MIT EMS