Patrick Zheng

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Education

Duke University, Durham, NC (GPA: 3.99 / 4.00) **May 2027**

Double Major: Bachelor of Science in Electrical and Computer Engineering; Computer Science

Relevant Coursework: Design & Analysis of Algorithms, Data Structures, Networks, Computer Vision, Digital Systems, Computer Architecture

Projects

Duke Robotics Club | **President** | *KiCad, ROS, Python, OpenCV, C++* **Sept 2023 - Present**

- Architected full robot design: evaluated existing needs, designed requirements, and established testing protocols
- Pioneered plug-and-play printed circuit board infrastructure, designed mechanical interface for seamless subsystem integration, and established new sensor suite, with a focus on debuggability, modularity, and scalable manufacturing
- Designed and integrated a separate robot's electrical system with severe space constraints, optimizing component accessibility, serviceability, and real-time system status visibility for rapid troubleshooting
- Innovated ROS 2 compatible, plug-and-play, robot-agnostic, sensor and actuator communication architecture

Continuum Controller | **Brain Tool Lab, TAST Member, Researcher** | *Altium, Fusion 360* **Jan 2026 - May 2026**

- Created human-centered, ergonomic Wii Nunchuk inspired handheld controller for continuum surgical robots
- Built custom controller-agnostic PCB interface connecting robot actuators to any style controller for experimentation

Tiger Compiler | **Developer & Designer** | *SML/NJ, Tiger, MIPS, QtSpim, RegEx* **Jan 2026 - May 2026**

- Designed and built a complete compiler for Andrew Appel's Tiger language in SML/NJ
- Implemented automatic lexical analysis, parsing, semantic analysis, type checking, IR generation, instruction selection, liveness analysis, graph-coloring register allocation, and functional MIPS code generation
- Optimized with strength reduction, selective callee-saved register preservation, recursive record type support, and custom types to prevent cascading and type-checking error runaways; register coalescing and freezing in progress

Square Game | **Developer & Designer** | *Verilog, MIPS, Xilinx Vivado* **Jan 2025 - May 2025**

- Built a 5-stage pipelined 50 MHz CPU in Verilog with ALU, mult/div, and standard/custom CPU instructions
- Developed a motion-controlled game using FPGA accelerometer input, VGA display output, and battery support
- Implemented collision detection, scoring via 7-segment displays, and custom background music

Work & Research Experience

Brain Tool Lab | TAST Member, Researcher | *Fusion 360, 3D Printing* **May 2024 - Present**

- Designing multiple DOF, handheld continuum robots for surgical applications, managed $2000+ in innovation grants
- Innovated compact force sensor for closed-loop robots, decreased cost from $5000 to $150 & lead time by 90%
- Presented at the 2025 ISMR conference & co-authored Tendon-Actuated Concentric Tube Endonasal Robot paper

Roblox | Software Engineering Intern | *Redis Bloom, CRDB, gRPC, SQL, C#, A/B Testing* **May 2025 - Aug 2025**

- Designed and built a full-stack feature to surface the most frequently played game between two users
- Managed and launched A/B test for a real-time system with high write, read, and storage requirements
- Engineered automatic big data batch update pipelines along with real-time Redis Bloom Top-K structures to ensure high availability and accurate results computed from months' worth of data per user
- Tested end-to-end flow for backend services and frontend UI to ensure universal platform compatibility

Cenntro Electric Group | **Engineering Intern** | *SeaTable, MariaDB* **June 2023 - Aug 2023**

- Tested systems and wrote user manuals for an autonomous guided beverage vehicle project
- Shadowed engineers and replaced vehicle batteries and cameras, tested faulty charging, and updated firmware
- Performed software verification on existing database operations and researched SeaTable for future migration

MIT Beaver Works Summer Institute | **Research Scholar** | *Python, ROS, OpenCV* **July 2022 - Aug 2022**

- Applied machine learning, flight dynamics, robot navigation, data handling, and computer vision to UAV tasks
- Developed autonomous systems to track AR Tags and follow defined objects in the Tello Drone's view
- Automated Tello Drone navigation to follow user-selected hands in Just Dance

Skills

Software: Python, C#/C/C++, Java, SML/NJ, Imperative & Functional Dev, ROS, SQL, RegEx, MATLAB, Verilog, MIPS, Tiger
Tech Stack: Spark, Kafka, Elasticsearch, CRDB, Redis/Redis Bloom, gRPC, Airflow, Postman, Wireshark, Grafana, Prometheus
Hardware: Fusion 360, Altium, FDM/SLA Printing, KiCad, PSpice, Soldering, Arduino, Laser Cutting, Power Tools, Oscilloscope
Languages: English (Native), Mandarin (Fluent), Spanish (Intermediate), Japanese (Beginner)