

Puja Chaudhury

Robotics Software Engineer

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PROFESSIONAL EXPERIENCE

Robotics Software Engineer

Laza Medical | Campbell, CA | Oct 2024 – Present

- Developed real-time C++ control software for a safety-critical autonomous medical robot, covering the ros2_control kinematic chain and hardware interfaces, teleoperation and motion control, soft and travel limit enforcement, and fault handling, while meeting strict latency requirements under Class II medical device design controls (DFMEA, hazard analysis) in collaboration with mechanical, electrical, and quality teams
- Drove hardware-software integration across prototype revisions, characterizing motor controllers, EtherCAT (CANopen/CiA 402) servo drives, actuation behavior, and sensor interfaces through end-of-line validation, and resolved system-level failures spanning software, firmware, power electronics, and fieldbus communication
- Built the absolute-encoder calibration, hardware-interface, and time-synchronized state layer joining robot kinematics to ultrasound-derived pose estimates, propagating registration uncertainty into the safety controller and operator-facing confidence display during procedures
- Integrated and deployed deep-learning-based 3D reconstruction models into the real-time ROS 2 perception stack feeding AI-guided navigation, including validation of FP16 model variants delivering ~2x runtime reduction
- Contributed to a clinical simulation workflow replaying recorded procedure data to validate control and perception behavior in simulation, enabling real-to-sim regression testing before hardware deployment
- Developed modular interfaces within a 62-package distributed ROS 2 system and owned its deployment and provisioning infrastructure: per-workstation install, network and EtherCAT interface detection, and launch tooling across development, simulation, and clinical robot configurations

Robotics Researcher

Autonomy and Intelligence Lab, Northeastern University | Boston, MA | Mar 2024 – Mar 2025

- First-authored an IEEE CDC 2025 paper on training neural network control policies with formal safety verification in the training loop, using differentiable reachability analysis (CROWN) to backpropagate reachable-set bounds through the policy parameters; released open-source implementation on GitHub
- Designed multi-objective reachability-based loss functions (goal-reaching, obstacle avoidance, bound tightness, invariance) that produced controllers satisfying reach-avoid specifications on unicycle and 6D quadrotor vehicle models under state uncertainty, verified without expensive branch-and-bound methods
- Achieved 4x training speedup (187s to 44s) over a numerical-gradient baseline and trained controllers whose reachable sets are tight enough for lightweight real-time verification, enabling runtime safety monitoring as specifications change during operation
- Demonstrated automatic discovery of forward invariant sets through training, guaranteeing the closed-loop system remains near the goal region indefinitely

Software Engineer

Mosaiq Labs | London, UK (remote) | Sep 2021 – Aug 2022

- Built and shipped the MVP of the company's financial-services workflow platform as an early engineer (React.js frontend, Python data processing backend), supporting the company's early-stage VC raise; the product line has since grown into an AI workflow-automation platform serving PE and asset management firms

Machine Learning Research Intern

University of Memphis | Memphis, TN | Jan 2021 – Jul 2021

- Improved speech emotion recognition accuracy by 5% through audio preprocessing (noise reduction, SNR improvement) and feature engineering (normalized MFCC and Chroma features) in Python

EDUCATION

Master of Science in Robotics (Computer Science Concentration)

Northeastern University | Boston, MA | GPA 3.7 | Sep 2022 – May 2024

Relevant Coursework: Computer Vision, Reinforcement Learning, Mobile Robotics, Empirical Research Methods

Bachelor of Technology in Electrical and Electronics Engineering

Vellore Institute of Technology | Vellore, India | GPA 3.6 | May 2017 – May 2021

Relevant Coursework: Power Electronics, Embedded Systems, Control Systems, Signals and Systems

PUBLICATIONS

- *Learning Verifiable Control Policies Using Relaxed Verification* | IEEE CDC 2025 | First Author
- *Comparison of Various Machine Learning Algorithms for Predicting Energy Price in Open Electricity Market* | IEEE ICUE 2020 | First Author
- *Application of Nature-Inspired Swarm Optimization Algorithms in Artificial Neural Networks* | IEEE ICAIS 2021 | Second Author

PROJECTS

Assistive Feeding Robotic Arm | github.com/catplotlib/AssistiveFeedingRobot

- Built an assistive feeding robotic arm (ROS, Python) performing perception-driven manipulation: real-time mouth tracking from an Intel RealSense RGB-D camera with depth-fused 3D pose estimation at 95% tracking accuracy and sub-10ms latency, driving arm motion to a moving target

Scratch-Built Autonomous Mobile Robot (Ongoing) | github.com/catplotlib/it-moves-sometimes

- Building an autonomous mobile robot from scratch with ROS 2 on resource-constrained embedded compute (Raspberry Pi + Arduino), fusing LiDAR and wheel-encoder data for real-time odometry and state estimation, and handling sensor timing, discovery, and middleware reliability on embedded hardware
- Integrated an LLM as a real-time task planner in a voice-to-action pipeline (voice activity detection, speech-to-text, LLM intent parsing, grounded motor command generation), managing end-to-end latency for responsive physical control

TECHNICAL SKILLS

Languages: C++, Python, MATLAB

Controls: robot kinematics, spatial transformations, real-time control, motion control and limit enforcement, control theory (reachability analysis, invariant sets), fault handling

Hardware Interfaces: EtherCAT, CAN/CANopen (CiA 402), servo drive characterization, absolute encoder calibration, motor and sensor interfacing, embedded systems

ML & Verification: formal verification of learned controllers (CROWN), PyTorch, JAX (jax_verify), integration and deployment of neural 3D reconstruction models (TorchScript/libtorch, FP16)

Simulation: MuJoCo, Gazebo, Isaac Sim

Tools: ROS 2, CMake, Git, Linux, Docker, Bitbucket Pipelines (CI/CD), Foxglove, RViz, AWS