

Henry Bao

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EDUCATION

Duke University

Durham, NC

Bachelor of Science in Engineering in Electrical and Computer Engineering

Aug. 2024 – May 2028

Relevant Coursework: Introduction to Deep Learning (ECE 685), ML Acceleration and Neuromorphic Computing (ECE 662), Robotic Manipulation (ME 555), Natural Language Processing (ECE 684), Introduction to Robotics Lab TA

EXPERIENCE

Undergraduate Robotics Researcher

Jan 2026 – Present

Duke Dexterous Robotics Lab, Advisor: Prof. Xianyi Cheng

Durham, NC

- Led collection of 125 human demonstration videos of object manipulation (mustard-bottle pickup) for human-to-robot imitation learning
- Trained an object mask + pose reconstruction algorithm combining SAM3D segmentation with Guided Diffusion that improved 6D pose estimation accuracy by 30% over a SAM3D + FoundationPose baseline
- Developed a sim-to-real retargeting system that converts reconstructed human demonstrations into robust robot trajectories using Mink IK initialization followed by MPPI-style sampling-based MPC in MuJoCo, with force perturbations and transition rewards to ensure reliable grasping and releasing on a 7-DoF arm

Automation Engineer

Oct. 2024 – Dec. 2024

Duke University Hospital

Durham, NC

- Collaborated with a clinical radiology team to automate breast biopsy console interactions, supporting up to 18 scans/day with ~92% reliability
- Designed an electromechanical actuation system with custom driver electronics and 3D-printed housing
- Integrated hardware control with ultrasound equipment and tuned actuation timing for reliable, smooth operation

PROJECTS

Towel Folding with Imitation Learning | ROS2, LeRobot, PyTorch, ACT, OpenManipulator Apr. - Aug. 2026

- Developed a two-stage imitation learning system for deformable object manipulation that first flattens a crumpled towel then folds it, using separate ACT policies trained on teleoperated demonstrations
- Designed Tunable Terminal Condition Classification (TTCC), an interpretable RGB-D vision module that decides when to switch from flattening to folding based on rectangularity fit, height standard deviation, and height range
- Integrated the full system in ROS2 with OpenManipulator-Y, RealSense D405/D415 cameras, and LeRobot ACT inference, achieving 80% end-to-end success with autonomous TTCC transitions versus 63% with manual switching

RoboMemory | FastAPI, MERN stack, Python, CockroachDB, AWS S3, MongoDB, Docker, Git Jan - July 2026

- Built a MERN-stack robotics lab assistant that converts robot experiment logs, metrics, notes, and artifacts into persistent agent memory for debugging and future data collection
- Designed a CockroachDB-backed memory layer for experiment metadata, quality scores, LLM summaries, semantic embeddings, artifact links, and stored agent recommendations
- Implemented hybrid retrieval using structured filters and vector similarity to surface related robot failures such as gripper slip, camera occlusion, high IMU shake, and low policy confidence
- Developed a chat-with-memory interface that answers grounded debugging questions and recommends next experiments based on retrieved failure patterns and data-quality issues

TECHNICAL SKILLS

Languages: Python, C++, Typescript, Javascript, MATLAB

Robotics: ROS2, IssacSim, MuJoCo, Mink, OpenManipulator, TurtleBot, RealSense, teleoperation

ML / Robot Learning: PyTorch, TensorFlow, Hugging Face, LeRobot, ACT, imitation learning, SAM3D, FoundationPose, Guided Diffusion

Tools & Systems: Git, FastAPI, Angular, React, Node.js, Next.js, CockroachDB, MongoDB, AWS S3, Linux, Docker