Maanasa Rajeshwer

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RESEARCH FOCUS

Embodied AI, Multimodal Perception, Robot Learning, Dexterous Manipulation, Human-Robot Interaction, Physical AI

EDUCATION

University of Pennsylvania, School of Engineering and Applied Science (SEAS), Philadelphia, PA *Dec 2026*
Master of Science in Engineering, Robotics *GPA*: 3.60/4.0
Concentration: Perception
Selected Coursework: Advanced Machine Perception, Deep Learning, Autonomous Racing (F1TENTH), Learning in Robotics, Advanced Robotics, MEMS and NEMS

University of North Carolina of Chapel Hill, Chapel Hill, NC *May 2022*
Double Major: Bachelor of Science in Computer Science *GPA*: 3.50/4.0
Bachelor of Science in Statistics and Analytics with a minor in Health and Society
Dean's List 2018, 2019, 2022 (4/5 semesters), Honors Carolina Laureate
Affiliations: *President* Carolina Irish Dance Association (CIDA) • *Fellow* Rewriting the Code • Women in ML • Women Who Code

TECHNICAL SKILLS

Robotics: ROS 2, Gazebo, Isaac Sim, Franka Emika Panda (sim & hardware), Kinematics (FK/IK), Motion Planning, AprilTags
Vision & Perception: OpenCV, NumPy, SciPy, Optical Flow(RAFT), Video Segmentation, Multi-Object Tracking, Camera Calibration
Machine Learning: PyTorch, Robosuite, Robomimic, CNNs, VAEs, Multimodal & Imitation Learning, Sensor Fusion, Repr. Learning
Software & Systems: Python, C++, Java, R, SQL, Git, Linux/Bash, LaTeX, Azure, Databricks, Jenkins, Spring Boot, REST, YAML/JSON
Visualization & Interfaces: TypeScript, React, Streamlit, Matplotlib, Taipy, Plotly, Seaborn

SELECTED ROBOTICS AND PERCEPTION PROJECTS

Spatially-Aware Re-Identification for Identity-Preserving Video Segmentation (Team of 3) *Dec 2025*

- Analyzed identity fragmentation in SAM2/SAM3 under object transformations, occlusions, and multi-view changes.
- Designed a training-free spatial re-identification pipeline combining SAM masklets, RAFT optical flow, spatial proximity (α=0.4), and tracklet-based temporal reasoning to maintain object identity through physical transformations.
- Eliminated ID switches in identical-object sequences (boxes, sticky notes), maintaining stable trajectories through occlusions and rapid motion (≤400 px inter-frame centroid displacement) where SAM2/SAM3 failed.

Reformulating Multi-Camera Tracking via BEV for Identical Objects (Team of 2) *Dec 2025*

- Reformulated multi-camera multi-object tracking for identical forklifts by introducing a BEV-based early-fusion detection architecture, resolving appearance homogeneity and late-fusion limitations of 2D pipelines.
- Built a synthetic multi-camera warehouse dataset in Isaac Sim (1200 frames, 2 cameras) with full nuScenes-format conversion for controlled evaluation and calibrated multi-view annotations.
- Designed a BEV detection network with learned attention-based camera fusion, achieving 98% AP @ IoU=0.5 and 0.92 cross-camera IoU consistency (+25% AP over 2D baseline), eliminating reliance on appearance-based re-identification.

VAE-Augmented Imitation Learning with LLM-Based Goal Generation (Team of 4) *May 2025*

- Built an imitation learning pipeline for simulated pick/place using behavioral cloning, VAEs, and LLM-based spatial goals.
- Learned compact latent trajectory representations from proprioceptive and object-centric state, integrating natural language goal parsing to generate constraint-compliant 3D placement targets and reduce reliance on visual inputs.

Vision-Based Manipulation with Franka Panda (Team of 4) *Dec 2024*

- Developed a perception-to-control manipulation system for static and dynamic block stacking using inverse kinematics.
- Implemented AprilTag-based estimation and real-time motion prediction for grasping blocks on a rotating platform.
- Addressed sim-to-real discrepancies through camera calibration, frame alignment, and end-effector offset correction.

Policy Learning for Continuous Robot Control *May 2025*

- Implemented PPO in PyTorch for continuous control of a bipedal walker in MuJoCo; trained stochastic policies for 1M+ timesteps and analyzed learning stability, exploration dynamics, and failure recovery in closed-loop control.

Garment Keypoint Detection and Folding Pipeline for Deformable Garments *In Progress*

- Designing a garment perception pipeline for deformable manipulation, including cloth segmentation and keypoint heatmap regression under self-occlusion and shape ambiguity.
- Exploring fold-line inference and canonical configuration estimation to connect vision outputs to folding actions.
- Evaluating keypoint localization accuracy using PCK metrics on a curated garment dataset.

Mini SLAM Project *In Progress*

- Benchmarking ORB-SLAM2 and visual-inertial SLAM systems on TUM RGB-D dataset, analyzing Absolute Trajectory Error (ATE) and loop-closure robustness under texture-sparse conditions.
- Investigating failure modes in dynamic scenes and exploring pose-graph refinement for improved trajectory consistency.

WORK HISTORY

Gap Inc, Remote

Data Engineer- Customer Data Engineering Team *Feb 2024 – June 2025*

- Led large-scale customer data unification pipelines across Amperity and C-360, supporting downstream analytics and ML use cases across marketing, personalization, experimentation, and internal decision systems.
- Designed and implemented PII masking and encryption workflows to improve data security, regulatory compliance, and cloud cost efficiency while managing sensitive customer data across 300+ customer data tables in production.

Data Engineer- Supply Chain Data Engineering Team *Aug 2023 – Feb 2024*

- Built and maintained Python-based data transformation and validation pipelines; documented schemas, metadata, and data relationships for analytics and forecasting consumers across supply chain systems.
- Automated CI/CD workflows using Jenkins shared libraries and Databricks notebooks, while developing Streamlit and Taipy proof-of-concept dashboards to improve deployment reliability and dataset accessibility for internal stakeholders.

Back End Engineer- Allocation Team *Feb 2023 – Aug 2023*

- Migrated legacy HBase pipelines to Azure SQL by refactoring Hadoop workflows into Python, supporting real-time inventory and in-season customer choice systems while reducing operational cost by $18k annually.
- Improved backend reliability by increasing test coverage and integrating robust error handling in Spring Boot services supporting live allocation, demand planning, and decision-critical workflows.

Front End Engineer- Shopping Bag UI Team *Aug 2022 – Feb 2023*

- Implemented production-scale frontend features using React and TypeScript, collaborating closely with design and backend teams within a large, distributed, multi-brand e-commerce platform.

Scope IT Consulting, Remote

Appian Business Process Management Consultant *Dec 2020 – Sep 2021*

- Engineered Appian BPM workflows for state-level systems (Georgia Dept. of Driver Services, Kansas Dept. of Transportation), orchestrating regular client demos for feedback integration.
- Designed ERDs and SQL-based data models to support structured data management, querying, and reporting.

Renaissance Computing Institute at UNC (RENCI), Chapel Hill, NC

Research Assistant *Jan 2020 – May 2020*

- Overcame challenges in the application of different, freely available biomedical data sets using R to drive innovations in clinical care and drug discovery, collaborating with a team to perform statistical, qualitative, and quantitative analyses.
- Supported development of a semi-automated annotation and crowdsourcing platform for training data generation.

COMMUNITY AND TEACHING EXPERIENCE

FIFE Academy, *Robotics Instructor & LEGO Robotics Aide (Grades 2-8)* *Oct 2025 – Current*

- Design and lead robotics programming using Scratch and Python on LEGO and XRP platforms, teaching sensing, motion, and control while developing adaptable curricula for diverse learning levels.