

# Sunny Deshpande

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## EDUCATION

### University of Illinois Urbana-Champaign

Master of Engineering in **Autonomy and Robotics** (GPA: 3.75/4.00)

Urbana-Champaign, USA

Aug 2025 - Sep 2026

- Current Coursework: **Reinforcement Learning, Advanced Robotic Planning, Autonomous Vehicle Safe Autonomy, Humanoid Robotics**

### Singapore University of Technology and Design

Bachelor of Engineering (Engineering Product Development), **Robotics Focus, Minor in Computer Science**

Singapore, Singapore

Sep 2021 - May 2025

- SUTD Honours and Research Programme (SHARP) with Global Distinguished Scholarship

## TECHNICAL SKILLS

**Robot Learning:** Deep Learning, Reinforcement Learning (PPO), Vision-Language-Action (VLA) / VLM integration; PyTorch, TensorFlow.

**Autonomy:** ML-based Robot Navigation, Autonomous Exploration, Path Planning (A\*), SLAM (GMapping), Mapping/Costmaps, Trajectory Generation & Tracking, Controllers (Pure Pursuit, PID, MPC), Sensor Fusion.

**Languages:** Python, C++, MATLAB, Bash.

**Robotics Tools:** ROS 2, Nav2, TF/URDF, OpenCV, Linux, Git, Docker, CMake, RViz, Rosbag, REST, MQTT, CUDA.

**Simulation:** Isaac Sim / Isaac Lab, Gazebo, MuJoCo, Virtual Test Drive (VTD), Domain Randomization, Scenario Generation.

## WORK EXPERIENCES

### Hyundai Motor Group Innovation Centre Singapore

May 2024 - Sep 2024

Robotics Fleet Software Engineer Intern - Robotics Centre

- Overhauled **deployed** fleet communication pipeline for **logistics AMR fleet** using **REST and MQTT**, improving critical real-time reliability and latency.
- Increased junction navigation speed by 40%** via redesigned motion planner and trajectory follower using **trajectory smoothing** and **pure pursuit-based controller**.
- Designed novel traffic path planner to **improve fleet routing of 200 AMRs** using congestion and time-of-arrival prediction, resulting in **10% increase in missions**.

### Venti Technologies

Sep 2023 - Dec 2023

Autonomous Vehicle Simulation Engineer Intern - Planning & Control Team

- Built vehicle **dynamics-informed simulation pipelines** in Virtual Test Drive (VTD) to validate planning, control, and prediction algorithms.
- Developed **scenario scripts and agent behaviors** to stress-test MPC controllers, **expanding scenario coverage** involving various realistic pedestrian and pulk traffic.

### Agency for Science, Technology and Research

May 2019 - Aug 2019

Robotics and Artificial Intelligence Research Intern - Perception Team

- Designed **end-to-end CNN-based** indoor navigation and obstacle-avoidance model (**10Hz frequency**) using **stereo RGB-D** and **robot-goal pose input**, deployed on **Pioneer P3-DX mobile robot** with **embedded Intense PC Pro Barebone** using with **95% success rate** in obstacle course.

## SELECTED PROJECTS

### Maze Frontier Exploration Simultaneous Exploration and Mapping (SLAM) with Object Tracking

Sep 2024 - Dec 2024

- Implemented a **Frontier-Based exploration** algorithm integrated with **GMapping SLAM** to autonomously **map and explore** unknown maze environments.
- Developed **custom object tracking and memory** algorithm for robot to **remember unseen key landmark objects** in maze.
- Engineered a global path planner using **A\* search** to navigate to detected frontiers while performing simultaneous object detection and tracking.

### Hierarchical Multi-Agent Reinforcement Learning for Humanoid Robot Interaction

Oct 2025 - Dec 2025

- Designed a hierarchical control architecture for **Sim-Unitree G1 humanoid**s, decoupling **high-level PPO** navigation policies from **low-level PPO** dynamics policies governing active 29-DOF joint actuation for locomotion.
- Engineered a **curriculum learning** schedule and height-scan state observations to train robust locomotion gaits capable of **traversing jagged, uneven terrains** in **Isaac Lab** simulations with **domain randomization**.

### Vision-Language-Action Model for Language-Guided Humanoid Loco-Manipulation with Navigation

Oct 2025 - Dec 2025

- Developed a **CLIP-based Vision-Language-Action (VLA)** architecture extending **HumanVLA**, achieving **62.1% success** on unseen tasks by jointly aligning **visual and language encoders** for improved cross-modal reasoning with instruction.
- Designed a **Teacher-Student distillation** pipeline using **Behavior Cloning** and **DAGger** to compress expert RL policies, enabling successful execution of 615 long-horizon rearrangement tasks in the **HITR simulation** environment within **Isaac Lab** using a **humanoid agent** with **reliable navigation**.

### AutoShield - Real-Time Pedestrian-Intent Prediction with Safety-Filtered Autonomous Driving

Oct 2025 - Dec 2025

- Developed **end-to-end ROS2-based** predictive autonomous driving control pipeline on **Polaris GEM e4 Autonomous Vehicle**, achieving **91% success rate** across diverse pedestrian scenarios.
- Implemented **LiDAR/RGB-D multi-sensor fusion** (0.8 distance, 0.7 direction) to power a **TTC-driven** decision state machine for risk-aware behavior planning.
- Integrated **YOLOv11** with **DBSCAN** clustering for pedestrian **behavior tracking** and **trajectory prediction**, enabling proactive motion planning using a **Stanley Controller** and **PID-based** velocity regulation, reducing emergency braking events.

### C.A.R.E. - Companion Autonomous Robotic Entity Humanoid Robot

Oct 2025 - Oct 2025

- Developed **full-stack** AI-powered embodied robotics pipeline integrating a **Gemini VLM API-driven** task planner with a **ROS2 Navigation2** backend for semantic goal navigation on **Booster K1 Humanoid Robot**, synchronizing **Snap AR Spectacles Teleop** via **WebSocket** communication architecture with **sub-100ms latency**.

### Deep-Learning Visual Odometry for Autonomous Vehicles in Rain

May 2023 - Aug 2023

- Developed **DL-based Visual Odometry** models (e.g., **DROID-SLAM**) for **Localization** in **adverse weather** with **Oxford RobotCar, 4Seasons** datasets
- Built benchmarking pipeline and **co-authored paper** presented at the **2023 IEEE 19th International Conference on Automation Science and Engineering (CASE)**.