Sunny Deshpande

sunnydeshpande9900@gmail.com | F-1 (UIUC), CPT eligible
Portfolio: sunnydeshpande.com | LinkedIn: linkedin.com/in/sunny-deshpande | GitHub: github.com/SunnyDeshpande

EDUCATION

University of Illinois Urbana-Champaign — Urbana-Champaign, USA
Master of Engineering in **Autonomy and Robotics** (**GPA: 3.75/4.00**) — Aug 2025 - Sep 2026
- Current Coursework: **Reinforcement Learning, Advanced Robotic Planning, Autonomous Vehicle Safe Autonomy**, **Humanoid Robotics**

Singapore University of Technology and Design — Singapore, Singapore
Bachelor of Engineering (Engineering Product Development), **Robotics Focus, Minor in Computer Science** — Sep 2021 - May 2025
- SUTD **Honours and Research Programme** (SHARP) with Global Distinguished **Scholarship**

TECHNICAL SKILLS

Planning & Control: Trajectory Prediction, Motion Planning, Path Planning, MPC, SLAM, Sensor Fusion, Pure Pursuit, Stanley Controller, Vehicle Dynamics, State-Space Control, PID.
Deep Learning & Perception: Deep Learning (PyTorch, TensorFlow), CV (SAM-3, YOLOv11, 6D Pose Estimation), VLA (HumanVLA).
RL & Simulation: PPO, Curriculum Learning, NVIDIA Isaac Lab, Virtual Test Drive (VTD), Gym, PyTorch, Sim-to-Real Transfer.
Software & Tools: C++ 17, Python, ROS2, Linux, CMake, Docker, Git, CUDA, VTD, Gazebo, DDS, CAN, MQTT/REST, LaTeX, MATLAB.
Hardware & Embedded Systems: NVIDIA Jetson, Ouster/Livox LiDAR, OAK-D RGB-D, Unitree G1 Humanoid, GEM e4 (Autonomous Vehicle), Arduino, ESP32, Ground-Underwater-Aerial Robotics.

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

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.

Hierarchical Multi-Agent Reinforcement Learning for Humanoid Robot Interaction — Oct 2025 - Dec 2025
- Designed a hierarchical control architecture for **Sim-Unitree G1 humanoids**, 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**.

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)**.

Lane-Tracking and Object Detection of Outdoor Scaled 4WD Race Car — Jan 2025 - Apr 2025
- Optimized a **vision-based lane perception pipeline** on an **NVIDIA Jetson Nano**, utilizing adaptive thresholding and radial-scan algorithms to handle variable outdoor lighting.
- Implemented a **real-time lateral controller** via polynomial curve fitting, achieving 45+ FPS inference and **control loop rates for high-speed** lane keeping.

Novel Dynamics-Intent Aware Pure Pursuit Controller (DIAPP) — Sep 2024 - Apr 2025
- Derived a dynamic vehicle model incorporating **non-linear tire slip angles** and **friction circle constraints** to predict trajectory deviation under high-lateral-acceleration cornering.
- Engineered a **modified Pure Pursuit control law** that **dynamically optimizes curvature selection** by **compensating for estimated slip vectors**, extending the classical geometric baseline for low-friction regimes.
- Benchmarked controller performance in simulation, demonstrating a **significant reduction in cross-track error (CTE) by 20%** during aggressive maneuvering where slip angles exceeded stable limits.