Sacchin Ganesh Sundar

Graduate Researcher · Field Robotics Group · University of Michigan

sacchin@umich.edu — +1 (248) 222-9059 — sacchinbhg.github.io — LinkedIn

Research Interests

Physics-aware perception; computational imaging; differentiable sensor models; Neural scene representations; multimodal world models; SLAM; robot learning; Neuro-symbolic planning

Education

University of Michigan Aug 2024 – Present
M.S. in Robotics (GPA: 3.827/4.000) Ann Arbor, MI, USA

Vellore Institute of Technology Sep 2020 – May 2024
B.Tech. in Computer Science (AI & Robotics) (GPA: 3.781/4.00) Chennai, India

Experience

University of Michigan *Ann Arbor, MI, USA*
Research Assistant, Field Robotics Group Nov 2024 – Present

- Neural implicit bathymetry from side-scan sonar using Lambertian & NEUS-style rendering of waterfall images.
- Physics head for transformer models predicting attenuation (β) and backscatter (B_∞); photometric/physics-aware losses for underwater color correction.
- SurfSLAM in preperation to IEEE Transactions on Field Robotics
- Datasets, training infra, and ablations.

University of Michigan *Ann Arbor, MI, USA*
Graduate Student Instructor Aug 2024 – Present

- Primary Lab Instructor for SLAM & Navigation, teaching a class of 40 student
- Developed codebase for undergraduate robotics coursework.

The ePlane Company *Chennai, India*
Autonomy Intern Aug 2023 – Jan 2024

- Designed GNC solutions for eVTOL drones, reducing trajectory deviation by 15% and improving flight stability.
- Engineered automatic power grid inspection using RRT-Connect, achieving 25% reduction in planning time.
- Integrated MAVROS & ArduPilot with <50 ms latency; enhanced flight control precision by 30%.
- Developed Aruco marker-based localization, increasing navigation accuracy by 20% and inspection efficiency by 35%.

Ati Motors *Bangalore, India*
Robotics AI Intern May 2022 – Jul 2022

- Developed image retrieval system for kidnapped robot problem; improved localization accuracy from 63% to 82%.
- Built custom CNN derived from ResNet-50 for optimized feature vectorization and weight training.
- Implemented OPTICS clustering and ORB-FLANN matching with visual bag-of-words for robust feature matching.

Hyundai Motors India *India*
Project Intern May 2021 – Jul 2021

- Established Faster R-CNN model achieving 85% accuracy in roof welding defect detection for body shop.
- Integrated model with existing PLC line for seamless quality control pipeline operation.

Publications

Submitted

- **Sundar, S.***, Kikani, A.*, Alam, A., et al. *MARVO: Marine-Adaptive Radiance-aware Visual Odometry.* Submitted to IEEE/CVF Conference on Computer Vision and Pattern Recognition 2026. Preprint available at arXiv:2511.22860. (*equal contribution)
  - Physics-aware transformer for underwater feature matching with radiance adapter compensating wavelength-dependent attenuation.
  - Multi-sensor factor-graph (visual-inertial-barometric) followed by offline RL-based pose-graph optimization.
  - Achieved 1.73m ATE and 1.2% drift on real underwater deployments, outperforming SLAM and Matching baselines.

In Preparation

- Isaacson, S., Bagoren, O., **Sundar, S.**, et al. *SurfSLAM: Sim-to-Real Stereo Underwater Reconstruction for Neural SLAM.* In preparation for IEEE Transactions on Field Robotics (T-FR).
  - Generated high-quality 3D ground-truth reconstructions and disparity maps for the lab's underwater stereo dataset using multi-view photogrammetry workflows.

– Ran and evaluated baseline stereo networks on both the synthetic and real-world underwater datasets to establish performance benchmarks for SurfSLAM.

Patent

GROUND UNDERWATER AERIAL ROBOTIC DRONE (G.U.A.R.D.) Filed 2021

India App. No.: 201941052320. Multi-terrain robotic drone (underwater, land, air) with modular sensors.

Selected Projects

NSOS: Neuro-Symbolic Grounding in Outdoor Scenes Nov 2024 – Dec 2024

- Extended NS3D framework to outdoor environments using 3D Gaussian Splatting for improved spatial and photometric reasoning.
- Developed 3D encoder consuming Gaussian splats with mean position, covariance, and RGB attributes for object-centric embeddings.
- Implemented differentiable neural executor for symbolic program execution on color-aware Gaussian features.
- Evaluated on ReferIt3D and Talk2Car datasets, establishing baseline for outdoor 3D language grounding tasks.

BAGS: Bundle Adjusted Gaussian Splatting Jan 2025 – Apr 2025

- Sparse-view object modeling with visual hull priors and floater suppression; BA for pose & geometry refinement.
- Outperforms COLMAP baselines with only 4 views (accuracy, completeness).

Spring-Mass 3D Object Reconstruction Sep 2024 – Jan 2025

- Differentiable spring-mass physics with Gaussian splats for deformable reconstruction; ˜60% lower Chamfer error.
- Achieved 82% improvement in dynamic reconstruction accuracy vs. baseline physics-augmented NeRF methods.

CalypsoSim: AUV Simulator Aug 2022 – Jan 2024

- ROS-compatible 6-DoF Fossen hydrodynamics; HIL with real-time ROS control; ˜40% runtime gains.
- Achieved 95%+ fidelity match with real-world AUV behavior in controlled environments.

HiDDOP: High-Density Dynamic Object Planning Jan 2023 – Aug 2023

- Attention social pooling + TD learning; zero collisions with efficient MLP+ELU policy.
- Utilized social attentive pooling to learn relative importance of neighbors in a data-driven fashion.

Deep Learning 6-DOF Pose Estimation Dec 2022 – Apr 2023

- Memory-augmented pose graph optimization for low-drift 6D object pose tracking using BundleTrack.
- Real-time performance of 10Hz with efficient CUDA implementation.

Technical Skills

Programming:	Python, C++, Rust, MATLAB, JavaScript
ML/Vis:	PyTorch, TensorFlow, OpenCV, scikit-learn, Weights & Biases
Robotics:	ROS/ROS2, SLAM, Gazebo, MoveIt!, OpenRAVE
Systems:	Git, Docker, Linux, CMake, GDB, Valgrind
Specialized:	CUDA, NeRFs, Gaussian Splatting, Physics-based Rendering

Relevant Coursework

Graduate
Deep Learning for Robot Perception; Robotics Systems Lab; Robotic Manipulators; CHRI; Math for Robotics

Undergraduate
Reinforcement Learning; Machine Learning; Mathematical Methods of CV; Robot Vision; Robot Programming (TA)

Awards & Honors

TAC Challenge: 2nd (2024), 6th (2023); CII National Robotics Gold (2023); Hyundai Innovation Challenge Winner (2021)

Leadership & Service

Outreach Chair, Robotics Graduate Student Council Jan 2025 – Present
University of Michigan, Ann Arbor, MI

- Lead demos, tours, and outreach strategy to broaden access to robotics.

Chairperson, Dreadnought Robotics Jul 2022 – May 2024
VIT Chennai, India

- Led 120+ member AUV team; mentorship, ops, $32k budget; TAC podium finishes.

Volunteer, REAL (Rural Education and Action for Liberation) Jun 2021 – Nov 2021
Sriperumbudur, India

- Arduino workshops for under represented students; SHG financial literacy.