SHREYAS DEVDATTA KHOBRAGADE

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SUMMARY

Robotics and Perception Engineer with a strong applied research background and hands-on experience building real-time autonomous systems. Experienced in computer vision, perception pipelines, motion planning, and sim-to-real deployment for aerial and ground robots. Proven ability to translate research ideas into production-ready systems running on embedded hardware under real-world constraints.

EDUCATION

Worcester Polytechnic Institute   **Aug 2024 - May 2026**
Master of Science, Robotics Engineering (GPA: 4.0)   *Worcester, MA*
- **Achievements:** Received Dr. Glenn Yee Graduate Student Project Award, EDU Bridge Scholarship
- **Coursework:** Computer Vision, Motion Planning, Reinforcement Learning, Hands-On Autonomous Aerial Robotics

Visvesvaraya National Institute of Technology   **Aug 2018 - May 2022**
Bachelor of Technology, Electronics and Communication Engineering (GPA: 8.26/10)   *Nagpur, India*

PUBLICATIONS

- **Shreyas Khobragade***, D. Singh*, N. J. Sanket.AsterNav: Autonomous Aerial Robot Navigation in Darkness Using Passive Computation..*(2026). IEEE Robotics and Automation Letters (RA-L), Early Access*
- **S.Khobragade**, A. Kinage, D. Shambharkar.Real-time Track and Anomaly Detection in Complex Railway Environment..*(2022). 2022 1st International Conference Paradigm Shifts in Communication, Embedded Systems, Machine Learning and Signal Processing (PCEMS)*

EXPERIENCE

PeAR Lab, WPI | *Graduate Researcher*   **Jul 2025 - Present**
- Designed and implemented a complete **sim-to-real autonomy pipeline** for aerial robots operating in **zero-light** and **GPS-denied environments**.
- Built a **perception** system using **structured lighting** and **coded apertures** for **dense depth estimation**, leveraging **passive computation** via **depth-from-defocus** cues to enable robust obstacle avoidance in zero-light conditions (<1 milli-lux).
- Trained and deployed deep learning models (DenseNet-121) for depth inference, achieving **real-time performance (20 Hz)** on **Jetson Orin Nano**.
- Integrated perception outputs with motion planning and control to enable closed-loop autonomous navigation in cluttered environments, achieving a **95.5% navigation success rate** while meeting strict real-time latency and **embedded deployment** constraints.
- Developing learning-based low-light navigation using structured lighting with **event cameras**.

Jio Platforms Limited | *5G Software Engineer R&D*   **Jun 2022 - May 2024**
- Developed and modified **high-performance C/C++ networking software** within the Vector Packet Processing (VPP) framework.
- Implemented shared-memory mechanisms to store **User Plane Function (UPF)** statistics, enabling improved real-time monitoring and faster debugging of system crashes by modifying VPP source code in C to support dynamic metric collection during network testing.
- Migrated and refactored UPF components to support newer VPP versions, improving system stability, performance, and maintainability.

PROJECTS

Einstein Vision: Advanced Visualizations for Self-Driving Cars | Github   **Jan 2025 - May 2025**
- Developed perception and visualization pipelines for **autonomous driving**, integrating **object detection, instance segmentation, lane detection, optical flow, pose estimation, and depth estimation** into a unified system designed for real-time performance and interpretable scene understanding.
- Integrated and troubleshot diverse **deep learning** models including Mask R-CNN, YOLO, Detic, Depth Anything V2, and RAFT to detect and track vehicles, pedestrians, lanes, and traffic signals, resolving cross-framework integration issues and improving robustness through model tuning.
- Generated high-fidelity rendered videos across 13 driving sequences, designing clear visual overlays that reduced perception ambiguities by 15–20% by combining deep learning outputs with classical heuristics to improve scene clarity and consistency.

Deep Visual-Inertial Odometry | Github   **Jan 2025 - May 2025**
- Modeled a **visual-inertial odometry (VIO)** pipeline combining CNN-based visual feature extraction with LSTM-based **IMU** fusion to improve pose estimation accuracy, leveraging joint optimization with Mean Squared Error and Geodesic loss for stable, drift-aware trajectory estimation.
- Generated synthetic training data in Blender across 25 trajectory types and 3 noise profiles, achieving a 28% reduction in RMSE of absolute trajectory error compared to baseline methods through improved data diversity and realistic motion perturbations.

Optimizing Mixed-Autonomy Traffic Using Reinforcement Learning | Github   **Oct 2024 - Dec 2024**
- Developed a **reinforcement learning** model using **Proximal Policy Optimization (PPO)** to improve traffic flow and fairness in lane-merging scenarios involving both autonomous and human-driven vehicles, optimizing cooperative behaviors under mixed-traffic conditions.
- Utilized Flow and SUMO for simulation, integrating fairness penalties in the reward function to balance efficiency and equity.
- Achieved significant improvements in metrics such as average speed, throughput efficiency, and fairness across various bottleneck scenarios.

Real-Time Motion Planning for Drones in Unknown Environments | Github   **Oct 2024 - Dec 2024**
- Developed a real-time motion planning framework integrating **OctoMap** for global 3D mapping and **EDT3D** for precise local collision detection.
- Designed a **kinodynamic RRT**-based planner to generate safe, efficient trajectories while accounting for vehicle dynamics and obstacle avoidance. Validated the framework in simulated environments, achieving robust, collision-free navigation in complex and cluttered scenarios.

TECHNICAL SKILLS

- **Programming Languages:** Python, C, C++, MATLAB, Assembly
- **Robotics Libraries/Frameworks:** ROS2, OMPL, Isaac Sim, Mavlink, ArduPilot, PX4 Autopilot
- **Machine Learning & Computer Vision:** PyTorch, TensorFlow, SciKit-Learn, OpenCV, Numpy, Pandas, Matplotlib, TensorRT
- **Simulation & Modeling:** Simulink, Blender, Fusion 360, Multisim, Proteus, Modelsim, Onshape, Solidworks, Gazebo
- **Tools & Technologies:** LaTeX, Git, LabVIEW, VPP, DPDK, Docker
- **Hardware:** Jetson Orin Nano/NX, Raspberry Pi, Realsense, Arduino Uno, ESP32, Pixhawk Flight Controller