Nirshal Chandra Sekar

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Education

University of Minnesota (UMN), Twin Cities, (PhD in Computer Science) — Sep 2025 - Present

- **Research:** Robotic Bi-Manual Manipulation, Imitation Learning, Learning from Human-Demonstrations

University of Minnesota (UMN), Twin Cities, (MS in Robotics, 4.0 GPA) — Sep 2023 - May 2025

- Computer Vision, Machine Learning, Deep Learning, Natural Language Processing

Vellore Institute of Technology, Vellore, (B.Tech Mechanical Engineering, 3.9 GPA) — Jun 2019 - May 2023

Skills

Programming Languages: Python, C/C++, JavaScript, MATLAB

Libraries: OpenCV, PyTorch, Omniverse Replicator, Open3D, PyBullet, NumPy, scikit-learn

Tools: Git/Github, Linux, Docker, ROS/ROS2, Gazebo, NVIDIA Isaac Sim, Blender, SolidWorks

Work Experience

Robotics: Perception and Manipulation Lab, Graduate Research Assistant UMN — Jan 2024 - Present

- Developing a **dual-arm robotic regrasping network** using voxel-based scene representations for manipulation planning.
- Built a **Grasp Imitation Pipeline** that produces task-specific grasps from single video, achieving 1 cm positional and 6° orientation errors.
- Engineered a **Real-Time Segmentation-Guided Grasping System** using **SAM**, **Contact GraspNet**, and the **RealSense L515** LiDAR.
- Designed a **Human Demo–Guided Object-Part Grasping Network** for grasping novel objects from a single video.
- Built a high-precision sensor fusion framework for accurate object localization in dynamic scenes.
- Performed multi-camera calibration (intrinsic, and extrinsic) to reliably align RGB-D camera sensors for manipulation tasks.
- Used foundational segmentation models to reduce training data needs and improve system scalability.
- Validated system performance through extensive real-world robotic manipulation tests.

Nilfisk, Software Engineering Intern Brooklyn Park, MN — May 2024 - Dec 2024

- Utilized **NVIDIA Isaac Sim's Replicator library** to generate **synthetic datasets** for detecting scraps on the factory floor
- Achieved a robust sim-to-real transfer and a **mAP of 92%** when validated on real-world data.
- Developed a **custom annotation tool** using Segment Anything Model to enhance YOLOv8 object detection and segmentation pipelines.
- Streamlined annotation workflows to improve labeling efficiency and data preparation accuracy for ML models.

Technical Projects

Bi-Manual Manipulation using Diffusion Policy Github — ROS, PyTorch, OpenCV

- Designed and executed a **vision-based (CNN) diffusion policy** for bottle uncorking using PyTorch and dual UR5e arms.
- Trained on 188 teleoperated demos via RealSense L515 LiDAR and D405 stereo cameras, using ROS for data collection and action execution.
- Achieved a **74.7% task completion rate** across 30 rollouts, showcasing effective deployment of learned policies.

Understanding Image Generation using Generative AI — PyTorch, GenAI

- Implemented (**GANs**, **PixelCNN**, and **VAEs**) from scratch, and trained/tuned these models to improve generative image quality.
- Coded the full **DDPM/DDIM** sampling pipelines, implementing the reverse diffusion process to generate samples from a pre-trained model.
- Implemented and trained **Conditional Flow-Matching** models, analyzing how flow-based objectives compare to diffusion-based sampling.
- Gained a comprehensive, end-to-end understanding of modern generative AI models and their training/sampling behaviors.

3D Semantic Reconstruction Paper — OpenCV, COLMAP, YOLOv8

- Collaboratively performed **3D semantic reconstruction** using **Structure from Motion (SfM)** and **Multi-View Stereo (MVS)** with **COLMAP**.
- Conducted **2D semantic segmentation** with **YOLOv8** and linked 2D points to 3D points via a voting process.
- Generated a fully labeled **3D triangle mesh model** with **76% semantic labeling accuracy** across the reconstructed surface.