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 voxel-based 3D scene understanding pipelines for high-fidelity spatial perception used in downstream manipulation and planning.
- Built a **Grasp Imitation** pipeline that extracts obj features and 3D hand poses from a video, reaching 1 cm positional and 6 orientation error.
- 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.

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

Depth Video Diffusion for Robot Policy Learning Github   Diffusion models
- Built a conditional **depth video diffusion model from scratch** using a lightweight **3D U-Net** with spatial and temporal attention.
- Designed a **multi-modal conditioning pipeline** with **Sentence-BERT** and a CNN-based **RGB-D** encoder.
- Integrated **FiLM-based conditioning** to modulate 3D U-Net feature maps with fused text and visual embeddings.
- Implemented a scalable **DDPM training and sampling pipeline** with **multi-GPU parallelization**.
- Evaluated realism using **Fréchet Video Distance (FVD)** and achieved 10-frame inference in **1.5 minutes/GPU**.

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.

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.