Samaksh Judson

(412) 251-8579 GitHub linkedin.com/in/samakshjudson judsonsamaksh@gmail.com

Education

Carnegie Mellon University — Pittsburgh, PA
Master of Science in Mechanical Engineering (CDM) — Dec 2024
Coursework - **Ongoing**: Deep Reinforcement Learning for Control, Path Planning **Completed:** Visual Learning and Recognition, Optimal Control and Reinforcement Learning, Introduction to Deep Learning, Engineering Computation

Birla Institue of Technology and Science, Pilani — Pilani, India
Bachelor of Engineering in Mechanical Engineering — June 2023
Coursework - Autonomous Mobile Robotics, Robotics, Foundations of Data Science, Control Systems

Work Experience

Kantor Lab | *ROS1, ROS2, Docker, Pytorch, C++, Arduino* — Robotics Institute, CMU
Graduate Research Assistant — May 2024 - Aug 2024
- Developed a 3D point cloud modeling system for occluded fruits in orchards using RAFT stereo algorithm.
- Implemented YOLOv8 for segmentation and an augmented DeepSORT algorithm for tracking fruits across frames.
- Executed a leafblower actuation system using inverse kinematics on servo motors to uncover occluded fruits.
- Deployed the solution in a ROS-based Docker container for integration with field robotics systems.
- Achieved upto **35%** improvement in occluded fruit detection accuracy compared to baseline models.

Indian Institute of Science | *Embedded C, Arduino, STM32, Pytorch* — Bangalore, India
Research Intern — Jun 2022 - Dec 2022
- Deployed PLC-controlled force-based sensor systems facilitating imitation learning based intent recognition for a hybrid-powered prosthetic arm, resulting in a **20%** increase in user interaction efficiency.
- Fine-tuned algorithms to perform dynamic response-based pronation and supination, improving human-machine interaction by **15%** compared to prevalent industry-grade designs.

Projects

Robotics Insitute, School of Computer Science, CMU:

Segmentation on Open-Source Datasets | *Python, Computer Vision* — Spring 2024
- Developed a novel diffusion model architecture to generate labelled synthetic data using, augmenting open-source datasets to enhance training size, resulting in an **8%** improvement in test accuracy due to better generalizability.
- Refined feature representations and utilized high-quality object masks to improve classification accuracy for detailed parts like hair and facial features on divergent test data and improved mask quality of open source datasets.

Optimal Control of a Sailboat | *JULIA, Python, Isaac Sim* — Spring 2024
- Developed a multi-level control system for an autonomous sailboat, including global route optimization (RRT*), trajectory optimization, and model predictive control (MPC), reducing navigation error by **15%** and improving generalizable real-world accuracy by **20%** when tested on Global Forecast data from NOAA.
- Compared direct collocation and iLQR trajectory optimization, to ensure efficacy in computation time.

I2GROW Systems Integration | *ROS, Python, SolidWorks, PLC, Mujoco* — Fall 2023 and Spring 2024
- Implemented a controlled indoor hydroponic agricultural system to siphon household carbon dioxide emissions.
- Developed a digital twin of lettuce plants using the NiCoLet model to predict plant growth, trained on environment data collected by an integrated sensor pipeline implemented in ROS with a prediction accuracy of **88%**.

Imperative Path Planning | *Python, ROS, Isaac Sim* — Fall 2023
- Developed a novel unsupervised approach to train a path planning policy for robot perception and navigation.
- Mitigated the disadvantages of conventional unsupervised learning techniques by employing bi-level trajectory optimisation to achieve **SOTA** zero-shot performance in obstacle avoidance and waypoint generation.

Leadership Roles

Vehicle Dynamics Lead | *MATLAB, Simulink, C++, SolidWorks, Adams Car* — BITS Pilani, India
Inspired Karters Formula Student Team — Oct 2019 - Mar 2022
- Spearheaded **40%** of the entire team in fabricating a racecar, optimizing vehicle dynamics, preparing sponsorship pitches and ensuring efficient task delegation for maximum team productivity and learning.
- Collaborated with cross-functional teams to integrate a Tyre-Road interaction model with a Laptime Simulation model, improving lap times by **10%** over off-the-shelf simulators through data analysis and grip optimization.

Skills

Programming Languages: bash, Python (Libraries: NumPy, PyTorch, Matplotlib, PANDAS, CV2), C/C++, JULIA
Application Software: Git, ROS 1 , ROS 2, MATLAB, Simulink, SolidWorks, Fusion 360, Isaac Sim, Mujoco, Docker