Harsh Maheshekа

Email: harsh.mahesheka.eee20@iitbhu.ac.in
Website: https://harshmahesheka.github.io/
Mobile: +91-947-0292-105

Education

- **Indian Institute of Technology (BHU)** — Varanasi, India
  Bachelor and Masters of Technology - Electrical Engineering; ***GPA: 9.50*** — *July 2020 - June 2025*
  with minor in Computer Science and Engineering

Publications

- **Daniel Honkeramp*, Harsh Mahesheka***, Jan Ole von Hartz, Tim Welschehold, Abhinav Valada
  Zero-Cost Whole-Body Teleoperation for Mobile Manipulation
  Accepted at IEEE Robotics and Automation Letters (RA-L) — *Equal Contribution
- **Harsh Mahesheka**, Zhixian Xie, Zhaoran Wang, Wanxin Jin
  Language-Model-Assisted Bi-Level Programming for Reward Learning from Internet Videos
  Accepted at Workshop on Language and Robot Learning at CORL 2024

Skills And Interests

- **Areas of Interests**: Deep Reinforcement Learning, Computer Vision
- **Languages & Libraries**: Python, MATLAB, C++, CMake, Tensorflow, Pytorch, Stable Baselines, RLlib
- **Tools and Simulators**: Robotic Operating System, Moveit, Gazebo, Isaac Sim, Isaac Gym, PyBullet, Carla

Research Experience

- **MyoLab, Carnegie Mellon University** — Remote
  Research Internship Under Dr. Vikas Kumar — *Nov 2024 - Present*
  - **Goal**: Create an accurate biomechanical model of a user's arm using inertial data from a smartwatch
  - Utilized inertial data from smartwatches to accurately track user's arm movements with **2cm** accuracy.
  - The data was then employed to simulate a human arm, with an optimization process applied to refine kinematic parameters such as joint strengths, segment lengths, movement constraints, etc. This ensured a highly accurate **digital clone** of the arm, enabling precise **synthetic data generation**.
- **Intelligent Robotics and Interactive Systems Lab, Arizona State University** — Remote
  Research Internship Under Dr. Wanxin Jin and Dr. Zhaoran Wang — *April 2024 - Dec 2024*
  - **Goal:** Learn biological motions from in-wild videos without extensive data preparation.
  - Developed a hierarchical **VLM-LLM** architecture for **inverse reinforcement learning** from videos by generating reward functions. The framework uses a high-level VLM (Gemini 1.5) to analyze expert and learner videos, providing feedback that a low-level LLM (GPT-4o) uses to update the reward function.
  - Implemented and tested the framework in **Isaac Gym**, training simulated robots (Ant, Humanoid, ANYmal) with **PPO** to perform complex biological motions like jumping, running and splitting.
- **Robot Learning Lab, University of Freiburg** — Freiburg, Germany
  DAAD-WISE Research Internship Under Dr. Abhinav Valada — *May 2023 - September 2024*
  - **Goal:** Develop a low-cost and intuitive teleoperation system for mobile manipulation
  - The teleoperation method produces whole-body motions for mobile manipulation by delegating the base motions to a **reinforcement learning agent**, leaving the operator to focus on end-effector motions.
  - Trained the reinforcement learning policy using **A2C** algorithm in **Isaac Sim** to generate whole-body motions and achieved **zero-shot Sim2Real** transfer on **PR2**, **HSR** robots.
  - Demonstrated precise, intuitive, and **40%** faster task completion compared to existing methods.
- **Robotics Research Center, IIIT Hyderabad** — Hyderabad, India
  Research Internship Under Dr. K. Madhava Krishna — *May 2022 - December 2022*
  - **Goal:** Develop a global planner to reduce localisation drift by avoiding featureless areas
  - Designed and implemented a **reinforcement learning-based global planner**, trained to intelligently navigate through environments by actively avoiding areas that could cause localization drift.
  - Developed a modular platform for training and validating reinforcement learning models for global planners, integrated with **ROS** and **Gazebo** for real-time performance assessment and tuning.

Industrial Experience

- **Hindustan Unilever Limited** — Mumbai, India
  ULIP Technical Intern — *May 2024 - June 2024*
  - **Energy Optimizer**: Used machine learning and data analytics to develop a tool to serve as an end-to-end solution for **optimising parameters** to enhance factory **energy efficiency**.
  - **Energy By Design**: Benchmarked various process parameters and machine specifications across factories to generate energy insights worth **3.5 crores**.

- **Google Summer of Code - Project Mesa** — Remote
  Student Developer — *May 2024 - September 2024*
  - **Mesa RL**: Enhanced the Mesa agent-based modelling framework for **Multi-Agent Reinforcement Learning** by creating wrappers and functions for seamless integration with reinforcement learning libraries like **RLlib** and **Stable Baselines**. Created **tutorials** and **documentation** for getting started.

- **Google Summer of Code - Open Robotics** — Remote
  Student Developer — *May 2022 - September 2022*
  - **Package Creation Tool**: Created a command line tool using **embedded Ruby** for helping new users get started with **Gazebo** by generating custom template packages.
  - **CMake Macros**: Created macros for installing and sourcing worlds, models, plugins, etc., in Gazebo.

Projects

- **Multi-Purpose Household Bot (Supervised by Dr. Shyam Kamal)**: *[Link]*
  - **Goal:** Design a Compact Ground Robot to perform household tasks like Cleaning and child care.
  - Designed a **CAD** model and integrated ROS pckages for **Exploration, Navigation**, and **Coverage**.
  - Used **Computer Vision** for tasks like threat detection and child following for child care in households.
  - Developed prototype with **Jetson Nano** and **STM Microcontroller** and **Intel Realsense**.
- **Centralized Multi-Agent Pick Up and Delivery System (Flipkart Grid 3.0)**: *[Link]*
  - **Goal:** Develop a Multi-Agent Pick Up and Delivery system to automate warehouses.
  - Designed and fabricated a swarm of Omnidirectional ROS-based mobile robots with centralized control.
  - Implemented **Conflict-Based Search** for Global Planning and **PID tracking** for Local Planning.
  - Localized bots using **Kalman filter-based sensor fusion** of overhead camera and odometry data.
- **Autonomous Wheelchair (Supervised by Dr. K. Madhav Krishna)**: *[Link]*
  - **Goal:** Develop an autonomous interactive robotic wheelchair for assisting disabled people
  - Used **RTAB** libraries for mapping and localization using **3-D point cloud** from Intel Realsense.
  - Deteced and modelled human movement with **Time Elastic Band** (TEB) Planner for path planning.
  - Build a **mobile app** and used **NLP** to enable voice-based commands for navigation.

Relevant Course Work

- **CSO-101** Computer Programming **CSE-458** Soft Computing, **CSE-241** Artificial Intelligence, **ME-314** Mechatronics, **EE-211** Linear Control Systems, **EE-313** Modern Control Engineering, **EE-414** Optimal and Adaptive Control, **EE-404** Operations Research, **CSO-323** Graph Theory and Applications,
- **Deep Learning Specialization** by Andrew Ng on Coursera, **Reinforcement Learning Specialization** by the University of Alberta on Coursera, **ROS Specialization** by Anis Koubaa on Udemy

Achievements

- Among **Top-15 students** selected from 400 applicants nationwide for **IUSSTF-Viterbi Scholarship 2023**.
- Awarded **DAAD-WISE Scholarship** 2023 to pursue a Research Internship in German Public Institutes.
- Got selected to present my project to a global audience at the **G20 Global Summit 2023**.
- Stood first in **Robotics Conclave**, third in **Labyrinth** (ROS-based maze solver), and first in **Scientist of Utopia** (Astronomy-based Hackathon) at Technex (Annual Technical Fest of IIT BHU).
- Among **Top-10** winners in **National Robotics Competition** for developing innovative household robots.
- Cleared Tabs in multiple International Debates, including being **ranked 3rd** out of 60+ teams in TIB-JUDO.

Services and Leadership

- **Secretary** of Robotics Club, IIT BHU.
- **Mentor** at RoboReG (Robotics Research Group at IIT BHU).
- **Debating Lead** at Literary Club, IIT BHU.
- **Teaching Assistant** for Dr. Shyam Kamal, for the course **EE-561** (Modern Control Theory)
- **Reviewer** at LangRob Workshop at Conference of Robot Learning, 2024.