Shambhuraj Anil Mane

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EDUCATION

- **Worcester Polytechnic Institute** — Worcester, MA
  Masters of Science in Robotics Engineering, 4.0/4.0. — *August 2023 - Present*
  Courses: Motion Planning, Reinforcement Learning, Computer Vision, Robot Control

- **Savitribai Phule Pune University** — Pune, India
  Bachelor of Mechanical Engineering, 8.12/10.0 — *August2016 - November 2020*
  Courses: Engineering Drawing, Mechatronics, Machine Design, Product Design and Development

SKILLS SUMMARY

- **Languages**: Python, C++, MATLAB, HTML
- **Developer Tools**: ROS/ROS2, Gazebo, MATLAB, Solidworks, 3D-experience, CATIA, Linux, Git, Bitbucket
- **Frameworks and Libraries**: nav2, ros2_control, moveit2, pandas/scikit-learn, PyTorch, OpenCV

PROFESSIONAL EXPERIENCE

- **Cognitive Medical Technology Laboratory, Worcester, MA — Lab Assistant**: *August 2023 - December 2023*
  - Built Concentric Tube Robot (CTR) consist of three curved tubes nested inside of each other resulting in a surgical instrument with a high degree of dexterity with 3D printing, Laser cutting and Tube fabrication methods and troubleshooting.

- **Infosys Limited, Mysore, India — Senior System Engineer**: *January 2021 - July 2023*
  - Delivered 500+ production orders in CATIA and SAP, accelerating manufacturing work instructions for structural elements of the Fuselage, resulting in streamlined production processes and increased efficiency by 25%.
  - Developed 150+ engine manuals and service bulletins for turbo engines, in compliance with industry regulations and achieving a consistent 100% quality standard, leading to improved customer satisfaction and reduced maintenance time by 30%

PROJECTS

- **Classical and Deep Learning Edge Detection** : *November 2023 - December 2024*
  - Executed boundary detection pipeline by applying filter banks, specifically implementing DoG filters, Leung-Malik Filters and Gabor Filters, to produce a texton map capturing image texture through clustered filter responses.
  - Optimized edge detection with probability-based algorithms and enhanced ResNet/DenseNet CNN architectures, achieving a 5% performance boost and 80% image classification accuracy on CIFAR-10.

- **Multi-agent Motion Planning with Improved CBS algorithms** : *October 2023 - December 2023*
  - Implemented Improved Conflict-Based Search (ICBS) algorithm, incorporating extensions like prioritizing conflicts and bypassing conflicts with consideration of kinodynamic constraints and bounding box suitable for real time application.
  - Combined ICBS with disjoint splitting to further improve performance over ICBS alone, reducing node generation by 5-10%.

- **Open-manipulator Arm** : *October 2023 - December 2023*
  - Designed and developed Open-manipulator Arm, which included implementing forward and inverse kinematics algorithm nodes in ROS2 and 3D robot visualization in gazebo. Also, developed PID for velocity and current controllers for the robot's end effector. Configured the Open-manipulator Arm with MoveIt 2 for real-time planning and pick-and-place applications.

- **Motion Planning for Holonomic and Non-Holonomic Mobile Robots**: *August 2023 - October 2023*
  - Implemented algorithms like BFS, DFS, Dikjstras, A*, PRM, RRT and RRT* with a configurable density of obstacles and conducted a comprehensive comparative analysis of these algorithms.
  - Developed a state lattice planner for differential and Ackermann constraints, incorporating optimized cost functions within a hybrid A* framework and executed the waypoint navigation in ROS2 using the nav2 stack.

- **Short Range Path finding using Reinforcement Learning approach** : *August 2023 - December 2023*
  - Developed a custom OpenAI Gym environment to simulate a Pioneer 3AT robot with differential drive and laser scanner in a 3D hospital environment using ROS2 and Gazebo.Significantly increased simulation speed to 50x real-time using launch files.
  - Trained a Proximal Policy Optimization (PPO) reinforcement learning agent with over 12 million steps to accomplish short-range path planning goals. The agent learned to navigate targets within 10 meters while avoiding obstacles.

- **Bionic Arm** : *August 2018 - March 2020*
  - Designed an 11 dof prosthetic arm in Solidworks with electronic circuit and developed 3D printed functional prototype.
  - Developed a machine learning model that utilized SVM and random forest algorithms for the classification of datasets comprising over 10k sample points per individual from three subjects. Designed model to analyze EMG sensor data, demonstrated a notable average accuracy of 89% in successfully predicting pinch and fist grasp movements.

LEADERSHIP

- **US Kids 4 Water, San Jose, CA — Robotics Team Lead**: *March 2023 - Present*
  - Led a team of 7 tutors and 6 supervisors to spread robotics awareness, reaching students across 10 rural villages.
  - Conducted robotics, logic learning, and Arduino programming sessions for 24 students from underprivileged communities.