

SAI SHARAN THIRUNAGARI

Buffalo, NY — saisharanthirunagari@gmail.com — linkedin.com/in/sai-sharan-thirunagari — 716-548-8844

Education

Master of Science - Robotics

University at Buffalo, The State University of New York - GPA: 3.62

Aug 2022 - May 2024 (Expected)

Buffalo, NY

Bachelor of Engineering in Mechanical Engineering

Shiv Nadar University

Aug 2018 - May 2022

Delhi NCR, India

Technical Skills

- **Programming and Software Development:** Matlab and Simulink, Python, C++, ROS, Ladder Logic, Gazebo, Rviz, PyBullet, Visual Studio, Git, Anaconda, Tensorflow, Keras, Pytorch, Matplotlib, Pandas, Scikit-learn
- **Hardware and Embedded Systems:** Ubuntu(18.04,20.04), Windows, Debian, Raspbian, Arduino, Raspberry Pi, Nvidia Jetson Nano, Qtpy, DC motors, PLC, Phidget, ESP8266
- **Design and Simulation Tools:** Eagle, Proteus, Fritzing, Matlab, Solidworks, Inventor, Fusion 360, CoppeliaSim

Experience

Human in Loops Systems Lab, Buffalo, NY

Graduate Research Assistant

Aug 2023 - Present

- Designed and constructed a robotic automation solution for precise and efficient fluid extraction in biomedical processes, reducing work time by 50 percent.
- Engineered robotic system with Autodesk inventor, 3D printing, and Iterated system with pneumatic systems, linear actuators, soft grippers, and sensors to optimize the process.
- Collaborated with a pharmaceutical company to test and refine a robotic prototype in real-time, gaining constant feedback from clients to enhance the system.
- Experienced working with industrial robotic manipulators Schunk Powerball, UR5e, and UR3e to combine into automation solutions.

Graduate Student Researcher

May 2023 - Aug 2023

- Led dynamic trajectory generation for 'Spot', a Boston Dynamics quadruped robot, focusing on autonomous object tracking and retrieval to increase human-robot collaboration.
- Developed a computer vision-based object detection system for 'Spot' using a neural network and 3,000+ image testing and validation dataset; integrated as a ROS package with real-time 3D localization via OpenCV and depth sensors.
- Refined Spot's navigation with advanced mapping and trajectory algorithms as a ROS module, integrated with Boston Dynamics' API, enhancing its human-robot interaction capabilities.
- Accomplished dynamic object tracking and adaptive trajectory prediction in Spot with Kalman filters, boosting real-time accuracy and responsiveness in varied environments.

Engineering Projects

Deep Reinforcement Learning in Robotics : Python, Pytorch, Keras, Visual Studio, Git

- Developed deep reinforcement algorithms tailored for robot control to achieve autonomy and efficiency in robotic movements.
- Transitioned from simulation-based training in PyBullet to real-world application
- Introduced innovative approaches to human-robot interaction, enhancing the ability of robots to understand and predict human actions for better collaboration and safety.

Adaptive control of Snake Robot : Python, PyBullet, OpenCV, Jetson Nano

- Designed a 10 DOF snake robot with 12 servomotor modules, utilizing Deep Reinforcement Learning and PyBullet simulation, based on a CATIA and URDF digital twin.
- Training robot physically to adapt to different terrains by operating NVIDIA Jetson Nano and overhead camera for position mapping using OpenCV and to run RL algorithms.
- Implementing path planning algorithms and obstacle detection by onboard camera leveraging SLAM.

Collision Avoidance : C++, Matlab, CoppeliaSim

- Adapted autonomous vehicle collision avoidance concepts to engineer a path planning algorithm for a Powerball robot manipulator.
- Navigating around both static and moving obstacles through Probabilistic Road Maps (PRM) and Temporal Probabilistic Road Maps (T-PRM) with A* search.

- Upgrading obstacle prediction accuracy by incorporating a Kalman filter into the system, reaching a 70 percent success rate in dynamic obstacle avoidance scenarios.

Path Planning: Python, OpenCV

- Developed 3 path planning algorithms-RRT, A-Star, and Dijkstra's for static obstacle avoidance, leveraging libraries of Python for map processing and visualization, and highlighting applications in self-driving vehicles and collaborative robotics.

Stereo Visual Odometry: Python, OpenCV, ROS, Camera

- Developed a stereo visual odometry system for accurate 6-degree-of-freedom camera pose estimation using stereo images.
- Implemented feature extraction, matching, and tracking algorithms to establish correspondences between stereo images.
- Utilized robust estimation techniques, including RANSAC, to effectively handle outliers and improve the accuracy of camera motion estimation.

Emotion, Age, and Gender Recognition: Matlab, Machine Learning

- Crafted a linear classifier for precise identification of characteristics including gender, age, and emotion, utilizing inherent feature-extraction functions.
- Discovered a positive correlation between enlarged training dataset size and recognition accuracy, achieving 97 accuracy in gender detection, 90 in age, and 51 in emotion recognition.

Markov Localization: Matlab, Python, Lidar

- Formulated a Markov localization algorithm for Simultaneous Localization and Mapping (SLAM) suite to improve the robot's state estimation for location scanning, integrating sensor data with motion models.
- Performed simulations to validate the effectiveness of the Markov localization method, confirming its robustness and dependability through extensive testing.

Mobile Robot path Following with PID and Pure Pursuit: ROS, Python, Lidar

- Incorporated PID and Pure Pursuit control techniques into Linux-based ROS frameworks to strengthen the robot's path tracing and motion planning functions, exploiting ROS utilities for seamless meshing.
- Customized the Fltenth autonomous race car application, showcasing adaptability to robotic models and acquiring a precise error margin of 0.2 meters.

Gesture Recognition for Human-Robot Interaction: Matlab, Machine Learning

- Engineered an advanced gesture recognition system by extracting Rubine features and deriving weights from training data collected via MATLAB GUI, intensifying linear classification and differentiating gestures with high precision by comparing test data with training data for each class. The system boosts an accuracy of 98.9 percent, underscoring its potential in applications like gesture-based controls.

Industrial Articulated Robot: 3DExperience, FEA, IoT, C language

- Devised a 6 DOF Articulated Robot by producing a 3D model in Catia leveraging 3DExperience.
- Performed Finite Element Analysis (FEA) to optimize each link to measure stress-strain behavior with BC's as torques calculated using analytical methods for a maximum payload of 50kg.
- Manufactured robot with 3D printer and integrated IoT for joint rotation data collection via I2C communication.

Electromechanical Food Processing Machine: Solidworks, Arduino, Pneumatics, Automation

- Built machine to autonomously produce a sweet dish operating SolidWorks as a modeling tool.
- Integrated electro-pneumatic systems, servomotors, induction motors, and proximity sensors into a closed-loop system controlled via Arduino.
- Performed kinematic and dynamic analysis for each subsystem to select actuators.

Leadership / Extracurricular

- Mentored 6 high school students in personal projects with a wide range of topics such as waste management, nature, social science, and theoretical physics. Guided in finding right research material, generating new ideas, and creating solutions for global impact.