SAI SHARAN THIRUNAGARI

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SUMMARY

Robotics Engineer with a Master's degree from the University at Buffalo. Experienced in designing robotic automation solutions and developing deep reinforcement learning algorithms for robot control. Skilled in trajectory generation and advanced path planning.

EDUCATION

Master of Science - Robotics   **Aug 2022 - May 2024 (Expected)**
University at Buffalo, The State University of New York - GPA: 3.62   Buffalo, NY

Bachelor of Technology in Mechanical Engineering   **Aug 2018 - May 2022**
Shiv Nadar University   Delhi NCR, India

EXPERIENCE

University at Buffalo, Human in Loops Systems Lab   **Buffalo, NY**
Graduate Research Assistant   **Aug 2023 - Present**

- Advised by Prof. Ehsan Tarkesh Esfahani
- Tasked with developing a robotic automation solution for efficient fluid extraction in biomedical processes and reduce the work time by 50%.
- Designed and constructed a system using Autodesk Inventor, integrating 3D printing, pneumatics, linear actuators, soft grippers, and sensors.
- Developed an adaptive parametric trajectory generation algorithm for dynamic tissue manipulation, improving accuracy by 30%.
- Collaborated with a pharmaceutical company for real-time prototype testing and refinement.
- Worked with PLC and industrial robotic manipulators (Schunck Powerball, UR5e, UR3e) for automation solutions.
- Reduced fluid extraction process time from 4 to 2 hours, decreased system errors by 40%, and reduced operational costs by 20%.

University at Buffalo, Artificial Intelligence Institute   **Buffalo, NY**
Graduate Student Researcher   **May 2023 - Aug 2023**

- Advised by Prof. David Doermann
- Tasked with enhancing Spot robot's autonomy in object recognition, tracking, and retrieval.
- Developed a dynamic trajectory algorithm, boosting tracking accuracy by 25%, using predictive modeling and adaptive control for real-time adjustments.
- Implemented advanced object detection with neural networks and OpenCV, shortening recognition time by 30%, utilizing over 3,000 images for deep learning accuracy.
- Integrated ROS-based mapping and trajectory algorithms, increasing retrieval efficiency by 20% through optimized path planning and robotic motion strategies.
- Applied Kalman filters for real-time tracking optimization, enhancing system performance by 15% with sensor fusion for precise robotic calibration.

Shiv Nadar Univeristy, Mechatronics Lab   **Delhi NCR, India**
Undergraduate Student Researcher   **Aug 2021 - May 2022**

- Advised by Prof. Ganeshthangaraj Ponniah
- Contributed to a research project to develop a terrain-adaptive snake robot for enhanced navigation capabilities.
- Engineered a snake robot equipped with 10 servomotors, utilizing deep reinforcement learning for autonomous movement and PyBullet simulation for accurate digital twin modeling in CATIA and URDF.
- Spearheaded the physical training of the robot on varied terrains, employing an NVIDIA Jetson Nano and an overhead camera setup for precise position mapping through OpenCV, facilitating the execution of adaptive reinforcement learning algorithms.

TECHNICAL SKILLS

- **Programming Languages:** Python, C++, C, MATLAB, CUDA.
- **Packages and Frameworks:** PyTorch, TensorFlow, Jupyter Notebook, OpenCV, CUDA, Pandas, Numpy, Matplotib, Decision tree, SVM, Clustering and Classification, OpenAI, Mujoco, Gazebo, PyBullet, Git.
- **Hardware and Modelling Tools:** Arduino, Raspberry Pi, Nvidia Jetson Nano, Solidworks, Inventor, Fusion 360, CoppeliaSim, RTOS, Microcontrollers, CI/CD, Debugging Tools, TCP/IP, UDP, CAN.

PROJECTS

Deep Reinforcement Learning in Robotics, 2023: 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.

Collision Avoidance and Path Planning for Industrial Robot, 2023 : C++, Matlab, CoppeliaSim
- Adapted autonomous vehicle collision avoidance concepts to engineer trajectory algorithms for a Powerball robot manipulator, enabling it to navigate around both static and dynamic obstacles using Probabilistic Road Maps (PRM) and Temporal Probabilistic Road Maps (T-PRM) with A* search.
- Developed three path planning algorithms: RRT, A* search, and Dijkstra's algorithm for static obstacle avoidance and compared m with dynamic cases, concluding that A* search demonstrates most potential when combined with T-PRM.
- Enhanced obstacle prediction accuracy by incorporating a vision system and Kalman filter into the system, achieving a 79% success rate in dynamic obstacle avoidance scenarios

Stereo Visual Odometry for Autonomous Vehicle, 2023: Python, OpenCV, ROS, Camera
- Engineered a Stereo Camera framework to achieve advanced visual odometry for precise 3D pose retrieval, focusing exclusively on the odometry dataset. This project was developed from scratch using computer vision techniques, OpenCV, and NumPy
- Performed visual odometry entirely using computer vision techniques to estimate the trajectory of stereo camera setup accurately. This approach enabled precise vehicle movement tracking through complex environments without relying on sensor fusion methods.
- Utilized advanced camera calibration and feature extraction methods to enhance the accuracy and reliability of odometry calculations utilizing RANSAC, achieving a significant improvement in performance and providing a robust foundation for autonomous vehicle navigation systems

Emotion, Age, and Gender Recognition for Human-Robot Interaction, 2023: 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
- As the dataset contains images of the same individuals in different situations, we developed a K-means clustering algorithm to categorize similar faces by detecting features and facial encodings, achieving 100% accuracy, attributed to comprehensive utilization of unique features processed by the OpenCV library.

Markov Localization and Path Following for Autonomous Navigation, 2023: Matlab, Python, Lidar
- Devised a Markov localization within a SLAM suite using MATLAB in 2023, significantly enhancing robot state estimation by integrating sensor data with motion models. Validated through extensive simulations, demonstrating robustness and dependability.
- Incorporated PID and Pure Pursuit control techniques into a Linux-based ROS framework to improve autonomous navigation, focusing on advanced path tracing and motion planning.
- Applied combined localization and control system to an F1tenth autonomous race car, showcasing adaptability and achieving an exceptional error margin of 0.2 meters, illustrating precision in robotic path following.

Gesture Recognition for Human-Robot Interaction, 2023: Matlab, Machine Learning
- Designed a sophisticated gesture recognition system by extracting Rubine features, with weight derivation from collected training data via MATLAB GUI enhancing linear classification and accurately differentiating gestures
- Boasted a 98.9% accuracy rate in comparing test data against training data, showcasing systems for applications such as gesture-based control systems
- As part of my study, I refactored a $1 classifier for gesture recognition. This modification emphasizes specific start and endpoints, which are crucial for algorithm-calculating features.

AWARDS & EXTRACURRICULAR

- Dean's List at Shiv Nadar University: Recognized for academic excellence by achieving a GPA within the top 10% of the class for two consecutive semesters.
- Mentored six high school students in personal projects on waste management, nature, social science, and theoretical physics. Guided in finding the right research material, generating new ideas, and creating solutions for global impact.