Sumanth Tangirala

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EDUCATION

Rutgers, the State University of New Jersey - New Brunswick 2022 - 2024
Masters in Computer Science GPA: 3.9/4.0

- Specializing in Robotics with a thesis on Kinodynamic Planning for High-Velocity Mobile Robots, with a special focus on Motion Planning with Velocity Goals
- Relevant Courses: Advanced Robotics, Socially Cognizant Robotics, Computer Vision, Natural Language Processing

Dhirubhai Ambani Institute of Information and Communication Technology (DA-IICT) 2016 - 2020
Bachelors in Technology, Information and Communication Technology GPA: 8.57/10

- Recipient of the (Indian) Prime Minister's Merit Scholarship from 2017 to 2020
- Relevant Courses: Machine Learning, Internet-of-Things, Data Mining, Introduction to GPU Programming

PUBLICATIONS

Roadmaps with Gaps over Controllers: Achieving Efficiency in Planning under Dynamics

*Aravind Sivaramakrishnan & Noah R. Carver & **Sumanth Tangirala** & Kostas E. Bekris; Submitted for review to the **2024** International Conference on Robotics and Automation (ICRA)*

- Developed collaboratively a decoupled strategy for motion planning, integrating offline-trained robot controllers with a sampling-based planner to improve the computational efficiency of generating low-cost trajectories
- Led the quadrotor-focused research within the project to train aerial robot controllers to overcome aerodynamic conditions using reinforcement learning techniques such as Hindsight Experience Replay and Soft-Actor-Critic, and was instrumental in the integration of this methodology for quadrotor motion planning algorithms

MORALS: Analysis of High-Dimensional Robot Controllers via Topological Tools in a Latent Space

*Ewerton R. Vieira & Aravind Sivaramakrishnan & **Sumanth Tangirala** & Edgar Granados & Konstantin Mischaikow & Kostas E. Bekris; Submitted for review to the **2024** International Conference on Robotics and Automation (ICRA)*

- Played a pivotal role in the collaborative effort that merged topological analysis with deep learning, specifically through the application of Morse Graphs in conjunction with contrastive loss-enhanced autoencoders
- Conceptualized and implemented a contrastive loss term, which refined the autoencoder's performance by enhancing the distinction between successful and failed trajectories in the latent space
- Led the evaluation process on a complex 67-dimensional humanoid robotic system, validating the efficacy of the MORALS framework in accurately estimating regions of attraction for high-dimensional controllers

Stacked Autoencoder Based Feature Extraction and Superpixel Generation for Multifrequency PolSAR Image Classification

*Tushar Gadhiya & **Sumanth Tangirala** & Anil K. Roy; In: Pattern Recognition and Machine Intelligence. PReMI **2019**. Lecture Notes in Computer Science, vol 11942. Springer, Cham*

- Developed a Deep Learning and Unsupervised Learning solution for classifying geological terrains using Multi-Frequency Fully-Polarized Polarimetric Synthetic Aperture Radar (PolSAR) data
- Implemented Auto-Encoders to reduce the dimensionality of feature vectors, Super-Pixel segmentation for denoising the reduced feature vector, and achieved terrain classification with a deep learning model

RESEARCH EXPERIENCE

PRACSYS Lab, Rutgers University Jan 2023 - Present
Graduate Researcher New Brunswick, NJ

- Developing methods for efficient motion planning strategies in uncertain and dynamic conditions using Reinforcement Learning and other data-driven techniques, with my current focus on achieving velocity goals for high-velocity robots
- Researching the field of high-dimensional robotic controller analysis in collaboration with the DATA-INSPIRE TRIPODS Institute by applying topological tools such as Morse Graphs to model robot dynamics accurately
- Engineered a perception and communication system in the lab using Robot Operating System (ROS) and OpenCV to facilitate the development and evaluation of closed-loop controllers for the MuSHR robot and other mobile robots

Smart City Lab, DA-IICT Aug 2018 - Dec 2019

Undergraduate Researcher Gandhinagar, India

- Conducted research on feature extraction, geospatial satellite image segmentation, and classification techniques for Fully Polarized PolSAR data using Deep Learning methods under the guidance of Prof. Anil Roy

Center for WIMS², University of Michigan May 2019 - Nov 2019

Undergraduate Research Assistant - IoT Solutions Developer Gandhinagar, India

- Architected an IoT solution using Raspberry Pis and Bluetooth-Low-Energy (BLE) protocol to remotely control and process data from environmental sensors in a collaboration between Center for WIMS² and Smart City Lab, DA-IICT
- Engineered a NodeJS backend service to manage sensor data for reliable connectivity and data flow over the internet
- Built a user-friendly GUI using Python for sensor control and data visualization between the sensors and end-users

Indian Space Research Organization (ISRO) May 2019 - Aug 2019

Research Intern Ahmedabad, India

- Analyzed Dual-Polarised PolSAR data for land cover classification, a less explored area compared to the prevalent focus on Fully Polarized PolSAR, using advanced decomposition algorithms, guided by Dr. Sanid Chirakkal
- Developed a time-series Machine Learning model to leverage these features to discriminate Ground Nut and Cotton Fields from other land cover classes using PolSAR data collected from Gujarat, India with an accuracy of 91.2%

WORK EXPERIENCE

Tekion Corporation, Jan 2020 - Jun 2022

Software Engineer Bangalore, India

- Developed systems that utilized data from sensors such as RFID and Odometers in cars to identify and diagnose vehicle issues for more than 700 dealerships through feature engineering and predictive machine learning models
- Developed recommender systems, employing techniques like collaborative filtering, that utilize historical repair order data to recommend relevant automobile repair jobs, enhancing customer satisfaction and service efficiency
- Promoted early for delivering robust products in short timeframes and given responsibility of managing a team of 3

PROJECTS

Obstacle Navigation with Unitree Go1 Robot Using Deep Reinforcement Learning Sep 2023 - Present

Github Repository: https://github.com/sumanth-tangirala/Obstacle-Navigation-with-Go1-Sim

- Training a controller policy for a robot dog to navigate an environment with obstacles simulated in NVIDIA IsaacGym
- Employing deep reinforcement techniques such as Proximal Policy Optimization (PPO), Actor-Critic, and Curriculum Training for motion planning around obstacles spread around in the environment

Parallelization of Fuzzy SLIC Super-Pixel Segmentation using CUDA Sep 2019 - Nov 2019

Github Repository: https://github.com/sumanth-tangirala/Fuzzy-SLIC-CUDA-Parallelization

- Designed and implemented a parallelization strategy using CUDA for Fuzzy Simple Linear Iterative Clustering (SLIC) to speed up the process of super-pixel image segmentation by leveraging NVIDIA GPUs
- Achieved a 200x speedup in comparision with sequential computation for images with dimensions up to 2048x2048

Just-Walk-Out Contactless Shopping (Inspired by Amazon Go) Feb 2019 - Apr 2019

- Architected an automated shopping experience, enabling customers to shop without traditional checkout processes
- Responsible for designing and implementing customer detection using NFC sensors; item quantification using LIDAR and pressure sensors; communication of item pickup events from aisle processors to hub processors
- Developed using Raspberry Pi, Arduino processors, NFC and LIDAR sensors, and Zigbee for in-store communication

SKILLS

Programming Languages: Python, C/C++, JavaScript

Machine Learning Tools: PyTorch, TensorFlow, Scikit-Learn, OpenCV, Stable Baselines

Robotics & Simulation Tools: Robot Operating System (ROS), Mujoco, IsaacGym

Technologies & Libraries: Raspberry Pi, Jetson, CUDA, NumPy