Sashank Tirumala

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Education

Indian Institute of Technology, Madras — Madras, TN
Bachelors and Masters of Technology (Dual Degree) in Engineering Design — *Aug. 2016 – May 2021*
CGPA: 9.07 (Rank 1st in class of 56)
Robotics Concentration GPA: 9.67

Publications

- Robust Quadrupedal Locomotion on Sloped Terrains: A Linear Policy Approach, , Kartik Paigwar, Lokesh Krishna, Sashank Tirumala, Naman Khetan, Aditya Varma Sagi, Ashish Joglekar, Shalabh Bhatnagar, Bharadwaj Amrutur, Ashitava Ghosal, Shishir Kolathaya 4th International Conference on Robot Learning (CoRL), 2020
- Learning Stable Manoeuvres for Quadruped Robots from Expert Demonstrations, Sashank Tirumala, Sagar Gubbi Venkatesh, Kartik Paigwar, Aditya Varma Sagi, Ashish Joglekar, Shalabh Bhatnagar,, Ashitava Ghosal, Bharadwaj Amrutur, Shishir Kolathaya, 29th IEEE International Conference on Robot and Human Interactive Communication (RO-MAN), 2020
- Gait Library Synthesis for Quadruped Robots via Augmented Random Search, Sashank Tirumala, Aditya Sagi, Kartik Paigwar, Ashish Joglekar, Shalabh Bhatnagar, Ashitava Ghosal, Bharadwaj Amrutur, Shishir Kolathaya, arXiv preprint arXiv:1912.12907

Awards and Accomplishments

Dr Srikanth Sundararajan Prize | *Highest GPA* 3^{rd} *year*	2020
Continental Fiction2Science Hackathon | 1^{st}	2020
Ms Latha & Sampath Srinath Prize | *Highest GPA* 2^{nd} *year*	2019
Mercedes-Benz Drive Challenge Hackathon | 1^{st}	2019
FIITJEE JEE Scholarship (top 0.5% nationally) | *Tuition scholarship for undergraduate education*	2016

Research Experience

Graduate Research Assistant — Sep 2020 – Present
Robotics Lab, IITM — *Chennai, TN*

- Designing and manufacturing a novel robot capable of transforming between a quadruped and a wheeled mobile robot under the guidance of professor T Asokan.
- The robot uses its wheeled capabilities to navigate flat ground and its legs to navigate rough and rocky terrain. Currently the project is in its manufacturing phase.

Undergraduate Research Assistant — May 2019 – August 2020
Robert Bosch Center for Cyber-Physical Systems, Indian Institute of Sciences — *Bangalore, KA*

- Worked with professor Shishir Kolathaya and professor Bharadwaj Amrutur in applying machine learning and reinforcement learning techniques to robot control
- Developed a novel neural network architecture that learnt complex quadruped robot manoeuvres with 90% lesser expert demonstrations. This resulted in a first author publication in 29^{th} IEEE Human and Robot Interactive Communication (RoMaN) conference in Italy.(Paper, Video)
- Developed a simple linear controller that can be learnt in simulation through reinforcement learning and deployed on a quadrupedal robot. The controller is capable of navigating rough slopy terrains. Such a controller can be used in low cost open source quadruped robots that lack compute power. This resulted in a co- author publication in the 4^{th} International Conference on Robot Learning (CoRL) in MIT. (Paper, Video)
- Worked on bridging the sim-to-real gap and generating a library of gaits on a quadruped robot using gradient free algorithms like Augmented Random Search. Developed a novel way to bridge the sim-to-real gap using a data driven regression based techniques. This has resulted in a paper currently under review. (Paper, Video)

Undergraduate Research Assistant — September 2018 – Jan 2018
Reconfigurable Intelligent Systems Engineering, IITM — *Chennai, TN*

- Worked with professor Balaraman Ravindran in designing gym environments to train robotic arms for manipulation tasks using reinforcement learning.

- Created online packages in Robot Operating System (ROS) to easily install and share the reinforcement learning environments. Used Gazebo and DART for the physics simulation, along with python for training the learning agents. Released this work as an open source framework that is used in RISE lab in IITM for research applications. (Code)

Industry Projects

Continental Inc | *Python, OpenCV, Tensorflow* May 2020 – July-2020

- Developed an image-tracking software to detect and localize tools on the factory floor.
- It uses QR code scanner, multiple cameras and could detect an upwards of 20 tools at a time. This was much larger than the number of tools detected by other teams.
- This project won the Continental India Fiction2Science Hackathon.

Mercedes-Benz Research Center | *Python, Blender* May 2019 – July 2019

- Developed software to simulate the LIDAR data collected on self driving cars.
- Used blender to generate mesh automatically from XML files. Wrote ray-casting algorithm to simulate a light ray and subsequent sensor data. Achieved the highest accuracy of all teams and could simulate complicated geometry like spiral roads and traffic signals.
- This project won the Benz Drive India Hackathon challenge.

Anveshak Robotics | *ROS, Embedded C* May 2018 – July 2018

- Worked on software required to teleoperate a rover meant to go on Lunar and Martian terrain
- Created a ROS Package that automatically detects and notifies the end user when a ROS node crashes. This is extremely helpful when teleoperating robots over long distances. Documented the software in a blog post on Medium which has to date received thousands of views and upvotes.
- Led the science team for this project. This team obtained the highest scores of all other teams in the University Rover Challenge, Utah, USA.

Course Projects

Virtual Reality Engineering | *C++* Autumn 2020

- Performed state estimation on real world objects to properly recreate their pose in simulation.
- Used Inertial Measurement Units and Bluetooth sensors to estimate the position and orientation of a cube and recreated it in a virtual room.

Object Oriented Programming | *C++* Autumn 2018

- Create a finite-difference Partial Difference Equation solver from scratch in C++.
- Implemented Automatic Differentiation for a range of functions, automatic discretization, and a linear system solver using iterative methods.

Field and Service Robotics | *Embedded C ,Matlab, Autodesk Fusion* Autumn 2018

- Designed a 2R robotic manipulator with a pen holder.
- Implemented code for the arm to draw pictures taken from a phone.
- The Inverse Kinematics was written in C, the computer vision in Matlab. Used a genetic algorithm to find the shortest path that the end-effector should travel.

Technical Skills

Courses: Linear and Non-Linear Optimization, Reinforcement Learning, Linear Control Theory, Robot Kinematics and Dynamics, Recursive State Estimation, Machine Learning.
Languages: Python, C/C++, Matlab, Mathematica, ROS
Developer Tools: Git, Docker, Google Cloud Platform, VS Code, Visual Studio
Libraries: Tensorflow, pyBullet, NumPy, Matplotlib

Leadership and Mentoring

- Teaching Assistant for course Physics of Measurement.
- Head of institute running club Forest Gumps. Organized $5k$, $10k$ and half-marathons.
- Winner of inter hostel Choreo-Nite (2018).