Shashank Rao Marpally

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Education

Arizona State University

Tempe, AZ

Masters in Robotics and Autonomous Systems (AI Concentration), GPA: 4.0/4.0 — *August 2019 - May 2021*

- **Research Assistant (Supervisor: Dr. Siddharth Srivastava)**
  - Developed PDDL state estimation of games with OpenCV and interfaced it with an AI action-model learning algorithm.
  - Designed a prototype using ROS, OpenRave, AutoCAD, and Fusion 360 to demonstrate robots assisting humans in the assembly of automotive parts (NSF-Funded Project).
- **Graduate Researcher (Supervisor: Dr. Yu Zhang)**
  - Research on Generating Progressive Explanations in Human-Robot Teaming using Inverse Reinforcement Learning.

National Institute of Technology, Karnataka

Mangalore, India

Bachelor of Technology in Mechanical Engineering, GPA: 8.93/10.0 — *August 2015 - May 2019*

- **Undergraduate Researcher (Supervisor: Dr. K.R.Guruprasad)**
  - Teaching Assistant for Automatic Control Engineering (ME322)
  - Thesis: Geometry-Based Mapping for Robot Exploration.

Research Interests

Human-Robot Interaction | Explainable AI | Robotics | Reinforcement Learning

Publications

Conferences

- Zakershahrak, Mehrdad, **Marpally, Shashank Rao***, Sharma, Akshay, Gong, Ze, Zhang, Yu. Order Matters: Generating Progressive Explanations for Planning Tasks in Human-Robot Teaming. *2021 IEEE International Conference on Robotics and Automation (ICRA)* (To Appear).
- Pulkit Verma, **Shashank Rao Marpally** and Siddharth Srivastava, Asking the Right Questions: Interpretable Action-Model Learning using Query-Answering. Proceedings of the *AAAI Conference on Artificial Intelligence*, 2021.
- **S. Rao Marpally**, M. S. Nagarakshith, A. Sadananda and K. R. Guruprasad, "Geometrical Mapping of an Initially Unknown Region by a Mobile Robot," 2019 *IEEE International Conference on Distributed Computing, VLSI, Electrical Circuits and Robotics* (DISCOVER), Manipal, India, 2019, pp. 1-5, doi: 10.1109/DISCOVER47552.2019.9008095.

Experience

Toyota Material Handling

Columbus, Indiana (Remote)

Robotics Intern — *June 2020 - July 2020*

- Implemented a ROS2 (C++) package to merge data from multiple LiDAR sensors in a Gazebo simulation (to be used in the development of an autonomous forklift) and deployed it using Docker containers.
- Gained experience as a Scrum Master and managed backlogs for the R&D team using DevOps and Excel.
- Technologies: ROS2, Gazebo, Docker, Azure DevOps, C++

IIT Kanpur, India

Kanpur, India

Research Intern — *June 2018 - August 2018*

- *Synthesized* training data from a simulated 6DOF UR5 industrial robot arm which consisted of generating feasible end-effector positions and recording joint space and cartesian space data of the generated motion plan
- *Achieved* 98% accuracy in modeling inverse kinematics of the robot by supplying joint space coordinates to a deep feedforward network trained on generated data and testing against cartesian space data.
- Technologies: Python, ROS, Gazebo, MoveIt!, TensorFlow

IIT Bombay, India *Mumbai, India*

Research Intern *June 2017 - August 2017*

- *Implemented* an algorithm that employs a decentralized approach for multiple robots to completely explore a region without direct communication with one another
- *Achieved* 100% exploration of any maze environment using the implemented algorithm.
- Technologies: Python, ROS, Gazebo

Systemantics Pvt. Ltd., India *Bangalore, India*

Software Intern *December 2017*

- *Re-designed* Android App UI for Control of a Robot to be more intuitive and practical by using Material Design concepts
- Technologies: Android App Development (Java, XML)

Projects

Robot Snakes Mimic snakes from video using genetic algorithms

- Used genetic algorithms to mimic snake motion from a video onto a simulated snake robot (CoppeliaSim).

Deep Reinforcement Learning Nanodegree

- Trained Unity-ML agents using DQN, DDQN, DDDQN, DDPG, and MA-DDPG Reinforcement Learning algorithms (PyTorch) to solve navigation, robot-reach, and multi-agent tennis tasks.

Explanation Generation in Human-Robot Teaming

- *Implemented* a framework that uses inverse reinforcement learning to learn the preferred order of explanations provided by an AI agent to humans to minimize the cognitive load in collaborative tasks.
- Designed human-study experiments (Amazon MTurk) to evaluate the proposed algorithm.

Follow-Me Robot

- Built a simulation of a robot in Gazebo (ROS), that uses an OpenCV-based vision controller for tracking and following a human.

ABU-ROBOCON 2018

- *Participated* in National Round of one of Asia's largest Robotics Competitions with a Team size of 8 (Most teams have 20+ students)
- First team from NIT Karnataka to successfully complete building required robots and reach national phase
- *Designed, developed, prototyped, fabricated and assembled* (as a team) two industry-level robots that were to play a cooperative game of shuttlecock throwing.

Stable Control of an Inverted Pendulum

- *Adapted* Particle Swarm Optimization method to achieve 100% stabilization of a simulated inverted pendulum system.

Smart City Model

- *Interfaced* multiple sensors and actuators to model a smart building and established communication between Arduino and central Raspberry Pi Server with I2C protocol. The resulting model was able to send statistics of the smart building to the central server to perform necessary actions by analyzing sensor readings and accordingly operating actuators
- *Collaborated* with a team of 25+ students to achieve project goals

Technical Skills

Frameworks: ROS, ROS2, TensorFlow, PyTorch, OpenCV

Tools and OS: AutoCAD, Fusion360, Git, Azure DevOps, Linux, Docker

Simulators: Gazebo, CoppeliaSim, Unity-ML Agents, OpenRave

Programming: Python, C, C++, Java, MATLAB, PDDL, XML

Hardware: ABB's YuMi, Fetch Robot, Raspberry Pi, Arduino