A.V.S. Sai Bhargav Kumar

☏ +91 8919669541
✉ bhargavvk18@gmail.com
https://bhargavvk18.wixsite.com/webpage

Areas of Interest

○ Robotics, Motion Planning, Machine Learning, Deep Learning

Work

2020 – Present **Deep Learning Software Engineer**, *MathWorks*, Hyderabad, India.
Currently working for MathWorks in developing Deep Learning algorithms for Automated Driving Toolbox, Computer Vision Toolbox, Lidar toolbox and Deep Learning Toolbox

2019 – 2020 **Engineer in EDG**, *MathWorks*, Hyderabad, India.
Worked on developing Deep Learning workflows using Domain Adaptation techniques in the context of semantic segmentation

2018–2019 **Motion Planning Intern**, *MathWorks*, Hyderabad, India.
Developed a Traffic simulator for testing MATLAB's Navigation and ADAS toolbox features. This project is the extension to my Master's thesis work for Multi Agent systems

2017–2019 **Research Assistant**, *Robotics Research Center, IIIT*, Hyderabad, India.
Conducted research in Motion planning, SLAM and Perception for autonomous driving.

Education

2016–2019 **MS by Research**, *International Institute of Information Technology*, Hyderabad, India, **CGPA-9.0/10.0**.
Electronics and Communication Engineering

2012–2016 **B.Tech**, *Indian Institute of Information Technology, Design and Manufacturing*, Kancheepuram, India, **CGPA-8.36/10.0**.
Electronics Design and Manufacturing(Bachelor's degree)

Publications

2020 **Reactive Navigation under Uncertainty through Hilbert Space Embedding of Probabilistic Velocity Obstacles**, *Jyotish, Bharath Gopalakrishnan*, **Bhargav**, *Arun Kumar Singh, K.Madhava Krishna and Dinesh Manocha*, IEEE Robotics and Automation Letters 2020, [Project-Page].

2020 **SROM: Simple Real-time Odometry and Mapping using LiDAR data for Autonomous Vehicles**, *Nivedita Rufus, Unni Krishnan R. Nair*, **A. V. S. Sai Bhargav Kumar**, *Vashist Madiraju, K. Madhava Krishna*, IEEE Intelligent Vehicles Symposium 2020, [Project-Page].

2019 **PIVO: Probabilistic Inverse Velocity Obstacle for Navigation under Uncertainty**, *IVO: Inverse Velocity Obstacles for Real Time Navigation*, Jyotish, Yash Goel, **A. V. S. Sai Bhargav Kumar**, K. Madhava Krishna, IEEE International Conference on Robot and Human Interactive Communication 2019.
[Project-Page]

2019 **IVO: Inverse Velocity Obstacles for Real Time Navigation**, *Jyotish, Yash Goel, **A. V. S. Sai Bhargav Kumar**, K. Madhava Krishna*, International Conference on Advances in Robotics 2019, [Project-Page].

2019 **Gradient Aware - Shrinking Domain based Control Design for Reactive Planning Frameworks used in Autonomous Vehicles**, *Adarsh Modh, Siddharth Singh, **A. V. S. Sai Bhargav Kumar**, Sriram N. N., K. Madhava Krishna*, International Conference on Advances in Robotics 2019, [Project-Page].

2019 **Motion Planning Framework for Autonomous Vehicles : A Time Scaled Collision Cone Interleaved Model Predictive Control Approach**, *Raghu Ram Theerthala, **A.V.S. Sai Bhargav Kumar**, Mithun Babu, K. Madhava Krishna*, IEEE Intelligent Vehicles Symposium 2019, [Project-Page].

2018 **Novel Lane Merging Framework with Probabilistic Risk based Lane Selection using Time Scaled Collision Cone.**, ***A. V. S. Sai Bhargav Kumar**, Adarsh Modh, Mithun Babu, Bharath Gopalakrishnan, K. Madhava Krishna*, IEEE Intelligent Vehicles Symposium 2018, [Project-Page].

Graduate Selected Coursework

Robotics Mobile robotics (IIIT Hyderabad), Introduction to Robotics(IIIT Hyderabad)

Computer Vision Computer Vision(IIIT Hyderabad), Digital Image Processing(IIIT Kancheepuram)

Machine Learning Statistical Methods in Artificial Intelligence (IIIT Hyderabad), Introduction to Robotics(IIIT Hyderabad), Machine Learning(Coursera)

Graduate Research Projects

2017-2019 **Self-Driving Car: Mahindra Rise Challenge**.
This competition involves developing a Driverless car for Indian traffic scenarios. My work in this project involved the development of both localization and planning pipeline for the autonomous car. For the motion planning pipeline, I extended the time-scaling concept to derive a closed-form analytical solution for performing complex maneuvers like merging onto the ongoing traffic by considering the collision risk. The successful implementation of the same on the autonomous vehicle and formed the crux of my thesis topic and led to publications in IV (Intelligent Vehicle Symposium-18) and AIR (Advances in Robotics-19). For the localization pipeline, I also worked on the sensor calibration, sensorfusion, and state estimation modules for developing the SLAM framework of the autonomous car.

2017-2019	**Multi Agent Systems**.

This work mainly involved development of both deterministic and stochastic variants of egocentric version of the famous velocity obstacle(VO). The idea is an egocentric velocity obstacle helps in improving real time implementations of collision avoidance in dynamic environments as there is no dependency on state estimation techniques to infer the robot pose and velocity. My contribution to this work include reformulating the the velocity obstacle to adapt to an egocentric framework, conducting the real time experiments on Bebop drone and writing the papers which got published in AIR (Advances in Robotics-19) and ROMAN(International Conference on Robot and Human Interactive Communication 2019).

2019-2020	**Investigation of non-parametric uncertainty in Motion planning**.

In this work, we developed an efficient algorithm for solving a class of chance constrained optimization by representing the non-parametric uncertainty as functions in Reproducing Kernel Hilbert Space(RKHS). My contributions in this include both developing an computationally efficient implementation of the proposed idea in C++ and its deployment on Bebop drome to conduct real time experiments. The efforts for this work got published in RA-L with ICRA 2020

2017-2018	**Risk Aware Merging**.

The main objective was to develop a risk aware merging behavior, for a traffic like scenario. I have developed a framework which has a two layer structure which ensures generating a collision-free merge maneuvers even in dense traffic scenarios. This lead to publications in IV(Intelligent Vehicle Symposium-18,19)

2016-2017	**Localisation and Navigation in GPS Denied Environment**.

In this project I have developed an algorithm that fuses the sensor data from a visual sensor and an IMU to estimate the robot's current location and navigate the robot to its destination with obstacle avoidance in GPS denied environment. Not having the GPS data makes the problems more challenging due to absence of fixed global reference frame. The planning stack was implemented using the RRT planner from the MRPT toolkit in Tory Parameter (TP) space, was deployed on Clearpath A200 mobile robot, and tested for its efficacy.

Technical Strengths

Coding	C, C++, Python, MatLab.
DL Libs.	PyTorch, TensorFlow, PaddlePaddle.
Robotic Kits	Husky, Pioneer 3-DX, TurtleBot, Parrot Bebop Quadcopter.
Data Science Libraries	NumPy, Pandas, Pillow, Scipy, Scikit-Learn.

Honors and Awards

2016-2019	**IIIT Hyderabad research fellowship**, *Awarded a fellowship to cover tuition and living expenses during my Masters*, Total value (approx.): INR 200000.
2012-2016	**Merit Cum Means Scholarship**, *Awarded a scholarship to cover tuition during my Bachelors*, Total value (approx.): INR 200000.

Professional Service

2020	Reviewer, IV(IEEE Intelligent Vehicles Symposium).
2019	Program Committee, ROBIO(International Conference on Robotics and Biomimetics).
2019	Reviewer, CASE(International Conference on Automation Science and Engineering).

Students Mentored

2018-Present	Unni Krishnan R Nair, Masters by Research student at IIIT Hyderabad, India.
2017-2019	Raghuram Theerthala, Masters by Research student at IIIT Hyderabad, India.
2017-2018	Adarsh Modh, Intern at the Robotics Research Center at IIIT Hyderabad, India.

References

Prof.K.Madhava Krishna, *Professor, Head Robotics Research Center, International Institute Of Information Technology, Hyderabad.*
email: mkrishna@iiit.ac.in

Dr.Harit Pandya, *Postdoctoral Research Associate at University of Lincoln.*
email: haritpandya@gmail.com, hpandya@lincoln.ac.uk

Mr.Bharath Gopalakrishnan, *Lead Research Engineer, Addverb Technologies.*
email: bharathg91@gmail.com , bharath.gopalakrishnan@addverb.in