

# Venkata Seetharama Sai Bhargav Kumar Avula

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## Work

- 2022 – **Computer Vision and Perception Engineer**, *Technology Innovation Institute*.  
Present
  - Working on developing both Classical and Deep Learning based Computer Vision algorithms for several project at T.I.I.
- 2020 – 2022 **Software Engineer in Deep Learning**, *MathWorks*.
  - Developed Deep Learning features for Automated Driving Toolbox, Computer Vision Toolbox, Lidar toolbox and Deep Learning Toolbox.
  - Developed deep learning layers for MATLAB.
  - Provided code generation support for both CPU and GPU targets to the functions developed.
  - Developed Deep Learning workflows as MATLAB Examples.
- 2019 – 2020 **Engineer in EDG**, *MathWorks*.
  - Developed domain adaptation workflows to address data scarcity and labeling problem of real world data, majorly in the context of semantic segmentation.
  - Solved several customer workflow related issues.
- 2018–2019 **Motion Planning Intern**, *MathWorks*.
  - 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, International Institute of Information Technology*.
  - Conducted research in Motion planning, SLAM and Perception for autonomous driving. Detailed publication list is given below.

## 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)

## Thesis

- 2019 **Motion Planning Framework for Autonomous Vehicle : A Time Scaled Collision Cone approach**, **A. V. S. Sai Bhargav Kumar**, [\[LINK\]](#).

## 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, [\[Project-Page\]](#), [\[Video\]](#).

- 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](#)], [[Video](#)].
- 2019 **PIVO: Probabilistic Inverse Velocity Obstacle for Navigation under Uncertainty**, 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](#)], [[Video](#)].
- 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](#)], [[Video](#)].
- 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](#)], [[Video](#)].
- 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](#)], [[Video](#)].

## 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.

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## Technical Strengths

Coding	C, C++, Python, MatLab.
DL Libs.	PyTorch, TensorFlow.
Software Proficiency	Robotics Operating System(ROS), OpenCV, GIT/Github.
Robotic Kits	Husky, Pioneer 3-DX, TurtleBot, Parrot Bebop Quadcopter.
Data Science Libraries	NumPy, Pandas, Pillow, Scipy, Scikit-Learn.

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## 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 350000.
- 2012-2016 **Merit Cum Means Scholarship**, *Awarded a scholarship to cover tuition during my Bachelors*, Total value (approx.): INR 200000.

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## 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).