Krishna Varadarajan

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EDUCATION

- **The Pennsylvania State University** — University Park, PA
  Master of Science in Mechanical Engineering; GPA: 3.96/4.00 — Aug. 2016 – May 2019

- **Vellore Institute of Technology, VIT University** — Vellore, India
  Bachelor of Technology in Mechanical Engineering; GPA: 9.20/10.00 (Top 2% in program) — Aug. 2010 – May 2014

- **Indian Institute of Technology - Madras** — Chennai, India
  Visiting Summer Research Fellow — May 2013 – July 2013

BRIEF

- **Relevant Coursework::** Linear Control, Digital Control, Mechatronics, Kalman Filtering, Matrix Algebra, Micrcomputer Interfacing
- **Languages proficient in::** C++, Python, MATLAB, R, HTML/CSS
- **Current Interests::** Control Systems, State Estimation, Sensor Fusion, Filtering, Robotics, Algorithms

EXPERIENCE

- **NIO USA Inc.** — San Jose, CA
  Perception Engineer — Nov 2018 - Present
  - **Production Quality Software Development**: Designing, developing, integrating, and testing production quality C++ software for implementing sensor fusion algorithms for the L4 perception stack
  - **Object Tracking and Data-Association**: Designing, and implementing tracking and data-association algorithms such as IMM, Robust Filtering, and MHT for objects obtained from RADAR, LiDAR, and vision sensors
  - **KPI Development and Regression Testing**: Developed the KPI (Key Performance Indicators) pipeline for testing, and tuning the sensor fusion algorithms; KPIs now being used for regression testing, and in the Jenkins build
  - **Multiple Hypothesis Tracking (MHT)**: Developed track-to-track association logic (track labeling) across hypotheses for MHT-based object fusion algorithm
  - **DNN based combined detection & tracking**: Leading the sensor fusion team's efforts on using low-level features from DNN object detection model to perform data association and object tracking
  - **Additional contributions::** Robust, time and space-optimized Intersection Over Union (IOU) algorithm; Parser for KITTI and Scale AI annotation datasets; Sim environment development for tracker validation

- **Volvo Group** — Hagerstown, MD
  Advanced Technology and Research Co-Op — Aug 2017 - Dec 2017
  - **Algorithm Design**: Developed algorithms to calculate trip parameters, driving behavior, hotel mode, and stop-start analysis parameters for Volvo customer trucks for energy management operations with teams in Greensboro, and Lyon, France
  - **App Development**: Developed an application in C# for engine dynamometer test cell to run vehicle duty-cycles through a Simulink model
  - **Road Topology Estimation**: Developed an algorithm to estimate the road topology distribution of a route using log-vehicle data, and simulation data

- **Intelligent Vehicles and Systems Group** — University Park, PA
  Graduate Student Researcher (NEXTCAR project) — Jan 2017 - Nov 2018
  - **Hardware Instrumentation**: Instrumented an experimental truck with ADAS sensors for HIL, SIL, and on-road testing
  - **On-Road Data Collection**: Collected test data on the experimental truck on multiple routes in the states of PA and MD
  - **Traffic Modeling and Simulation**: Set-up traffic modeling and simulation capabilities in the research lab, and performed microscopic traffic simulations on AIMSUN
  - **Traffic Estimation Algorithm**: Developed a traffic estimation algorithm to visualize traffic captured using one front-facing RADAR on a mobile truck
  - **Free Space Estimation**: Developed algorithm to measure the available free space in ego-vehicle's lane by fusing lane map with front-facing RADAR and camera

- **Department of Mechanical Engineering, Penn State** — University Park, PA
  Graduate Teaching Assistant — Aug 2016 - May 2018
  - **Classes Assisted/Taught**: Vehicle Road Dynamics (senior-year class), ME Design Methodology (junior-year class), Introduction to Thermal Sciences (inter-department class)
  - **Highlight**: Mentored 8 project teams to deliver industry-sponsored semester-long design projects as part of the junior-year design class

- [Indian Institute of Science](link)   Bengaluru, India
  Junior Research Fellow   *July 2014 - June 2016*
  - **Smart-Manufacturing Lab**: Designed, and established India's first smart manufacturing laboratory, funded by Boeing R&T
  - **Patient Transfer Device**: Led a research team of four research fellows to design, and develop an assistive device to transfer patients from one bed to another. The work was filed for an Indian patent in June 2015.

Selected Projects

- **Autonomous Search-and-Rescue Robot**: Designed the finite state machine for a robot capable of identifying, and picking-up tennis balls while solving any given maze simultaneously using the bug (reactive navigation) automata
- **Autonomous Object-Picking Arm**: A 2-link robotic arm capable of detecting desired objects in its range, and placing them at a desired location using a camera, and inverse kinematics algorithms
- **LQG Controller with Kalman Filter**: Implemented a LQG controller with current and delayed Kalman estimators for 6 states of a 3-disk rotor system
- **Near-Minimum Time Controller**: Implemented the continuous-time analogous of a deadbeat controller to drive the states of 3-disk rotor system from $30°$ to $0°$
- **Formula SAE Italy**: Designed and manufactured the suspension and steering system for a 4-wheel open cockpit racing car powered by an IC engine

Programming Skills

- **Languages**: C++, Python, MATLAB, R, HTML/CSS   **Build Systems**: CMake, waf
- **(Meta)OS**: LINUX, ROS, MacOS   **Misc.**: GDB, Google Test, Git, JIRA

Patents

- **"Subject Transfer Apparatus"** - Application No.: 2972/CHE/2015 (*Status: Pending*)
  /brief: Assistive device to transfer patients with limited mobility from one platform to another

Publications

- **Master's thesis - Penn State** (2019) "Analyzing the Effects of Geometric Lane Constraints on RADAR-based Sensing of Available Vehicle Headway using Mapped Lane Geometry and Camera Registration of Lane Position" [Link]

- **Krishna Varadarajan, et al.** (2019) (*Accepted in invited session*) "Analyzing the Effects of Geometric Lane Constraints on RADAR-based Sensing of Available Vehicle Headway using Mapped Lane Geometry and Camera Registration of Lane Position" *In:* ASME Dynamic Systems and Control Conference (DSCC)

- **V.S.Krishna Prasad, et al.** (2013) "Simulation and Modeling of Performance Characteristic of Wire Cut EDM on Inconel825 using Multiple Regression and ANN." *In:* International Conference on Mathematical Computer Engineering - ICMCE. pp. 157-165 [Link]

Selected Milestones

- [2010] Undergraduate merit award (VIT University)
- [2011] Represented VIT University in Formula SAE Italy
- [2012-13] Winner and runner-up across medical hackathons organized by CAMTech in India, Uganda, and USA
- [2013] Selected one of 30 students from India for RedX workshop by Camera Culture Group at MIT Media Lab
- [2013] Selected to present a portable EOG-EEG device to the former President of India Late Dr. APJ Abdul Kalam (Camera Culture Group, MIT Media Lab)
- [2016] 100% financial support to pursue M.S. in Mechanical Engineering (Penn State University)