Jayanth Bhargav

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Research Interests

Machine Learning, Control Theory, Robotics, Optimization, Reinforcement Learning, Online Planning & Control, Sequential Decision Making

Education

Aug 2021 to Present	**Purdue University**, *West Lafayette USA* Doctor of Philosophy in Electrical and Computer Engineering *Advisors: Prof. Shreyas Sundaram, Prof. Mahsa Ghasemi*	*GPA: 3.75/4*
Aug 2019 to May 2021	**University of Pennsylvania**, *Philadelphia USA* Master of Science in Electrical and Systems Engineering *Research Advisor: Prof. Rahul Mangharam*	*GPA: 3.70/4*
Aug 2015 to July 2019	**Rasthreeya Vidyalaya College of Engineering**, *Bangalore IN* Bachelor of Engineering in Electrical and Electronics Engineering *Rank 1 - University* **Gold Medal**	*GPA: 9.45/10*

Experience

June 2022 Present	**Pacific Northwest National Laboratory (PNNL)**, *Richland USA* ***PhD Intern - Machine Learning*** **Research: Multi-Agent Reinforcement Learning for Autonomous Vehicle Navigation** ○ Studying various adversarial communication models for multi-agent coordination and control ○ Developing adversarial goal-inferencing and mitigation strategies for AV fleets ○ Algorithm development, testing & validation against benchmarks in high-fidelity simulators
Aug 2021 Present	**Purdue University**, *West Lafayette USA* ***Graduate Research Assistant/ Doctoral Student*** **Research: Sequential Decision Making and Control under uncertainty** ○ Sequential decision making for Mixed Observable Markov Decision Processes (MDPs) ○ Studying the complexity of sensor selection for mixed-observable MDPs ○ Developed Gazebo simulators for autonomous drones & ground vehicles in miniature cities ○ Reinforcement Learning based multi-agent navigation and control in urban environments
May 2020 to July 2021	**University of Pennsylvania**, *Philadelphia USA* ***Graduate Research Assistant, Real-Time & Embedded Systems Laboratory (mLab)*** **Research: Overtaking strategies of 1/10th scale autonomous vehicles** ○ Studying various driving & overtaking strategies and analysing F1 tracks ○ Enhancing MPCC for overtaking maneuvers in two-player racing games on real F1 tracks ○ Track-based Policy learning to improve chances of overtaking at track portions Publication: C4 ○ Experiment based learning of position advantage in race track portions Publication: C5 ○ Switched-Model Predictive Contouring Control (MPCC) for integrating driving behaviors

May 2018 to May 2019	**ABB Renewable Energy Laboratory**, *RVCE Bangalore IN* ***Undergraduate Research Assistant***

Major Thesis: Data-driven diagnostics and control for smart-grids
- Test-bench for Failure Modes & Effect Analysis (FMEA) of Standalone PV in smart grids
- Data driven expert systems for safe operation & control of renewable energy units
- Signature analysis of faults and optimal sensor network design Publication: C1
- IoT based automation for efficient operation of solar panels Publication: C2
- End-to-end solution for solar energy system design & monitoring Presentation, Publication: J2

Minor Thesis: Predictive models for power management of hybrid micro-grids
- Scheduling techniques for optimal power management in renewable integrated micro-grids
- Application of numerical techniques for iterative discrete short time scheduling
- Building predictive models for forecasting output of erratic renewable sources
- Novel training strategy for time-series regression of solar power Publication: J1

Aug 2016 to Dec 2018	**Team Chimera** - **Student Formula SAE** , *RVCE Bangalore IN* ***Engine Control Unit Design***

- Design of control units for safety and emergency vehicle shutdown
- Design & integration of speed control for induction motor based electric car
- Integration of driver assist systems with infotainment for driver safety
- Website: Team Chimera

Publications

Conferences/Workshops

C1 "Signature Analysis of Electrical Faults in Standalone PV Systems with Storage," 2019 IEEE 3rd International Conference on Recent Developments in Control, Automation & Power Engineering (RDCAPE 2019) [PDF]

C2 "IoT Based Wireless Sensor Network (WSN) for Condition Monitoring of Low Power Rooftop PV Panels," 2019 IEEE 4th International Conference on Condition Assessment Techniques in Electrical Systems (CATCON 2019) [PDF]

C3 "Parametrics for the choice of Embedded Systems and Control Algorithms for Application Specific Robot Designs.," 2018 IEEE 2nd International Conference on Inventive Systems and Control (ICISC 2018) [PDF]

C4 "Track based Offline Policy Learning for Overtaking Maneuvers with Autonomous Racecars", Workshop on "Opportunities and Challenges for Autonomous Racing" at the 2021 International Conference on Robotics and Automation (ICRA 2021) [PDF]

C5 "Deriving Spatial Policies for Overtaking Maneuvers with Autonomous Vehicles", Workshop on "Intelligent Transportation Systems" at the 2022 IEEE 14th International Conference on COMmunication Systems & NETworkS (COMSNETS) [PDF]

Journals and Book Chapters

J1 "Novel Modular LS-SVM Based Regression Model for Prediction of Solar Power" International Journal of Science, Technology, Engineering and Management-A VTU Publication [PDF]

J2   "User Interactive GUI for Integrated Design of PV Systems" Intelligent Renewable Energy Systems, Wiley Online Library [PDF]

Technical Reports

T1   "PennCloud-CIS 505 Software Systems Final Project Report Fall 2020" [PDF]

T2   "Learning Interactions and Dynamics of Swarms." [PDF]

T3   "Distributed Sampling-Based Target Tracking." [PDF]

T4   "Path optimization for autonomous robots in grid world" [PDF]

Research & Academic Projects

Aug 2020   **PennCloud - Fully Distributed Cloud with Webmail and Storage Services**

to Dec 2020   *Software Systems, Distributed Servers, Webmail and Data Storage* Technical Report: T1

- A fault-tolerant & client-consistent cloud with Key-Value Stores, HTTP & SMTP servers
- Developed multi-threaded SMTP & POP3 servers in C++ to serve concurrent mail clients
- Developed a scalable HTTP 1.1 compliant server to support GET, PUT, POST & DELETE
- Distributed Replication & Fault Tolerance by implementing 2-Phase Commit Protocol
- Google Protobuf based API's for back-end to front-end server communication and data exchange

Jan 2020   **Learning Interactions and Dynamics of Swarm Robots**

to May 2020   *Deep Learning, System Identification, Multi-agent systems* Technical Report: T2

- Developed CNN,RNN,LSTM & MLP for learning the interactions & dynamics of swarms.
- Sparse Identification of Non-Linear Dynamics (SINDy) for learning candidate non-linear functions.
- A novel neural-ODE based deep learning model to accurately predict non-linear transient states

Jan 2020   **Distributed Algorithm for Multi Robot Multi Target Tracking**

to May 2020   *Path Planning, Active Information Acquisition, Sensing* Technical Report: T3

- Developed a novel distributed sampling-based tree-building algorithm for target tracking tasks
- Implemented a Extended Kalman Filter for target localization/sensing
- Performed extensive simulations to prove scalability for larger targets & lesser robots.

Aug 2019   **Path optimization for constrained grid world robots**

to Dec 2019   *Integer Optimization, TSP, Graph traversal* Technical Report: T4

- A hybrid optimization problem using Travelling Salesman Problem (TSP) and Linear Programming
- Solved an obstacle avoidance and node constrained path planning for robots in a grid-world using LINDO Optimization software.

Aug 2017   **Robotic Exoskeleton for Rehabilitation**

to May 2018   *Robotic System Design, Precision control* Publication: C3

- Arm Exoskeleton design for rehabilitation of patients suffering from muscular dystrophy
- Designed smooth and precision speed and position control system immune to backlash and varying pay loads.
- Designed and Tuned a PID controller for backlash error correction
- Published a review paper on various SOTA control algorithms and embedded systems used in robot designs.

Teaching

Fall 2019	**Nonlinear Systems and Control** ESE 619 UPenn
	Teaching Assistant under Dr. Erfan Nozari
Summer 2020	**Programming and Math** Summer Academy, UPenn
	Course Instructor - Python programming for Math
Fall 2020	**Linear Systems Theory** ESE 500 UPenn
	Teaching Assistant under Dr. George J. Pappas
Spring 2021	**Certificate in College and University Teaching**
	Centre for Teaching and Learning, University of Pennsylvania
Fall 2021	**Electrical Engineering Fundamentals II** ECE 20002 Purdue
	Teaching Assistant under Dr. Mike Capano

Honors and Awards

- **Gold Medal** (Summa Cum Laude/Rank 1) in Electrical and Electronics Engineering
- **Outstanding Student Award** for Service, University of Pennsylvania
- Outstanding Graduate Mentor Award, Purdue University
- The Sorroco Award for the Best Outgoing Student, RV College of Engineering®
- Best Bachelor Project/Thesis in Electrical Engineering
- Award of Excellence in Engineering Mathematics, RV College of Engineering®
- **Hindustan Aeronautics Limited (HAL) Scholarship for Merit & Excellence**

Coursework

Machine Learning	Applied Machine Learning, Deep Learning, Big Data Analytics, Reinforcement Learning, Learning in Robotics
Optimization & Control	Classical Control Theory, Modern Control Theory, Discrete Control Systems, Linear Systems Theory, Model Predictive Control, Modelling and Control of Power Systems, Linear,Nonlinear and Convex Optimization, Structure and Dynamics of Large Scale Networks, Lumped Systems Theory, Real Analysis
Electrical Sciences	Signals and Systems, Digital Signal Processing, Microcontrollers, Graph Theory
Computer Science	Algorithms and Data Structures, Distributed/Software Systems

Skills

Programming	C, C++, Python, MATLAB, R, LaTeX
Machine Learning	TensorFlow, PyTorch, Keras, SageMaker, GPflow, Scikit-learn
Optimization	LINDO, GAMS, Forcespro, MPT
Modelling	MATLAB- Simulink, Simscape
Robotics	ROS, Gazebo, Open AI Gym

Professional Services

Reviewer	IEEE Robotics and Automation Society - ICRA, RAL
President	Electrical & Systems Engineering Graduate Association, Univeristy of Pennsylvania
Coordinator	IEEE R10 Student Branch Chapter, Bengaluru

- Chaired a Seminar on Future of e-mobility at IEEE PES Chapter in association with Mahindra Reva
- Student Volunteer for IEEE Asia Pacific Power and Energy Engineering Conference
- Organized and Chaired the Student Transition and Elevation Program at IEEE Young Professionals Bangalore Chapter

Coordinator	Formula Racing Team RVCE Bangalore, 2017-18
Speaker	Robotics, AI and Automation Workshop, IEEE RVCE Chapter Bangalore