

Kshitij Jerath

My overarching research goal is to advance the understanding of complex dynamics observed in large-scale self-organizing systems, and to design bottom-up control algorithms that guide such systems to desired states via minimal intervention. My current work focuses on design and control of robotic swarms, transportation networks, and human-robot teams, with emphasis on the role of a small set of agents in influencing macro-scale system dynamics. In the future I intend to apply the developed tools to diverse networked systems such as social ensembles, system reliability, and neural systems.

EDUCATION

Ph.D., Mechanical Engineering, The Pennsylvania State University	2014
Location: University Park, PA	
Advisors: Dr. Sean Brennan and Dr. Asok Ray	
Thesis title: Influential subspaces in self-organizing multi-agent systems	
M.S., Electrical Engineering, The Pennsylvania State University	2014
Location: University Park, PA	
Advisors: Dr. Constantino Lagoa	
Paper title: Sensor noise modeling, characterization, and simulation	
M.S., Mechanical Engineering, The Pennsylvania State University	2010
Location: University Park, PA	
Advisor: Dr. Sean Brennan	
Thesis title: Impact of adaptive cruise control on the formation of self-organized traffic jams on highways	
B.Tech., Mechanical and Automation Engineering, Amity School of Engineering and Technology	2006
Location: New Delhi, India	
Advisors: Dr. S B L Garg and Dr. Keshavendra Chaudhary	
Thesis title: Unmanned aerial vehicle for terrain monitoring	

WORK EXPERIENCE

Assistant Professor at University of Massachusetts, Lowell	2018 – Present
<ul style="list-style-type: none"> Conducted research on traffic flow and connected autonomous vehicles, swarm robotics, UAVs, multi-scale stream learning, and human-robot teams Taught graduate and undergraduate courses on robotics (MECH.5300), system dynamics and control (MECH.4510), control of automated systems (MECH.3230), and networked multi-agent systems (MECH.5550) Faculty coordinator for Robotics minor 	
Assistant Professor at Washington State University	2015 – 2018
<ul style="list-style-type: none"> Conducted research on complex systems, connected autonomous vehicles, UAVs, and virtual reality interfaces for controlling robotic swarms Taught undergraduate courses on system dynamics (ME 348), mechatronics (ME 401), control systems (ME 481) and Fundamentals of Engineering Exam review course (ME 466) Faculty advisor for WSU Aerospace club 	

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Post-doctoral scholar at The Pennsylvania State University	2014 – 2015
<ul style="list-style-type: none"> Incorporated sensor systems into vehicle conceptual design and mission analysis for unmanned aerial systems as a post-doctoral scholar in the Department of Aerospace Engineering 	
Instructor (Graduate Teaching Fellow) at The Pennsylvania State University	2013 – 2015
<ul style="list-style-type: none"> Primary instructor for senior-level course on Aerospace Control Systems (AERSP 460) and junior-level course on Vibration of Mechanical Systems (ME 370) in Fall 2013 Held classes and office hours, assigned homework, conducted exams and assessed student performance 	
Graduate Teaching Assistant at The Pennsylvania State University	2011 – 2013
<ul style="list-style-type: none"> Held recitation classes, and graded exams and homework assignments for: <ul style="list-style-type: none"> Graduate-level course on Digital Signal Processing (ACS 513) Senior-level course on Modeling of Dynamic Systems (ME 450) Junior-level course on Vibration of Mechanical Systems (ME 370) 	
Graduate Research Assistant at The Pennsylvania State University	2007 – 2011
<ul style="list-style-type: none"> Developed theory and performed simulations to study effect of intelligent vehicles on traffic flow Implemented and experimentally validated real-time vehicle tracking algorithm with low-cost sensors Performed data analysis and generated failure models for transit buses and its components Published papers at conferences and in peer-reviewed journals 	
Research Associate in Intellectual Property Group at Evalueserve	2006 – 2007
<ul style="list-style-type: none"> Drafted patents for inventions in the fields of navigation/mechanical devices, and web utilities Performed invalidation searches for utility and design patents Analyzed patent landscape of aircraft health monitoring systems for leading aircraft manufacturer 	

GRANTS AND CONTRACTS

Total award amount raised: As PI or co-PI: **\$5.80 million**

Total award amount raised as PI: **\$2.53 million**

Office of Naval Research: Long-Term Underwater Autonomy for Surveillance and Manipulation	\$1.66 million	2023 – 2025
<ul style="list-style-type: none"> PI: Holly Yanco; co-PIs: Reza Ahmadzadeh, Kshitij Jerath, Maru Cabrera, Adam Norton, and Paul Robinette Develop new capabilities for long-term autonomy and supervisory control of underwater robots operating in highly complex environments that include poor or irregular communication, coordinating multiple agents performing surveillance, inspection, and maintenance tasks, and interacting with humans in multiple roles. 		
Army Research Lab: Trust-NEARCHAT: Trust Network Emergence Amongst Resource-Constrained Human-Agent Teams	\$1.5 million	2021 – 2024
<ul style="list-style-type: none"> PI: Kshitij Jerath; co-PIs: Paul Robinette, Reza Ahmadzadeh Awarded through Army Research Lab's STRONG (Strengthening Teamwork for Robust Operations in Novel Groups) program Examine impact of resource constraints applied to individual learning agents on the macroscopic level emergence of trust networks in teams 		

Army Research Lab: CHATS: Computational HAT model of status sensitivity to facilitate team trust and performance under suboptimal conditions	\$1.5 million* UML: \$177,665	2021 – 2024
<ul style="list-style-type: none"> • PI (UML): Kshitij Jerath; co-PIs: Paul Robinette, Reza Ahmadzadeh • *Total award amount: \$1.5 million. Sub-award through University of Delaware • Create and implement robots to assist human teammates in an escape room scenario. 		
Army Research Lab: Individualized Adaptations to Calibrate Multi-Human Multi-Agent Team Trust	\$99,507	2021 – 2022
<ul style="list-style-type: none"> • PI: Paul Robinette; co-PIs: Kshitij Jerath, Reza Ahmadzadeh, Thanuka Wickramaratne • Enabling intelligent agents to reason about trust decisions made by human teammates and apply an appropriate future policy of actions to symbiotically improve overall team processes. 		
NSF: MRI: Development of a Calibration System for Stereophotogrammetry to Enable Large-Scale Measurement and Monitoring	\$455,096	2020 – 2023
<ul style="list-style-type: none"> • PI: Alessandro Sabato; co-PIs: Christopher Niezrecki, Kshitij Jerath, and Yan Luo • Awarded through Major Research Instrumentation (MRI) program at NSF to develop multi-sensor system for real-time calibration of stereophotogrammetry and remotely paired digital cameras 		
Army Research Lab: Emergence of Trust Clusters in Human-Agent Teams Operating under Resource Constraints	\$99,861	2020 – 2021
<ul style="list-style-type: none"> • PI: Kshitij Jerath; co-PIs: Paul Robinette, Reza Ahmadzadeh • Awarded through Army Research Lab's STRONG (Strengthening Teamwork for Robust Operations in Novel Groups) program • Assess subsequent impacts on team performance and cohesion in soldier-robot teams conducting search and rescue operations 		
DEVCOM Soldier Center: DECISIVE: Development and Execution of Comprehensive and Integrated Subterranean Intelligent Vehicle Evaluations	\$1.1 million	2020 – 2021
<ul style="list-style-type: none"> • PI: Holly Yanco; co-PIs: Reza Ahmadzadeh, Kshitij Jerath, Adam Norton, Paul Robinette, Jay Weitzen, Thanuka Wickramaratne • Design and evaluation of test methods for obstacle avoidance and navigation algorithms for small Unmanned Aerial Systems 		
NSF: CPS: Medium: Collaborative Research: Automated Discovery of Data Validity for Safety-Critical Feedback Control in a Population of Connected Vehicles	\$1.2 million* UML: \$501,150	2019 – 2023
<ul style="list-style-type: none"> • PI: Kshitij Jerath; co-PI: Cindy Chen • *Total award amount: \$1.2 million. Awarded through cross-disciplinary Cyber Physical Systems (CPS) program at National Science Foundation (NSF). • Identify spatiotemporal scales over which information remains relevant in the context of friction measurements using connected vehicles on freeways 		
NSF: Scale-dependent observability of emergent dynamics: Application to Traffic Flow with Connected Vehicles	\$259,749	2017 – 2022
<ul style="list-style-type: none"> • PI: Kshitij Jerath • Awarded through CMMI Dynamics, Control and System Diagnostics (DCSD) program at NSF • Assess optimal scale to observe and predict complex traffic flow dynamics using connected vehicles 		

RESEARCH AND ENGINEERING EXPERIENCE

Identifying influential subspaces of agents in self-organizing multi-agent systems	2013 – Present
<ul style="list-style-type: none"> • Developed framework for evaluating agent influence in networked multi-agent systems • Identified influential subspaces on highways where connected vehicles can impact self-organized jams • Performed observability analysis for reduced order models of complex nonlinear traffic dynamics 	
Emergence of trust networks in multi-human, multi-agent teams	2019 – Present
<ul style="list-style-type: none"> • Implemented multi-agent reinforcement learning (MARL) in simulated robot navigation tasks 	
Modeling and control of robotic swarms	2015 – Present
<ul style="list-style-type: none"> • Generated multi-scale models and state estimators for robotic swarms • Created efficient controllers and exploration-coverage algorithms for robotic swarms • Developed human gesture-based virtual reality control of robotic swarms using Unreal game engine 	
Sensor-driven conceptual design for small unmanned aerial system (UAS)	2014 – 2018
<ul style="list-style-type: none"> • Developed simulation framework for photorealistic simulations of UAS waypoint navigation missions • Performed Monte Carlo simulations of navigation missions with on-board lidars and cameras 	
Studying the effects of intelligent and connected vehicles on traffic flow dynamics	2008 – Present
<ul style="list-style-type: none"> • Generated and analyzed stochastic models of traffic jam dynamics • Analyzed the effect of variations in parametric driver models on the formation of traffic jams • Performed microscopic simulations of traffic flow using statistical mechanics-inspired models 	
Human detection in complex construction environments	2012
<ul style="list-style-type: none"> • Conducted proof-of-concept study for major construction equipment manufacturer to detect humans at construction sites using LIDAR 	
GPS-free terrain-based vehicle tracking	2009 – 2011
<ul style="list-style-type: none"> • Developed noise models for simulating low-cost sensors • Implemented real-time vehicle tracking with simulated low-cost sensors using Sigma Point Kalman filters in absence of GPS • Implemented vehicle tracking on large road networks using multiple model estimation schemes 	
Reliability analysis of in-service transit buses	2007 – 2009
<ul style="list-style-type: none"> • Analyzed failure rate data from transit buses and Larson Transportation Institute bus testing program using regression and Hidden Markov models • Generated performance comparison scheme for bus models and agencies 	
Design of unmanned aerial vehicle	2006
<ul style="list-style-type: none"> • Designed, built and flew an R/C Unmanned Aerial Vehicle (UAV) • Initiated project idea, formed and managed a group of 10 persons for 5 months • Performed feasibility studies for various design specifications 	
Testing of Hydraulic Control Unit on Airbus A320	2005
<ul style="list-style-type: none"> • Observed assembly, disassembly and maintenance procedures for jet engines (IAE V2500 and Pratt and Whitney JT8D) at the Jet Engine Overhaul Complex (JEOC), New Delhi, India • Helped develop in-house testing setup for the Hydraulic Control Unit (HCU) of the Nose wheel steering system on the Airbus A320 at the Aircraft Accessory Overhaul Shop, Indian Airlines Ltd., New Delhi, India 	

Anti-Lock Braking System (ABS)

2004

- Designed and built an anti-lock braking system for hydraulic brakes of a compact car using 3-way solenoid valve and induction proximity sensor

PUBLICATIONS

^IEEE Trans. on Intelligent Transportation Systems is the top-ranked journal in the field of transportation as per Google Scholar Metrics. It has an Impact Factor of 9.551

^Measurement Impact Factor: 5.131

^IEEE Control System Letters Impact Factor: 2.332

^IEEE Sensors Impact Factor: 4.325

^IFAC-PapersOnLine Impact Factor: 1.132

Springer Nature Computer Science Impact Factor: 3.78

Journal Publications

1. K. Jerath, V. V. Gayah, and S. Brennan; *Mitigating Delay due to Capacity Drop near Freeway Bottlenecks: Zones of Influence of Connected Vehicles*, accepted, PLOS ONE
2. L. Gao, J. Mitrovich, C. Beal, W. Bai, S. P. Maddipatla, C. Chen, K. Jerath, H. Haeri, L. Sinanaj, S. Brennan, *Boxes-based Representation and Data Sharing of Road Surface Friction for CAVs*, Data Science for Transportation, vol. 5, no. 9, 2023
3. F. Bottalico, C. Niezrecki, K. Jerath, Y. Luo, and A. Sabato; *Sensor-Based Calibration of Camera's Extrinsic Parameters for Stereophotogrammetry*, IEEE Sensors, vol. 23, no. 7, pp. 7776-7785, 2023
4. L. Sinanaj, H. Haeri, S. S. P. Maddipatla, L. Gao, R. Pakala, N. Kathiriya, C. Beal, S. Brennan C. Chen, K. Jerath; *Granulation of Large Temporal Databases: An Allan Variance Approach*, Springer Nature Computer Science, vol. 4, no. 1, pp. 7, 2023
5. S. S. P. Maddipatla, H. Haeri, K. Jerath, S. Brennan; *Fast Allan Variance (FAVAR) and Dynamic Fast Allan Variance (D-FAVAR) Algorithms for both Regularly and Irregularly Sampled Data*, IFAC-PapersOnLine, vol. 54, no. 20, pp. 26-31, 2021
6. T. Kim, and K. Jerath; *Congestion-aware Cooperative Adaptive Cruise Control and Mitigation of Self-Organized Traffic Jams*, IEEE Transactions on Intelligent Transportation Systems, 2021.
7. H. Haeri, C. Beal, and K. Jerath, *Near-optimal Moving Average Estimation at Characteristic Timescales: An Allan Variance Approach*, IEEE Control Systems Letters, vol. 5, no. 5, pp. 1531-1536, 2020
8. H. Haeri, K. Jerath, and J. Leachman, *Thermodynamics-inspired Macroscopic States of Bounded Swarms*, ASME Letters in Dynamic Systems and Control, vol. 1, pp 011-015, 2020
9. K. Jerath, S. Brennan, and C. Lagoa, *Bridging the gap between sensor noise modeling and sensor characterization*, Measurement, vol. 116, pp 350-366, 2018
10. K. Jerath, A. Ray, S. Brennan, and V. V. Gayah, *Dynamic prediction of vehicle cluster distribution: A statistical mechanics-inspired approach*, IEEE Transactions on Intelligent Transportation Systems, vol. 16, no. 5, 2015
11. K. Jerath and S. Brennan; *Analytical Prediction of Self-Organized Traffic Jams as a Function of Increasing ACC Penetration*, IEEE Transactions on Intelligent Transportation Systems, vol. 13, no. 4, 2012
12. J. Yutko, K. Jerath, and S. Brennan; *A Failure Rate Analysis of Complex Vehicles*, International Journal of Heavy Vehicles and Systems, vol. 17, no. 1, 2010

Journal Manuscripts (under review)

13. Z. Yang and K. Jerath; *Renormalization Group-theoretic Approach to Multi-scale Modeling of Traffic Flow*, under review, Journal of Computational Science
14. E. Meriaux and K. Jerath; *Evaluation of Collision Tolerance, and Trajectory-following Capabilities of Small Unmanned Aerial System*, Submission to Drones

Journal Manuscripts (in preparation)

15. Z. Yang and K. Jerath; *Information-based Observability on Traffic Flow*, for submission to Journal of Computational Science
16. H. Haeri, N. Kathiriya, and K. Jerath; *Stream Learning under Continual Concept Drift via Multi-Scale Model Stability Analysis*, for submission to IEEE Transactions on Knowledge and Data Engineering

Full-length Conference Publications

17. Yasin Findik, Paul Robinette, Kshitij Jerath, S. Reza Ahmadzadeh, *Relational Q-Functionals: Multi-Agent Learning to Recover from Unforeseen Robot Malfunctions in Continuous Action Domains*, 21st International Conference on Ubiquitous Robots (UR), New York, USA, June 24-27, 2024
18. N. Kathiriya, H. Haeri, C. Chen, and K. Jerath; Iterative Forgetting: Online Datastream Regression using Adaptive Granulation, accepted, Databases and Machine Learning workshop at IEEE Conference on Data Engineering (ICDE) 2024
19. S.P. Maddipatla, R. Pakala, H. Haeri, C. Chen, K. Jerath, and S. Brennan; *Using Databases to Implement Algorithms: Estimation of Allan Variance Using B+-tree Data Structure*, 2024 American Control Conference, Toronto, Canada, Jul 8-12, 2024
20. Y. Findik, H. Osooli, P. Robinette, K. Jerath and R. Ahmadzadeh; *Influence of Team Interactions on Multi-Robot Cooperation: A Relational Network Perspective*, Multi-robot Systems Symposium, Boston, MA, USA, Dec 2023
21. Y. Findik, P. Robinette, K. Jerath, and S. Reza Ahmadzadeh, *Impact of Relational Networks in Multi-Agent Learning: A Value-Based Factorization View*, IEEE Conference on Decision and Control, Singapore, Dec 2023
22. H. Haeri, N. Kathiriya, C. Chen, K. Jerath, *Adaptive Granulation: Data Reduction at the Database Level*, 15th International Conference on Knowledge Management and Information Systems, Rome, Italy, 13-15 November, 2023 (**Acceptance rate: 15%**)
23. Y. Findik, P. Robinette, K. Jerath, and S. Reza Ahmadzadeh, *Collaborative Adaptation: Learning to Recover from Unforeseen Malfunctions in Multi-Robot Teams*, MADGames workshop at IEEE Intelligent Robots and Systems (IROS), Detroit, MI, USA, Oct 1-5, 2023
24. H. Osooli, P. Robinette, K. Jerath, S. R. Ahmadzadeh, *A Multi-Robot Task Assignment Framework for Search and Rescue with Heterogeneous Teams*, IROS 2023 Advances in Multi-Agent Learning - Coordination, Perception, and Control Workshop, in 2023 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), Detroit, MI, USA, Oct 1-5, 2023.
25. R. Pakala, N. Kathiriya, H. Haeri, S.P. Maddipatla, K. Jerath, C. Beal, S. Brennan, and C. Chen; *Distributed Edge computing system setup for vehicle communication*, DATA 2023: 12th International Conference on Data Science, Technology and Applications, Rome, Italy, July 11-13, 2023
26. F. Bottalico, C. Niezrecki, K. Jerath, Y. Luo, and A. Sabato; *Experimental Quantification of Sensor-Based Stereocameras' Extrinsic Parameters Calibration*. In Society for Experimental Mechanics Annual Conference and Exposition, June 2023 (pp. 49-55). Springer Nature Switzerland.
27. F. Bottalico, N. A. Valente, C. Niezrecki, K. Jerath, Y. Luo, and A. Sabato; *Sensor-aided camera calibration for three-dimensional digital image correlation measurements*. In Health Monitoring of Structural and Biological Systems XVII (Vol. 12488, pp. 233-242). SPIE, Long Beach, CA, USA, Apr 24-28, 2023
28. F. Mazzone and K. Jerath; *Understanding Agent Competency: Effects of Environment Complexity on Area Coverage Time*, Intelligent Agents (IA) at IEEE Symposium Series on Computational Intelligence 2022, Singapore, Dec 4-7, 2022
29. E. Meriaux and K. Jerath; *Evaluation of Navigation and Trajectory-following Capabilities of Small Unmanned Aerial Systems*, IEEE Symposium on Technologies for Homeland Security 2022, virtual

30. F. Bottalico, N. A. Valente, S. Dabetwar, **K. Jerath**, Y. Luo, C. Niezrecki, and A. Sabato; *A sensor-based calibration system for three-dimensional digital image correlation*, Proc. SPIE 12048, Health Monitoring of Structural and Biological Systems XVI, 120480Z, 19 April 2022, <https://doi.org/10.1117/12.2612106>
31. H. Haeri, B. Soleimani, and **K. Jerath**; *Optimal Moving Average Estimation of Noisy Random Walks using Allan Variance-informed Window Length*, Proceedings of the American Control Conference 2022, July 2022, Atlanta, GA
32. L. Gao, C. Beal, W. Bai, S. P. Maddipatla, C. Chen, **K. Jerath**, H. Haeri, L. Sinanaj, and S. Brennan; *Boxes-based Representation and Data Sharing of Road Surface Friction for CAVs*, 2021 Road Safety and Simulation International Conference (RSS), 08-10 June 2022, Athens, Greece.
33. S. S. P. Maddipatla, H. Haeri, **K. Jerath**, S. Brennan; *Fast Allan Variance (FAVAR) and Dynamic Fast Allan Variance (D-FAVAR) Algorithms for both Regularly and Irregularly Sampled Data*, presented at the Modeling, Estimation, and Control Conference (MECC) 2021, Austin, TX, USA (**Best paper award**)
34. Sinanaj, H. Haeri, L. Gao, S. S. P. Maddipatla, C. Chen, **K. Jerath**, C. Beal, S. Brennan; *Allan Variance-based Granulation Technique for Large Temporal Databases*, 13th International Conference on Knowledge Management and Information Systems, 25-27 Oct 2021 (virtual) (**Acceptance rate: 16%; Best student paper award**)
35. H. Haeri, R. Ahmadzadeh, and **K. Jerath**; *Reward-Sharing Relational Networks in Multi-Agent Reinforcement Learning as a Framework for Emergent Behavior*, Adaptive and Learning Agents Workshop 2021, London (virtual)
36. L. Gao, S. Maddipatla, C. Beal, **K. Jerath**, C. Chen, L. Sinanaj, H. Haeri, and S. Brennan; *A Micro-simulation Framework for Studying CAVs Behavior and Control Utilizing a Traffic Simulator, Chassis Simulation, and a Shared Roadway Friction Database*, American Control Conference, New Orleans, LA, USA, 2021
37. Z. Yang, H. Haeri, and **K. Jerath**, *Renormalization Group Approach to Cellular Automata-based Multi-scale Modeling of Traffic Flow*, Unifying Themes in Complex Systems X: Proceedings of the Tenth International Conference on Complex Systems (Springer Proceedings in Complexity), Nashua, NH, 2020
38. Z. Yang and **K. Jerath**, *Observability Variation in Emergent Dynamics: A Study using Krylov Subspace-based Model Order Reduction*, American Control Conference 2020, Denver, CO, USA
39. Z. Yang and **K. Jerath**, *Examining the Observability of Emergent Behavior as a Function of Reduced Model Order*, American Control Conference 2018, Milwaukee, WI, USA
40. M. Scott and **K. Jerath**, *Multi-robot Exploration and Coverage: Entropy-based Adaptive Maps with Adjacency Control Laws*, American Control Conference 2018, Milwaukee, WI, USA
41. M. Scott and **K. Jerath**; *Mission Performance Evaluation of Low-speed Small Unmanned Aerial Systems using Virtual Range and Stereo Camera Sensors*, AIAA Unmanned Systems Conference, 2018, Kissimmee, FL, USA
42. T. Kim, and **K. Jerath**; *Mitigation of self-organized traffic jams using cooperative adaptive cruise control*, 2016 International Conference on Connected Vehicles and Expo (ICCVE), 2016, Seattle, WA, USA
43. **K. Jerath**, and J. Langelaan; *Simulation Framework for UAS Conceptual Design*, AIAA Modeling and Simulation Technologies Conference, 2016, San Diego, CA, USA
44. **K. Jerath** and S. Brennan; *Identification of locally influential agents in self-organizing multi-agent systems*, American Control Conference 2015, Chicago, IL, USA
45. **K. Jerath**, V. V. Gayah, and S. Brennan; *Influential Subspaces of Connected Vehicles in Highway Traffic*, Symposium Celebrating 50 Years of Traffic Flow Theory, TRB Committee on Traffic Flow Theory and Characteristic, 2014, Portland, OR, USA
46. **K. Jerath**, A. Ray, S. Brennan, and V. Gayah; *Statistical Mechanics-inspired Framework for Studying the Effects of Mixed Traffic Flows on Highways*, Proc. of American Control Conference, 2014, Portland, OR, USA
47. **K. Jerath** and S. Brennan; *GPS-Free Terrain-based Vehicle Tracking on Road Networks*, Proceedings of American Control Conference, 2012, Montreal, Canada
48. **K. Jerath** and S. Brennan; *GPS-Free Terrain-based Vehicle Tracking Performance as a function of Inertial Sensor Noise Characteristics*, Proc. of Dynamic Systems and Control Conference, 2011, Arlington, VA, USA
49. **K. Jerath** and S. Brennan; *Adaptive Cruise Control: Towards higher traffic flows, at the cost of increased susceptibility to congestion*, Proceedings of AVEC10, 2010, Loughborough, UK

50. R. Deshpande, D. Johar, A. Kasyap, C. Feng, **K. Jerath**, and Z. Li; *Intellectual Property Monetization by R&D Organizations in India and China*, Proceedings of the International Symposium on the Management of Technology, 2007, Hangzhou, PRC.

Conference Manuscripts (under review)

51. H. Haeri, N. Kathiriya, C. Chen, and **K. Jerath**; *Stream Learning under Continual Concept Drift via Multi-Scale Model Stability Analysis*, under review, ACM Knowledge and Data Discovery (KDD) Conference 2024
52. A. Daniels, P. Robinette, R. Ahmadzadeh, and **K. Jerath**; *Concurrent Learning of Network Topology and Coordination Policy in Multi-agent Systems using Graph Attention*, under review, IEEE Conference on Decision and Control, 2024
53. A. Kolli, P. Robinette, S. Ahmadzadeh, and **K. Jerath**; *Learning graph topology in multi-agent systems: A graph-attention approach*, under review Modeling, Estimation, and Control Conference, 2024
54. Z. Yang and **K. Jerath**; *Energy-guided Data Sampling for Traffic Prediction with Small Training Datasets*, under review Modeling, Estimation, and Control Conference (MECC), 2024

Technical Reports

55. A. Norton, R. Ahmadzadeh, **K. Jerath**, P. Robinette, J. Weitzen, T. Wickramaratne, H. Yanco, M. Choi, R. Donald, B. Donoghue, C. Dumas, P. Gavriel, A. Giedraitis, B. Hertel, J. Houle, N. Letteri, E. Meriaux, Z. Rezaei, R. Singh, G. Willcox, N. Yoni, DECISIVE Benchmarking Data Report: sUAS Performance Results from Phase I, 2023.
56. A. Norton, R. Ahmadzadeh, **K. Jerath**, P. Robinette, J. Weitzen, T. Wickramaratne, H. Yanco, M. Choi, R. Donald, B. Donoghue, C. Dumas, P. Gavriel, A. Giedraitis, B. Hertel, J. Houle, N. Letteri, E. Meriaux, Z. Rezaei, R. Singh, G. Willcox, N. Yoni, *DECISIVE Test Methods Handbook: Test Methods for Evaluating sUAS in Subterranean and Constrained Indoor Environments, Version 1.1*, Technical Report, University of Massachusetts Lowell, 2022.
57. Auburn University, Stanford Research Institute, The Pennsylvania State University, and Kapsch TrafficCom Inc., *Next Generation Vehicle Positioning Techniques for GPS-Degraded Environments to Support Vehicle Safety and Automation Systems*, Technical Report, 2014
58. S. Brennan, P. Vemulapalli, **K. Jerath**, M. Robinson, M. Guo, *Human detection to increase safety in complex construction environments*, Technical report, Penn State/Volvo Construction Equipment, 2012
59. S. Brennan, **K. Jerath**, D. Klinikowski, S. Muthiah, and J. Yutko, *Study of the relationship between results of the Bus Testing Program and in-service performance of buses*, Technical Report, The Pennsylvania State University, 2008

Abstracts, Posters, and Other Publications

60. S. Barclay and **K. Jerath**; *Human-guided Swarms: Impedance Control-inspired Influence in Virtual Reality Environments*, ArXiv preprint: arXiv:2402.04451
61. H. Haeri, R. Ahmadzadeh and **K. Jerath**, Reward-Sharing Relational Networks in Multi-Agent Reinforcement Learning as a Framework for Emergent Behavior, Northeastern Robotics Colloquium (NERC) 2022, Lowell, MA, 2022
62. A. Daniels, F. Mazzone and **K. Jerath**, *Understanding Agent Competency: Effects of Environment Complexity on Area Coverage Time*, Northeastern Robotics Colloquium (NERC) 2022, Lowell, MA, 2022
63. C. Pezeshki and **K. Jerath**, *Canonical Knowledge Structures and Complexity in the Design of Artificial Intelligence*, Collective Intelligence Conference, Brooklyn, NY, USA, 2017
64. **K. Jerath**; *Influential subspaces in self-organizing multi-agent systems*, Ph.D. dissertation, Department of Mechanical and Nuclear Engineering, The Pennsylvania State University, 2014
65. **K. Jerath**; *Cooperative Intelligent Vehicles: Are we there yet?*, Award-winning entry to the ITSA Student Essay Competition, 2012
66. **K. Jerath**; *Impact of Adaptive Cruise Control on the Formation of Self-Organized Traffic Jams on Highways*, M.S. Thesis, Department of Mechanical and Nuclear Engineering, The Pennsylvania State University, 2010

TEACHING AND MENTORING EXPERIENCE

University of Massachusetts Lowell

2018 – Present

- **MECH 3230:** Control of Mechanical Systems (New undergraduate course with integrated project-based learning)
- **MECH 4510:** Dynamic Systems Analysis
- **MECH 5300:** Autonomous Robotic Systems (New graduate course and new projects)
- **MECH 5540:** Dynamic Systems and Control
- **MECH 5550:** Networked Multi-agent Systems (New graduate course and projects)
- **MECH 4230: Mechanical Engineering Capstone** (Advised team of two undergraduate students)
- **ENGN.4019/4020: Industry Capstone with Brooks Automation** (Advised team of four undergraduate students from electrical, mechanical, and computer engineering across two semesters on project related to customizable design and vibration analysis of a robotic arm end-effector used for transporting semiconductor wafers)

Washington State University

2015 – 2018

- **ME 348:** System Dynamics
- **ME 401:** Mechatronics
- **ME 481:** Control systems (introduced robotics-based projects to enhance learning outcomes)

Penn State University

2013 – 2014

- **AERSP 460:** Aerospace Control Systems
- **ME 370:** Vibrations of Mechanical Systems

Graduate student advising

Primary advisor (Graduated 1 PhD and 3 MS students, as of Spring 2024)

1. Zhaohui Yang (Ph.D., 2021, Mechanical Engineering, UML): *Macroscopic Observability of Emergent Behaviors in Multi-scale Models of Traffic Flow*
2. Hossein Haeri (Ph.D., 2024 (expected), Mechanical Engineering + M.S., 2023, Computer Science, UML)
3. Alden Daniels (Ph.D., 2025 (expected), Computer Science, UML)
4. Taehooie Kim (M.S., 2017, Mechanical Engineering, WSU): *Cooperative Adaptive Cruise Control: Impact on Self-organized Traffic Jams*
5. Mitchell Scott (M.S., 2018, Mechanical Engineering, WSU): *Information-based Multi-robot Navigation, Exploration and Coverage using Adaptive Occupancy Grids*
6. Niket Kathiriya (M.S., 2023, Computer Science, UML): *Iterative Forgetting: A Novel Online Data Stream Regression Method*
7. Michael Buckley (M.S., 2024 (expected), Mechanical Engineering, UML)
8. Akshay Kolli (M.S., 2024 (expected), Computer Science, UML)

Co-advisor

1. Lorina Sinanaj (M.S., 2021, Computer Science, UML): *Allan Variance-based Granulation Technique for Large Temporal Databases*
2. Rinith Pakala (M.S., 2023, Computer Science, UML): *Distributed Edge Computing System for Vehicle Communication*
3. Yasin Findik (Ph.D., 2025 (expected), Computer Science, UML)
4. Hamid Osooli (Ph.D., 2025 (expected), Computer Science, UML)
5. Monish Reddy Kotturu (M.S., 2024 (expected), Computer Science, UML)

Thesis committees

1. Amir Iqbal (Ph.D., Mechanical Engineering, UML)

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2. Yuan Gao (Ph.D., Mechanical Engineering, UML)
3. Satya Maddipatla (Ph.D., Mechanical Engineering, Penn State)
4. Wushuang Bai (Ph.D., Mechanical Engineering, Penn State)
5. Hamid Osooli (M.S., Computer Science, UML)
6. Debashis Saha (M.S., Civil Engineering, WSU)
7. Brian Laferriere (M.S., Mechanical Engineering, WSU)

SERVICE AND PROFESSIONAL ACTIVITIES

- **Member of**
 - Participating member of ASME Automotive and Transportation Systems (ATS) Technical Committee
 - IEEE Intelligent Transportation Systems Society (ITSS)
 - American Institute of Aeronautics and Astronautics (AIAA)
 - American Society for Engineering Education (ASEE)
- **Program Committee**, 17th International Symposium on Distributed Autonomous Robotic Systems (DARS 2024) at New York City, NY
- **Associate Editor** for American Control Conference (ACC) 2023
- **Program Committee** for International Conference on Complex Systems (2020) at Nashua, NH
- **Organized** Tenth Northeast Robotics Colloquium (2022) at Lowell, MA
- Organized and chaired invited sessions at various conferences:
 - American Control Conference 2022 (titled (a) Traffic-Awareness Vehicle Controls; and (b) Automated Vehicle Controls)
 - Modeling, Estimation, and Control Conference (MECC) 2021 (titled (a) Modeling and Controls of Car Following and Driver Behaviors, and (b) Advanced Vehicle Safety Controls)
 - *Advanced Driver Assist Systems* at American Control Conference 2021 in New Orleans, LA
 - *Connected vehicle systems* at Dynamic Systems and Controls Conference 2020 in Pittsburgh, PA
 - *Influence in multi-agent systems* at the American Control Conference (ACC) 2015 in Chicago, IL
 - *Systems, Control and Communication* at College of Engineering Research Symposium 2014 at Penn State University, State College, PA
- Chaired/co-chaired regular sessions at various conferences:
 - *Observers for nonlinear systems* at American Control Conference 2020 in Denver, CO
 - *Large-scale systems* at American Control Conference 2018 in Milwaukee, WI
- **Reviewed proposals** as part of four (4) NSF review panels ((July 2016, April 2018, March 2022, January 2024), and for Canada Foundation for Innovation (CFI)
- **Served as judge for best paper award** for the Automotive and Transportation Systems Technical committee at American Control Conference 2021 and 2022
- **Invited talks at**
 - Washington State University (Mar 17, 2021): Renormalization Group Theory and Applications to Traffic Flow
 - University of Massachusetts Amherst; Self-organization in traffic flow: Applications to modeling and mitigation of traffic jams, Sep 12, 2019
 - University of New Hampshire; Collective behavior in robotic swarms: Modeling and control - A complex systems perspective, Oct 25, 2019
- **Reviewer for:**
 - IEEE Transactions on Intelligent Transportation Systems
 - IEEE Intelligent Transportation Systems Magazine
 - IEEE Transactions on Vehicular Technology

- IEEE Transactions on Automatic Control
- Transportation Research: Part B
- Journal of Network and Computer Applications
- Transportation Research Record
- American Control Conference
- Dynamic Systems and Control Conference
- International Conference on Complex Systems
- IEEE Conference on Decision and Control
- International Conference on Intelligent Robots
- IEEE Vehicle Power and Propulsion Conference
- Northeastern Robotics Colloquium (NERC)
- Attended Conferences and Workshops:
 - American Control Conference (2012, 2014, 2015, 2017, 2018, 2020, 2022)
 - NSF Cyber Physical Systems PI Meeting, Washington D.C. (2019, 2020, 2021, 2022)
 - Multi Robot Systems Symposium, Boston, MA (2023)
 - IEEE Symposium Series on Computational Intelligence (2022)
 - Northeast Robotics Colloquium, Lowell, MA (2022)
 - Modeling, Estimation and Control Conference (2021)
 - Adaptive and Learning Agents (ALA) workshop at International Conference on Autonomous Agents and Multiagent Systems (AAMAS) 2021
 - Northeast Regional Conference on Complex Systems (2021)
 - Dynamic Systems and Controls Conference (2011, 2019)
 - International Conference on Complex Systems (2018, 2020)
 - Annual Meeting of the Transportation Research Board, Washington D.C., Jan 11-13, 2019
 - Collective Intelligence Conference, New York, NY (2017)
 - International Conference on Connected Vehicles and Expo, Seattle, WA (2016)
 - AIAA Modeling and Simulation Conference, San Diego, CA (2016)
 - TRB Symposium Celebrating 50 Years of Traffic Flow Theory, Portland, OR (2014)
 - 3rd Robotics Roadmapping Workshop, Lowell, MA – Nov 15-16, 2019
 - Presenting Data and Information with Edward Tufte, Cambridge, MA, June 3, 2019
 - NSF Grants Conference, Alexandria, VA (2016)
 - WSU Office of Research Advancement and Partnership Grant writing course (2016)
 - Active Learning Workshop by National Effective Teaching Institute (NETI) at Pullman, WA (2016)
- **University and department committees at UMass Lowell:**
 - Robotics Faculty search committee (chair (2019), member (2018, 2022, 2023)),
 - Robotics Strategic Planning Working Group (Team Lead, 2019-21),
 - Faculty Coordinator for Robotics Minor (2019-present)
 - Course coordinator for MECH.3230 (Control of Automated Systems)
- **University and department committees at WSU:**
 - Member of UAS drone safety committee (WSU Department of Environmental and Health Safety, 2016-17),
 - Undergraduate Studies committee (MME department, 2016-17),
 - Website redesign committee (MME department, 2015-16)
- Advised WSU Aerospace club for the Intercollegiate Rocket Engineering Competition (IREC): 2015-17
- Member, Penn State Robotics Club and Intelligent Ground Vehicle Competition (IGVC) Team: 2007-2009
- Coordinator of Student Activities, SAE Student Chapter at Amity School of Engineering and Technology: 2005-2006

HONORS

- **Best paper award** at the 2021 Modeling, Estimation and Control Conference, MECC 2021
- **Best student paper award** at the 13th International Conference on Knowledge Management and Information Systems, 2021
- Awarded **Best Presentation in Session** at the American Control Conference, 2014
- Received the **Kulakowski Travel Award** by the Department of Mechanical and Nuclear Engineering at The Pennsylvania State University, 2014
- **Media coverage:** Research mentioned in **Society of Industrial and Applied Mathematics News** – “*Smells like a traffic jam*”, November 2013
- Awarded **Graduate Teaching Fellowship** by Department of Mechanical and Nuclear Engineering at The Pennsylvania State University, 2013
- Awarded **Best Presentation in Session** at the American Control Conference, 2012
Awarded **2nd place** in Student Essay Competition organized by **Intelligent Transportation Society of America**, 2012 for essay titled “*Cooperative intelligent vehicles: are we there yet?*”