

KYLE HOLLINS WRAY

Director of Engineering at Robust AI

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PROFESSIONAL STATEMENT

My ambition is to lead, mentor, and grow robotics/AI teams to actualize real-world autonomous robots, guided by an expertise in both the theoretical foundations of AI models and their real-world application to robotics.

HIGHLIGHTS

15 Years of Robotics/AI Research and Development Experience	26 Top Robotics/AI Papers Published (ICRA, AAAI, etc.)
12 Years of Industry Experience (6 Auto. R&D, 4 Gov't R&D, 2 Tech. Startup)	Co-Author on AI Decision-Making Textbook at Stanford
4 Years of Leadership Experience (5 Ph.D., 1 M.S., 6 Intern, 10 Ph.D. St.)	58 Patents Granted (28 US, 30 International)
Communicator to Executives, Stakeholders, VCs, Customers, Professionals	Deployed AI on 20+ Autonomous Robots and Vehicles
Negotiated Contracts and Established Collaborations with 5 Universities	Expert in Robotics, AI, Decision-Making, C++, ROS
Principal Investigator and Project Manager of R&D for Millions of USD	Participated Raising \$20+ Million USD Series A-1

EDUCATION

Executive Education

2024 • **Stanford LEAD Program, Graduate School of Business (GSB)** Stanford University

Academic Education

2019 • Ph.D. in Computer Science <i>Thesis: Abstractions in Reasoning for Long-Term Autonomy</i>	University of Massachusetts Amherst <i>Advisor: Shlomo Zilberstein</i>
2016 • M.S. in Computer Science	University of Massachusetts Amherst
2013 • M.A. in Mathematics	The Pennsylvania State University
2012 • M.S. in Computer Science and Engineering Computational Science Graduate Minor	The Pennsylvania State University
2009 • B.S. in Computer Science	The Pennsylvania State University
2009 • B.S. in Mathematics	The Pennsylvania State University

EXPERIENCE

Professional Experience

2022–present • Director of Engineering , Fleet Intelligence Team and Planning and Optimization Team	Robust AI
2021–2022 • Principal Researcher , Autonomous Vehicle Team and Energy Management Team	Nissan North America
2020–2021 • Senior Researcher , Autonomous Vehicle Team and Energy Management Team	Nissan North America
2019–2020 • Researcher , Autonomous Vehicle Team	Nissan North America
2016–2019 • Research Consultant/Intern , Autonomous Vehicle Team	Nissan North America
2012–2013 • Software Engineer , Materials and Manufacturing	Applied Research Laboratory
2010–2012 • Research Assistant , Tactical Processing	Applied Research Laboratory
2009–2010 • Software Engineer , Weapons Systems Engineering	Applied Research Laboratory

Academic Experience

2021–2023 • Visiting Scholar , College of Engineering, Department of Aeronautics and Astronautics	Stanford University
2013–2019 • Research/Teaching Assistant , College of Computer Science	University of Massachusetts Amherst

HONORS AND AWARDS

2020	● ICAPS Best Dissertation Award	ICAPS
	● Victor Lesser Distinguished Dissertation Award Runner-Up	AAMAS
	● Nissan's Patent Research Award (2020)	Nissan North America
2018	● Nissan's Patent Research Award (2018)	Nissan North America
2016	● Outstanding Graduate Research Award	University of Massachusetts Amherst
2015	● Passed Ph.D. Qualifying Exam and Portfolio with Distinction	University of Massachusetts Amherst
2014	● Outstanding Teaching Assistant Award	University of Massachusetts Amherst
2009	● Dean's List	The Pennsylvania State University

RESEARCH AND DEVELOPMENT INTERESTS

Artificial Intelligence	Autonomous Robots	Automated Planning	Reinforcement Learning	POMDPs
Multi-Objective Models	Hierarchical Models	Safe & Trustworthy AI	Constraint Programming	Imitation Learning
Autonomous Driving	Human-Robot Interaction	Path & Motion Planning	Fleet Task Optimization	Long-Term Autonomy

BOOKS

MIT Press 2022 ● Mykel J. Kochenderfer, Tim A. Wheeler, and **Kyle H. Wray**. "Algorithms for Decision Making." MIT Press, B1 700 pages, 2022.

PUBLICATIONS

- ICRA 2024 ● Arec Jamgochian, Hugo Buurmeijer, **Kyle Wray**, Anthony Corso, and Mykel Kochenderfer. "Constrained Hierarchical Monte Carlo Belief-State Planning." 2024 IEEE International Conference on Robotics and Automation (ICRA), Yokohama, Japan, May 2024.
- IV 2023 ● Anil Yildiz, Esen Yel, Anthony L. Corso, **Kyle H. Wray**, Stefan J. Witwicki, and Mykel J. Kochenderfer. "Experience Filter: Transferring Past Experiences to Unseen Tasks or Environments." 2023 IEEE Intelligent Vehicles Symposium (IV), Anchorage, Alaska, June 2023.
- ECC 2023 ● Kenneth Czuprynski and **Kyle Hollins Wray**. "Banded Controllers for Scalable POMDP Decision-Making." 2023 European Control Conference (ECC), Bucharest, Romania, June 2023.
- AIJ 2023 ● Connor Basich, Justin Svegliato, **Kyle H. Wray**, Stefan Witwicki, Joydeep Biswas, and Shlomo Zilberstein. "Competence-Aware Systems." Artificial Intelligence (AIJ), volume 316, number 103844, 2023.
- IROS 2022 ● **Kyle Hollins Wray**, Stas Tiomkin, Mykel J. Kochenderfer, and Pieter Abbeel. "Multi-Objective Policy Gradients with Topological Constraints." 2022 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), Kyoto, Japan, October 2022.
- SoCS 2022 ● Shuwa Miura, **Kyle Hollins Wray**, and Shlomo Zilberstein "Heuristic Search for SSPs with Lexicographic Preferences over Multiple Costs." Proceedings of the Fifteenth International Symposium on Combinatorial Search (SoCS), Vienna, Austria, July 2022.
- ICRA 2022 ● **Kyle Hollins Wray** and Kenneth Czuprynski. "Scalable Gradient Ascent for Controllers in Constrained POMDPs." 2022 IEEE International Conference on Robotics and Automation (ICRA), Philadelphia, Pennsylvania, USA, May 2022.
- RA-L 2022 ● Sadegh Rabiee, Connor Basich, **Kyle Hollins Wray**, Shlomo Zilberstein, and Joydeep Biswas. "Competence-Aware Path Planning via Introspective Perception." IEEE Robotics and Automation Letters (RA-L), 2022.
- IROS 2021 ● Connor Basich, Justin Svegliato, Allyson Beach, **Kyle H. Wray**, Stefan Witwicki, and Shlomo Zilberstein. "Improving Competence via Iterative State Space Refinement." 2021 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), pages 1865–1871, Prague, Czech Republic, September 2021.
- IV 2021 ● **Kyle Hollins Wray**, Richard Lui, and Liam Pedersen. "Engine Activation Planning for Series Hybrid Electric Vehicles." 2021 IEEE Intelligent Vehicles Symposium (IV), pages 238–244, Nagoya, Japan, July 2021.

- ICRA 2021 P16 • **Kyle Hollins Wray** and Kenneth Czuprynski. “[Scalable POMDP Decision-Making Using Circulant Controllers.](#)” 2021 IEEE International Conference on Robotics and Automation (ICRA), pages 6831–6837, Xi’an, China, May 2021.
- ISR 2021 P15 • **Kyle Hollins Wray**, Bernard Lange, Arec Jamgochian, Stefan J. Witwicki, Atsuhide Kobashi, Sachin Hagari-bommanahalli, and David Ilstrup. “[POMDPs for Safe Visibility Reasoning in Autonomous Vehicles.](#)” 2021 IEEE International Conference on Intelligence and Safety in Robots (ISR), pages 191–195, Nagoya, Japan, March 2021.
- AAMAS 2020 P14 • Connor Basich, Justin Svegliato, **Kyle Hollins Wray**, Stefan J. Witwicki, Joydeep Biswas, and Shlomo Zilberstein. “[Learning to Optimize Autonomy in Competence-Aware Systems.](#)” Proceedings of the Nineteenth International Conference on Autonomous Agents and Multiagent Systems (AAMAS), pages 123–131, Auckland, New Zealand, May 2020.
- IROS 2019 P13 • Sandhya Saisubramanian, **Kyle Hollins Wray**, Luis Pineda, and Shlomo Zilberstein. “[Planning in Stochastic Environments with Goal Uncertainty.](#)” 2019 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), pages 1649–1654, Macau, China, November 2019.
- IROS 2019 P12 • Justin Svegliato, **Kyle Hollins Wray**, Stefan J. Witwicki, Joydeep Biswas, and Shlomo Zilberstein. “[Belief Space Metareasoning for Exception Recovery.](#)” 2019 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), pages 1224–1229, Macau, China, November 2019.
- ICRA 2019 P11 • **Kyle Hollins Wray** and Shlomo Zilberstein. “[Generalized Controllers in POMDP Decision-Making.](#)” 2019 IEEE International Conference on Robotics and Automation (ICRA), pages 7166–7172, Montreal, Canada, May 2019.
- IJCAI 2018 P10 • Justin Svegliato, **Kyle Hollins Wray**, and Shlomo Zilberstein. “[Meta-Level Control of Anytime Algorithms with Online Performance Prediction.](#)” Proceedings of the Twenty-Seventh International Conference on Artificial Intelligence (IJCAI), pages 1499–1505, Stockholm, Sweden, July 2018.
- AAAI 2018 P9 • **Kyle Hollins Wray**, Akshat Kumar, and Shlomo Zilberstein. “[Integrated Cooperation and Competition in Multi-Agent Decision-Making.](#)” Proceedings of the Thirty-Second Conference on Artificial Intelligence (AAAI), pages 4751–4758, New Orleans, Louisiana, USA, February 2018.
- IROS 2017 P8 • **Kyle Hollins Wray** and Shlomo Zilberstein. “[Approximating Reachable Belief Points in POMDPs.](#)” 2017 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), pages 117–122, Vancouver, Canada, September 2017.
- IJCAI 2017 P7 • **Kyle Hollins Wray**, Stefan J. Witwicki, and Shlomo Zilberstein. “[Online Decision-Making for Scalable Autonomous Systems.](#)” Proceedings of the Twenty-Sixth International Joint Conference on Artificial Intelligence (IJCAI), pages 4768–4774, Melbourne, Australia, August 2017.
- AAAI 2017 P6 • Luis Pineda, **Kyle Hollins Wray**, and Shlomo Zilberstein. “[Fast SSP Solvers Using Short-Sighted Labeling.](#)” Proceedings of the Thirty-First Conference on Artificial Intelligence (AAAI), pages 3629–3635, San Francisco, CA, USA, February 2017.
- IROS 2016 P5 • **Kyle Hollins Wray**, Dirk Ruiken, Rod A. Grupen, and Shlomo Zilberstein. “[Log-Space Harmonic Function Path Planning.](#)” 2016 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), pages 1511–1516, Daejeon, South Korea, October 2016.
- IJCAI 2016 P4 • **Kyle Hollins Wray**, Luis Pineda, and Shlomo Zilberstein. “[Hierarchical Approach to Transfer of Control in Semi-Autonomous Systems.](#)” Proceedings of the Twenty-Fifth International Joint Conference on Artificial Intelligence (IJCAI), pages 517–523, New York City, NY, USA, July 2016.
- AAAI 2016 P3 • **Kyle Hollins Wray** and Shlomo Zilberstein. “[A POMDP Formulation of Proactive Learning.](#)” Proceedings of the Thirtieth Conference on Artificial Intelligence (AAAI), pages 3202–3208, Phoenix, AZ, USA, February 2016.
- IJCAI 2015 P2 • **Kyle Hollins Wray** and Shlomo Zilberstein. “[Multi-Objective POMDPs with Lexicographic Reward Preferences.](#)” Proceedings of the Twenty-Fourth International Joint Conference on Artificial Intelligence (IJCAI), pages 1719–1725, Buenos Aires, Argentina, July 2015.
- AAAI 2015 P1 • **Kyle Hollins Wray**, Shlomo Zilberstein, and Abdel-Ilhah Mouaddib. “[Multi-Objective MDPs with Conditional Lexicographic Reward Preferences.](#)” Proceedings of the Twenty-Ninth Conference on Artificial Intelligence (AAAI), pages 3418–3424, Austin, TX, USA, January 2015.

PATENTS GRANTED**United States Patents Granted**

- US Patent 2024 US28 • **Kyle Hollins Wray**, Stefan Witwicki, and Shlomo Zilberstein. “Learning in Lane-Level Route Planner.” United States Patent. Granted in 2024.
- US Patent 2024 US27 • **Kyle Hollins Wray**, David Ilstrup, Liam Pedersen, Richard Lui, and Christopher Ostafew. “Navigation Map Learning for Intelligent Hybrid-Electric Vehicle Planning.” United States Patent 11,946,760. Granted on April 2, 2024.
- US Patent 2024 US26 • **Kyle Hollins Wray**, Stefan Witwicki, and Shlomo Zilberstein. “Explainability and Interface Design for Lane-Level Route Planner.” United States Patent 11,945,441. Granted on April 2, 2024.
- US Patent 2024 US25 • **Kyle Hollins Wray**, Stefan Witwicki, and Shlomo Zilberstein. “Belief State Determination for Real-Time Decision-Making.” United States Patent 11,921,506. Granted on March 5, 2024.
- US Patent 2024 US24 • **Kyle Hollins Wray**, Stefan Witwicki, and Shlomo Zilberstein. “Objective-Based Reasoning in Autonomous Vehicle Decision-Making.” United States Patent 11,899,454. Granted on February 13, 2024.
- US Patent 2024 US23 • **Kyle Hollins Wray**, Stefan Witwicki, and Shlomo Zilberstein. “Shared Autonomous Vehicle Operational Management.” United States Patent 11,874,120. Granted on January 16, 2024.
- US Patent 2023 US22 • Omar Bentahar, Arec Jamgochian, **Kyle Hollins Wray**, and Stefan Witwicki. “Apparatus and Method for Post-Processing a Decision-Making Model of an Autonomous Vehicle Using Multivariate Data.” United States Patent 11,782,438. Granted on October 10, 2023.
- US Patent 2023 US21 • **Kyle Hollins Wray**, Stefan Witwicki, Shlomo Zilberstein, Omar Bentahar, and Arec Jamgochian. “Explainability of Autonomous Vehicle Decision Making.” United States Patent 11,714,971. Granted August 1, 2023.
- US Patent 2023 US20 • **Kyle Hollins Wray**, Stefan Witwicki, and Shlomo Zilberstein. “Autonomous Vehicle Operation with Explicit Occlusion Reasoning.” United States Patent 11,702,070. Granted on July 18, 2023.
- US Patent 2023 US19 • Luis Lorenzo Bill, David Ilstrup, Stefan Witwicki, **Kyle Hollins Wray**. “Annotation and Mapping for Vehicle Operation in Low-Confidence Object Detection Conditions.” United States Patent 11,681,780. Granted on June 20, 2023.
- US Patent 2023 US18 • Atsuhide Kobashi, Stefan Witwicki, Christopher Ostafew, **Kyle Hollins Wray**, and Kuniaki Noda. “3D Occlusion Reasoning for Accident Avoidance.” United States Patent 11,635,763. Granted on April 25, 2023.
- US Patent 2023 US17 • **Kyle Hollins Wray**, Stefan Witwicki, and Shlomo Zilberstein. “Risk Aware Executor with Action Set Recommendations.” United States Patent 11,635,758. Granted on April 25, 2023.
- US Patent 2023 US16 • **Kyle Hollins Wray**, Liam Pedersen, Richard Lui, and Christopher Ostafew. “Route Planner Optimization for Hybrid-Electric Vehicles.” United States Patent 11,614,335. Granted on March 28, 2023.
- US Patent 2023 US15 • **Kyle Hollins Wray**, Stefan Witwicki, and Shlomo Zilberstein. “Learning Safety and Human-Centered Constraints in Autonomous Vehicles.” United States Patent 11,613,269. Granted on March 28, 2023.
- US Patent 2023 US14 • **Kyle Hollins Wray**, Liam Pedersen, Richard Lui, and Christopher Ostafew. “Intelligent Engine Activation Planner.” United States Patent 11,608,048. Granted on March 21, 2023.
- US Patent 2023 US13 • **Kyle Hollins Wray**, Omar Bentahar, Astha Vagadia, Laura Cesafsky, Arec Jamgochian, Stefan Witwicki, Najamuddin Mirza Baig, Julius S. Gyorf, Shlomo Zilberstein, and Sparsh Sharma. “Explainability of Autonomous Vehicle Decision Making.” United States Patent 11,577,746. Granted on February 14, 2023.
- US Patent 2022 US12 • **Kyle Wray**, Stefan Witwicki, Shlomo Zilberstein, and Liam Pedersen. “Autonomous Vehicle Operational Management Including Operating A Partially Observable Markov Decision Process Model Instance.” United States Patent 11,500,380. Granted on November 15, 2022.
- US Patent 2022 US11 • Connor Basich, **Kyle Hollins Wray**, Stefan Witwicki, and Shlomo Zilberstein. “Introspective Competence Modeling for AV Decision Making.” United States Patent 11,307,585. Granted on April 19, 2022.
- US Patent 2022 US10 • **Kyle Hollins Wray**, Stefan Witwicki, and Shlomo Zilberstein. “Multiple Objective Explanation and Control Interface Design.” United States Patent 11,300,957. Granted on April 12, 2022.
- US Patent 2021 US9 • **Kyle Hollins Wray**, Stefan Witwicki, Shlomo Zilberstein, and Melissa Cefkin. “Orientation-Adjust Actions for Autonomous Vehicle Operational Management.” United States Patent 11,120,688. Granted on September 14, 2021.

- US Patent 2021 • **Kyle Wray**, Stefan Witwicki, Shlomo Zilberstein, and Liam Pedersen. “Autonomous Vehicle Operational Management Blocking Monitoring.” United States Patent 11,113,973. Granted on September 7, 2021.
US8
- US Patent 2021 • **Kyle Hollins Wray**, Stefan Witwicki, and Shlomo Zilberstein. “Centralized Shared Autonomous Vehicle Operational Management.” United States Patent 11,110,941. Granted on September 7, 2021.
US7
- US Patent 2021 • **Kyle Hollins Wray**, Stefan Witwicki, and Shlomo Zilberstein. “Autonomous Vehicle Operational Management Scenarios.” United States Patent 11,084,504. Granted on August 10, 2021.
US6
- US Patent 2021 • **Kyle Hollins Wray**, Stefan Witwicki, and Shlomo Zilberstein. “Reinforcement and Model Learning for Vehicle Operation.” United States Patent 11,027,751. Granted on June 8, 2021.
US5
- US Patent 2021 • Kuniaki Noda, **Kyle Hollins Wray**, and Stefan Witwicki. “Autonomous Vehicle Operational Management With Visual Saliency Perception Control.” United States Patent 10,901,417. Granted on January 26, 2021.
US4
- US Patent 2020 • **Kyle Hollins Wray**, Stefan Witwicki, and Shlomo Zilberstein. “Continual Planning and Metareasoning for Controlling an Autonomous Vehicle.” United States Patent 10,836,405. Granted on November 17, 2020.
US3
- US Patent 2020 • **Kyle Wray**, Stefan Witwicki, Shlomo Zilberstein, and Liam Pedersen. “Autonomous Vehicle Operational Management Control.” United States Patent 10,654,476. Granted on May 19, 2020.
US2
- US Patent 2020 • Justin Svegliato, Stefan Witwicki, **Kyle Hollins Wray**, and Shlomo Zilberstein. “Introspective Autonomous Vehicle Operational Management.” United States Patent 10,649,453. Granted on May 12, 2020.
US1

International Patents Granted

- EP Patent 2023 • Kuniaki Noda, **Kyle Hollins Wray**, and Stefan Witwicki. “Autonomous Vehicle Operational Management With Visual Saliency Perception Control.” European Patent 3,841,525. Granted on November 22, 2023.
I30
- CN Patent 2023 • **Kyle Wray**, Stefan Witwicki, Shlomo Zilberstein, and Liam Pedersen. “Autonomous Vehicle Operational Management.” Chinese Patent 110325928. Granted on April 04, 2023.
I29
- CA Patent 2023 • **Kyle Wray**, Stefan Witwicki, Shlomo Zilberstein, and Liam Pedersen. “Autonomous Vehicle Operational Management.” Canadian Patent 3,052,951. Granted on March 14, 2023.
I28
- CN Patent 2022 • **Kyle Wray**, Stefan Witwicki, Shlomo Zilberstein, and Liam Pedersen. “Autonomous Vehicle Operational Management Including Operating A Partially Observable Markov Decision Process Model Instance.” Chinese Patent 110431037. Granted on November 29, 2022.
I27
- CN Patent 2022 • **Kyle Wray**, Stefan Witwicki, Shlomo Zilberstein, and Liam Pedersen. “Autonomous Vehicle Operation Management Obstruction Monitoring.” Chinese Patent 110418743. Granted on October 4, 2022.
I26
- EP Patent 2022 • **Kyle Wray**, Stefan Witwicki, Shlomo Zilberstein, and Liam Pedersen. “Autonomous Vehicle Operation Management Including Operating a Partially Observable Markov Decision Process Model Instance.” European Patent 3,580,084. Granted on July 6, 2022.
I24
- CN Patent 2022 • **Kyle Hollins Wray**, Stefan Witwicki, and Shlomo Zilberstein. “Autonomous Vehicle Operational Management Scenarios.” Chinese Patent 111629945. Granted on April 26, 2022.
I23
- JP Patent 2022 • Kuniaki Noda, **Kyle Hollins Wray**, and Stefan Witwicki. “To Provide A Method Which Is Used When Passing Vehicular Traffic Network Autonomous Traveling Vehicle.” Japanese Patent 7,048,818. Granted on April 5, 2022.
I25
- JP Patent 2022 • **Kyle Hollins Wray**, Stefan Witwicki, and Shlomo Zilberstein. “An Autonomous Traveling Vehicle Operation Management Plan.” Japanese Patent 6,992,182. Granted on January 13, 2022.
I22
- CN Patent 2021 • **Kyle Hollins Wray**, Stefan Witwicki, Shlomo Zilberstein, and Melissa Cefkin. “Orientation-Adjust Actions for Autonomous Vehicle Operational Management.” Chinese Patent 112368662. Granted on December 10, 2021.
I21
- JP Patent 2021 • **Kyle Wray**, Stefan Witwicki, Shlomo Zilberstein, and Liam Pedersen. “The Operation of the Autonomous Traveling Vehicle Management Control.” Japanese Patent 6,969,756. Granted on November 24, 2021.
I20
- RU Patent 2021 • Kuniaki Noda, **Kyle Hollins Wray**, and Stefan Witwicki. “Operational Control of Autonomous Vehicle With Visual Salience Perception Control.” Russian Patent 2,759,975. Granted on November 19, 2021.
I19
- CN Patent 2021 • **Kyle Wray**, Stefan Witwicki, Shlomo Zilberstein, and Liam Pedersen. “Autonomous Vehicle and Method of Autonomous Vehicle Operation Management Control.” Chinese Patent 110603497. Granted on November 16, 2021.
I18

- CA Patent 2021 I17 ● **Kyle Wray**, Stefan Witwicki, Shlomo Zilberstein, and Liam Pedersen. “Autonomous Vehicle Operational Management Blocking Monitoring.” Canadian Patent 3,052,953. Granted on November 9, 2021.
- JP Patent 2021 I16 ● **Kyle Hollins Wray**, Stefan Witwicki, and Shlomo Zilberstein. “Centralized Shared Autonomous Vehicle Operational Management.” Japanese Patent 6,963,158. Granted on November 5, 2021.
- CN Patent 2021 I15 ● Kuniaki Noda, **Kyle Hollins Wray**, and Stefan Witwicki. “Autonomous Vehicle Operation Management With Visual Saliency Perception Control.” Chinese Patent 112868031. Granted on October 15, 2021.
- KR Patent 2021 I14 ● **Kyle Wray**, Stefan Witwicki, Shlomo Zilberstein, and Liam Pedersen. “Self-Driving Vehicle Operational Management.” Korean Patent 10-2305291. Granted on September 29, 2021.
- JP Patent 2021 I13 ● **Kyle Wray**, Stefan Witwicki, Shlomo Zilberstein, and Liam Pedersen. “The Method Used to Traverse the Vehicle Traffic Network Autonomous Traveling Vehicle.” Japanese Patent 6,897,938. Granted on July 7, 2021.
- JP Patent 2021 I12 ● **Kyle Wray**, Stefan Witwicki, Shlomo Zilberstein, and Liam Pedersen. “Partially Observed Markov Decision Process Autonomous Vehicle Motion Management Including Operating a Model Instance.” Japanese Patent 6,890,757. Granted on June 18, 2021.
- CA Patent 2021 I11 ● **Kyle Wray**, Stefan Witwicki, Shlomo Zilberstein, and Liam Pedersen. “Autonomous Vehicle Operational Management Control.” Canadian Patent 3,052,952. Granted on June 1, 2021.
- RU Patent 2021 I10 ● **Kyle Hollins Wray**, Stefan Witwicki, and Shlomo Zilberstein. “Options for Autonomous Vehicle Operation.” Russian Patent 2,744,640. Granted on March 12, 2021.
- CA Patent 2021 I9 ● **Kyle Hollins Wray**, Stefan Witwicki, and Shlomo Zilberstein. “Autonomous Vehicle Operational Management Scenarios.” Canadian Patent 3,083,719. Granted on March 2, 2021.
- KR Patent 2021 I8 ● **Kyle Wray**, Stefan Witwicki, Shlomo Zilberstein, and Liam Pedersen. “Autonomous Vehicle Operation Management Including Operating a Partially Observable Markov Decision Process Model Instance.” Korean Patent 10-2199093. Granted on January 6, 2021.
- EP Patent 2020 I7 ● **Kyle Wray**, Stefan Witwicki, Shlomo Zilberstein, and Liam Pedersen. “Autonomous Vehicle Operational Management Blocking Monitoring.” European Patent 3,580,104. Granted on November 11, 2020.
- RU Patent 2020 I6 ● **Kyle Wray**, Stefan Witwicki, Shlomo Zilberstein, and Liam Pedersen. “Operational Control of Autonomous Vehicle, Including Operation of Model Instance of Partially Observed Markov Process of Decision Making.” Russian Patent 2,734,744. Granted on October 22, 2020.
- RU Patent 2020 I5 ● **Kyle Wray**, Stefan Witwicki, Shlomo Zilberstein, and Liam Pedersen. “Traffic Network Blocking Tracking During Operational Control of Autonomous Vehicle.” Russian Patent 2,734,732. Granted on October 22, 2020.
- RU Patent 2020 I4 ● **Kyle Wray**, Stefan Witwicki, Shlomo Zilberstein, and Liam Pedersen. “Real-Time Vehicle Control.” Russian Patent 2,733,015. Granted on September 28, 2020.
- RU Patent 2020 I3 ● **Kyle Wray**, Stefan Witwicki, Shlomo Zilberstein, and Liam Pedersen. “Control of Autonomous Vehicle Operational Control.” Russian Patent 2,725,920. Granted on July 7, 2020.
- KR Patent 2020 I2 ● **Kyle Wray**, Stefan Witwicki, Shlomo Zilberstein, and Liam Pedersen. “Autonomous Vehicle Operational Management Blocking Monitoring.” Korean Patent 10-2090919. Granted on May 18, 2020.
- KR Patent 2020 I1 ● **Kyle Wray**, Stefan Witwicki, Shlomo Zilberstein, and Liam Pedersen. “Autonomous Vehicle Operational Management Control.” Korean Patent 10-2090920. Granted on March 19, 2020.

ADDITIONAL PUBLICATIONS

Workshop Papers

- AAAI 2024 W10 ● Ava Pettet, Yunuo Zhang, Baiting Luo, **Kyle Wray**, Hendrik Baier, Aron Laszka, Abhishek Dubey, Ayan Mukhopadhyay. “Decision Making in Non-Stationary Environments with Policy-Augmented Search.” Proceedings of the 2024 AAAI Workshop on AI Planning for Cyber-Physical Systems (AAAI 2024 Workshop), February 2024.
- ECAI 2020 W9 ● Connor Basich, Justin Svegliato, Shlomo Zilberstein, **Kyle Hollins Wray**, and Stefan J. Witwicki. “Improving Competence for Reliable Autonomy.” Proceedings of the 2020 ECAI Workshop on Agents and Robots for Reliable Engineered Autonomy (ECAI 2020 Workshop), August 2020.

- RSS 2020 W8 • **Kyle Hollins Wray**, Bernard Lange, Arec Jamgochian, Stefan J. Witwicki, Atsuhide Kobashi, Sachin Hagaribommanahalli, and David Ilstrup. “POMDP Autonomous Vehicle Visibility Reasoning.” 2020 RSS Workshop on Interaction and Decision-Making in Autonomous Driving, July 2020.
- ICAPS 2019 W7 • Sandhya Saisubramanian, **Kyle Hollins Wray**, Luis Pineda, and Shlomo Zilberstein. “Planning in Stochastic Environments with Goal Uncertainty.” ICAPS Workshop on Planning and Robotics, Berkeley, CA, USA, June 2019.
- AAAI 2018 W6 • **Kyle Hollins Wray** and Shlomo Zilberstein. “Policy Networks for Reasoning in Long-Term Autonomy.” AAAI Fall Symposium on Reasoning and Learning in Real-World Systems for Long-Term Autonomy, pages 103–110, Arlington, VA, USA, October 2018.
- ICAPS 2017 W5 • **Kyle Hollins Wray** and Shlomo Zilberstein. “Approximating Reachable Belief Points in POMDPs with Applications to Robotic Navigation and Localization.” ICAPS Workshop on Planning and Robotics, pages 104–110, Pittsburgh, PA, USA, June 2017.
- IJCAI 2016 W4 • Luis Pineda, **Kyle Hollins Wray**, and Shlomo Zilberstein. “Fast SSP Solvers Using Short-Sighted Labeling.” IJCAI Fourth Workshop on Goal Reasoning, New York City, NY, USA, July 2016.
- AAAI 2015 W3 • Luis Pineda, **Kyle Hollins Wray**, and Shlomo Zilberstein. “Revisiting Multi-Objective MDPs with Relaxed Lexicographic Preferences.” AAAI Fall Symposium on Sequential Decision Making for Intelligent Agents, pages 63–68, Arlington, VA, USA, November 2015.
- AAAI 2014 W2 • **Kyle Hollins Wray** and Benjamin B. Thompson. “An Application of Multiagent Learning in Highly Dynamic Environments.” AAAI Workshop on Multiagent Interaction without Prior Coordination, pages 42–48, Quebec City, Canada, July 2014.
- AAAI 2014 W1 • **Kyle Hollins Wray** and Benjamin B. Thompson. “A Distributed Communication Architecture for Dynamic Multiagent Systems.” AAAI Workshop on Multiagent Interaction without Prior Coordination, pages 49–55, Quebec City, Canada, July 2014.

Extended Abstracts

- AAMAS 2024 EA5 • Ava Pettet, Yunuo Zhang, Baiting Luo, **Kyle Wray**, Hendrik Baier, Aron Laszka, Abhishek Dubey, Ayan Mukhopadhyay. “Decision Making in Non-Stationary Environments with Policy-Augmented Search (Extended Abstract).” In Proceedings of the Twenty-Third International Conference on Autonomous Agents and Multiagent Systems (AAMAS), Auckland, New Zealand, May 2024.
- RSS 2020 EA4 • **Kyle Hollins Wray** and Stefan J. Witwicki. “Multi-Objective POMDPs for Robust Autonomy.” 2020 RSS Workshop on Robust Autonomy, July 2020.
- AAMAS 2019 EA3 • **Kyle Hollins Wray** and Shlomo Zilberstein. “Policy Networks: A Framework for Scalable Integration of Multiple Decision-Making Models (Extended Abstract).” In Proceedings of the Eighteenth International Conference on Autonomous Agents and Multiagent Systems (AAMAS), pages 2270–2272, Montreal, Canada, May 2019.
- AAMAS 2016 EA2 • **Kyle Hollins Wray**, Luis Pineda, and Shlomo Zilberstein. “Hierarchical Approach to Transfer of Control in Semi-Autonomous Systems (Extended Abstract).” In Proceedings of the Fifteenth International Conference on Autonomous Agents and Multiagent Systems (AAMAS), pages 1285–1286, Singapore, May 2016.
- AAAI 2015 EA1 • **Kyle Hollins Wray** and Shlomo Zilberstein. “A Parallel Point-Based POMDP Algorithm Leveraging GPUs (Extended Abstract).” AAAI Fall Symposium on Sequential Decision Making for Intelligent Agents, pages 95–96, Arlington, Virginia, USA, November 2015.

THESES

- UMass 2019 T3 • **Kyle Hollins Wray**. “Abstractions in Reasoning for Long-Term Autonomy.” *Advisor*: Dr. Shlomo Zilberstein. University of Massachusetts Amherst, May 2019.
- PSU 2013 T2 • **Kyle Hollins Wray**. “Altruists and Egoists: A Local Interaction Model of Imitation in Social Graphs.” *Advisor*: Dr. Eli Byrne. The Pennsylvania State University, August 2013.
- PSU 2012 T1 • **Kyle Hollins Wray**. “A Game Theoretic Approach to Multi-Agent Systems in Highly Dynamic, Information-Sparse, Role Assignment Scenarios.” *Advisor*: Dr. Benjamin Thompson. The Pennsylvania State University, December 2012.

RESEARCH FUNDING AND GRANTS

Principal Investigator (PI) and Project Manager (PM)

- 2021–2022 • **Millions of USD:** Autonomous Driving Decision-Making and Route Planning System R&D Nissan North America
- 2021–2022 • **Millions of USD:** Next-Gen Hybrid Electric Vehicle Energy Management System R&D Nissan North America

Collaborations

- 2020–2022 • **\$195,547:** Introspective Perception and Planning for Long-Term Autonomy (UMass) (Industry Support) NSF
- 2020–2022 • **\$400,000:** Introspective Perception and Planning for Long-Term Autonomy (UT Austin) (Industry Support) NSF
- 2017–2019 • **\$707,512:** Reliable Semi-Autonomy with Diminishing Reliance on Humans (Shadow Wrote One-Third) NSF

TEACHING

Teaching Assistant (Lecturer)

University of Massachusetts Amherst

- 2015 • **Introduction to Problem Solving** (Undergraduate, Online), Robert Moll, *Topic:* Programming Foundations
- 2014 • **Introduction to Problem Solving** (Undergraduate, Online), Robert Moll, *Topic:* Programming Foundations
- 2014 • **Introduction to Problem Solving** (Undergraduate), Robert Moll, *Topic:* Programming Foundations
- 2013 • **Reasoning Under Uncertainty** (Undergraduate), Benjamin Marlin, *Topic:* Probability Theory and ML Intro

Teaching Assistant (Regular)

University of Massachusetts Amherst

- 2014 • **Artificial Intelligence** (Graduate), Shlomo Zilberstein, *Topic:* Core AI Course on Planning, (PO)MDPs, RL, & MAS

Guest Lecturer

Stanford University

- 2023 • **Decision Making Under Uncertainty** (Graduate), Mykel Kochenderfer, *Topic:* POMDP FSCs & Multi-Agent Systems
- 2022 • **Advanced Topics in Sequential Decision Making** (Graduate), Mykel Kochenderfer, *Topic:* SSP & Heuristic Search
- 2021 • **Decision Making Under Uncertainty** (Graduate), Mykel Kochenderfer, *Topic:* POMDP FSCs & Multi-Agent Systems
- 2020 • **Decision Making Under Uncertainty** (Graduate), Mykel Kochenderfer, *Topic:* POMDP FSCs & Multi-Agent Systems
- 2020 • **Advanced Topics in Sequential Decision Making** (Graduate), Mykel Kochenderfer, *Topic:* SSPs & Heuristic Search
- 2019 • **Decision Making Under Uncertainty** (Graduate), Mykel Kochenderfer, *Topic:* Multi-Agent Systems

Vanderbilt University

- 2024 • **AI for Social Impact** (Graduate), Ayan Mukhopadhyay, *Topic:* Long-Term Semi-Autonomy

San Jose State University

- 2021 • **Artificial Intelligence and Data Engineering** (Graduate), Stas Tiomkin, *Topic:* Approximate Solutions to POMDPs

University of Texas at Austin

- 2021 • **F1/10 Autonomous Driving (AD)** (Undergraduate), Joydeep Biswas, *Topic:* Scalable Decision-Making in AD

University of Massachusetts Amherst

- 2018 • **Artificial Intelligence** (Graduate), Ina Fiterau, *Topic:* Partially Observable Markov Decision Processes
- 2017 • **Artificial Intelligence** (Graduate), Shlomo Zilberstein, *Topic:* Bayesian Networks

LEADERSHIP, MANAGEMENT, AND MENTORSHIP

Researchers, Developers, and Engineers

2022–2023	● Dr. Marina Kollmitz, Roboticist, Robust AI	Path, Motion, and Trajectory Planning
2022	● Dr. Tim Caselitz, Research Scientist, Robust AI	Multi-Robot Mapping and World Model
2022	● Dr. Marcell Vazquez-Chanlatte, Researcher, Nissan	AD Reinforcement Learning and Belief Verification
2022	● Dr. Francisco Miranda, Senior Researcher, Nissan	Advanced AD Pedestrian Perception
2022	● Dr. Corey Heath, Researcher, Nissan	Advanced AD Pedestrian Decision-Making and Interaction
2021–2022	● Luis Bill, Researcher, Nissan	AD System Decision-Making Integration

Research Interns

2022	● Jeff Li Wen, Research Intern, Nissan	Nissan Powertrain Project
2022	● Tomer Arnon, Research Intern, Nissan	Nissan AD Lane Change Project
2021	● Anil Yildiz, Research Intern, Nissan	Nissan AD Learning Project
2019	● Connor Basich, Research Intern, Nissan	Nissan AD Safety Validation Project
2019	● Bernard Lange, Research Intern, Nissan	Nissan AD T-Intersection Project
2019	● Arec Jamgochian, Research Intern, Nissan	Nissan AD Pass Obstacle Project

Postdoctoral Scholars

2021–2023	● Dr. Esen Yel, Aeronautics and Astronautics, Stanford University	Nissan & Stanford AD Learning Project
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Doctoral Students

2023	● Harrison Delecki, Aeronautics and Astronautics, Stanford University	Nissan & Stanford POMDP Projects
2022–2023	● Rachel Freedman, EECS, University of California, Berkeley	Berkeley & Stanford POMDP Project
2021–2023	● Anil Yildiz, Aeronautics and Astronautics, Stanford University	Nissan & Stanford AD Learning Project
2023–2024	● Arec Jamgochian, Aeronautics and Astronautics, Stanford University	Stanford CPOMDP Solver Project
2021–2023	● Jeff Li Wen, Earth System Science, Stanford University	Stanford Wildfire AI Project
2022–2023	● Ava Pettet, Computer Science, Vanderbilt University	Vanderbilt & Stanford AI Project
2020–2022	● Tina Diao, Management Science and Engineering, Stanford University	Stanford Medical AI Project
2021	● Shuwa Miura, Computer Science, University of Massachusetts Amherst	Nissan & UMass Powertrain AI Project
2018–2019	● Justin Svegliato, Computer Science, University of Massachusetts Amherst	UMass Metareasoning Project
2018–2019	● Sandhya Saisubramanian, Computer Science, University of Massachusetts Amherst	UMass AI Project

Masters Students

2021–present	● Mahdi Al-Husseini, Aeronautics and Astronautics, Stanford University	Stanford Wildfire & Medevac AI Projects
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Additional Students

2020–2021	● Komail Rezaee, Sofia High School, Kabul, Afghanistan	Fellowship Project
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Doctoral Thesis Committees

2024	● Arec Jamgochian, Aeronautics and Astronautics, Stanford University	<i>Advisor:</i> Mykel Kochenderfer
2020	● Edward Balaban, Aeronautics and Astronautics, Stanford University	<i>Advisor:</i> Mykel Kochenderfer

PUBLIC COMMUNICATION AND INVITED TALKS

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- Stanford 2021 • “AI Safety in Practice.” Panelist. Stanford Center for AI Safety, September, 2021.
 - ICAPS 2020 • “Abstractions in Reasoning for Long-Term Autonomy.” International Conference on Planning, and Scheduling (ICAPS), October, 2020.
 - Berkeley 2020 • “Multi-Objective Decision-Making in Autonomous Vehicles.” Berkeley Artificial Intelligence Research (BAIR) Laboratory, University of California, Berkeley, October 2020.
 - Stanford 2019 • “Abstractions in Reasoning for Long-Term Autonomy.” Stanford Intelligent Systems Laboratory (SISL), Stanford University, August 2019.
 - UNH 2018 • “POMDPs for Robots with Applications to Autonomous Vehicles.” Artificial Intelligence Research Group, University of New Hampshire (UNH), May 2018.
 - Brown 2018 • “Multi-Objective Decision-Making in Autonomous Vehicles.” Humanity-Centered Robotics Initiative (HCRI), Brown University, February 2018.
 - Berkeley 2017 • “POMDPs for Robots with Applications to Autonomous Vehicles.” Berkeley Artificial Intelligence Research (BAIR) Laboratory, University of California, Berkeley, July 2017.
 - NATC 2017 • “Multi-Objective Decision-Making in Autonomous Vehicles.” Nissan Advanced Technology Center (NATC), Atsugi, Japan, June 2017.
 - ARL 2012 • “Defender: A Dynamic Predator-Prey Problem.” Office of Naval Research (ONR), Applied Research Laboratory (ARL), July 2012.

PROFESSIONAL SERVICE**Area Chair, Organizer, and Guest Editor**

- AAAI 2024 • **Area Chair**, AAAI Conference on Artificial Intelligence Conference
- JATS 2024 • **Co-Guest Editor**, ACM Journal of Autonomous Transportation Systems Special Issue Journal
- AAAI 2018 • **Chair and Co-Organizer**, AAAI Fall Symposium on Long-Term Autonomy Conference

Associate Editor and Senior Program Committee Member

- RA-L 2024 • **Associate Editor**, IEEE Robotics and Automation Letters Journal
- ICAPS 2024 • **Senior Program Committee**, International Conference on Automated Planning and Scheduling Conference
- RA-L 2023 • **Associate Editor**, IEEE Robotics and Automation Letters Journal
- AAAI 2023 • **Senior Program Committee**, AAAI Conference on Artificial Intelligence Conference
- AAAI 2022 • **Senior Program Committee**, AAAI Conference on Artificial Intelligence Conference
- AAAI 2021 • **Senior Program Committee**, AAAI Conference on Artificial Intelligence Conference
- AAAI 2020 • **Senior Program Committee**, AAAI Conference on Artificial Intelligence Conference

Reviewer and Program Committee Member

- CASE 2024 • **Reviewer**, International Conference on Automation Science and Engineering Conference
- JAIR 2024 • **Reviewer**, Journal of Artificial Intelligence Research Journal
- ICRA 2024 • **Reviewer**, International Conference on Robotics and Automation Conference
- JAIR 2023 • **Reviewer**, Journal of Artificial Intelligence Research Journal
- RA-L 2023 • **Reviewer**, IEEE Robotics and Automation Letters Journal
- ICRA 2023 • **Reviewer**, International Conference on Robotics and Automation Conference
- JAIR 2023 • **Reviewer**, Journal of Artificial Intelligence Research Journal
- AIJ 2022 • **Reviewer**, Artificial Intelligence Journal
- IROS 2022 • **Reviewer**, International Conference on Intelligent Robots and Systems Conference

ICRA 2022	● Reviewer , International Conference on Robotics and Automation	Conference
RA-L 2022	● Reviewer , IEEE Robotics and Automation Letters	Journal
JAIR 2021	● Reviewer , Journal of Artificial Intelligence Research	Journal
AIJ 2021	● Reviewer , Artificial Intelligence	Journal
RAS 2021	● Reviewer , Robotics and Autonomous Systems	Journal
JAIS 2021	● Reviewer , Journal of Aerospace Information Systems	Journal
IROS 2020	● Reviewer , International Conference on Intelligent Robots and Systems	Conference
AIJ 2020	● Reviewer , Artificial Intelligence	Journal
JAIR 2019	● Reviewer , Journal of Artificial Intelligence Research	Journal
AAAI 2019	● Program Committee , AAAI Conference on Artificial Intelligence	Conference
ICRA 2019	● Reviewer , International Conference on Robotics and Automation	Conference
NIPS 2018	● Reviewer , Neural Information Processing Systems	Conference
ICAPS 2018	● Subreviewer , International Conference on Automated Planning and Scheduling	Conference
IJCAI 2016	● Subreviewer , International Joint Conference on Artificial Intelligence	Conference
ICAPS 2016	● Subreviewer , International Conference on Automated Planning and Scheduling	Conference
IJCAI 2015	● Program Committee , International Joint Conference on Artificial Intelligence	Conference
RAS 2014	● Reviewer , Robotics and Autonomous Systems	Journal

PROFESSIONAL MEMBERSHIPS

- 2023–present ● **Member**, American Institute of Aeronautics and Astronautics (AIAA)
- 2011–present ● **Member**, Association for the Advancement of Artificial Intelligence (AAAI)
- 2011–present ● **Member**, Institute of Electrical and Electronics Engineers (IEEE)
- 2011–present ● **Member**, Association for Computing Machinery (ACM)

TECHNICAL SKILLS

<i>Programming (Main):</i>	C, C++, Python, Julia, LaTeX
<i>Programming (Other):</i>	Bash, Z Shell, Javascript/Typescript, CUDA, HTML/CSS, Java, Matlab/Simulink, Visual Basic 6.0
<i>Libraries:</i>	ROS, gRPC, OR-Tools, SQLAlchemy, PostgreSQL, POMDPs.jl, JuMP, Flux, SDL, GTK, OpenGL
<i>Software (Development):</i>	Git, Docker, Gimp, Inkscape, Solidworks
<i>Software (Management):</i>	GitLab, GitHub, Jira, Bitbucket, Monday.com, Microsoft Office, Google Workspace
<i>Technical Project Management:</i>	Gantt, Agile, Scrum, Kanban
<i>Operating Systems:</i>	Linux (Arch, Ubuntu), MacOS, Windows

REFERENCES

Available Upon Request