Zachary Nolan Sunberg

Ann and H. J. Smead Aerospace Engineering Sciences
University of Colorado Boulder
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Academic Appointments

Assistant Professor [January 2020 – Present]
University of Colorado, Boulder, CO
Ann and H. J. Smead Aerospace Engineering Sciences Department

Postdoctoral Research Scholar [October 2018 – October 2019]
University of California, Berkeley, CA
Supervisor: Claire Tomlin, Hybrid Systems Laboratory

Education

Doctor of Philosophy in Aeronautics and Astronautics [2018]
Stanford University, Stanford, CA
Advisor: Mykel Kochenderfer | Thesis: "Safety and Efficiency in Autonomous Vehicles through Planning with Uncertainty"

Master of Science in Aerospace Engineering [2013]
Texas A&M University, College Station, TX
Advisor: Jonathan Rogers | Thesis: "A Real Time Expert Control System for Helicopter Autorotation"

Bachelor of Science in Aerospace Engineering [2011]
Texas A&M University, College Station, TX
Summa cum Laude, Minor in Mathematics

Industry Experience

Google, Inc., Mountain View, CA [Summer 2014]
Software Engineering Intern
Evaluated and optimized a NASA collision avoidance program for use with Google self-piloted air vehicles.

Lockheed Martin Autonomous Systems, Littleton, CO [Summer 2009]
Engineering Intern
Helped in testing of autonomous SMSS allterrain military transport vehicle navigation system; wrote rough terrain navigation program in C++ based on the A* search algorithm; wrote software in C++ for analyzing the performance of an advanced video analysis tool.

Awards and Fellowships

NSF CAREER Award	[2024]
IET Cyberphysical Systems Journal Premium Paper Award	[2023]
AIAA Journal of Guidance, Control, and Dynamics Excellent Reviewer	[2021,2022]
IJCAI 2019 Distinguished Program Committee member	[2019]
Association for the Advancement of Artificial Intelligence (AAAI) Doctoral Consortium	[2018]
National Science Foundation Graduate Research Fellowship	[2012-2016]

Publications

My name and the names of my students are indicated with bold font.

Peer Reviewed Journal Articles

[J1] Prashin Sharma, **Benjamin Kraske**, Joseph Kim, **Zakariya Laouar**, Ella Atkins, and **Zachary Sunberg**. "Risk-Aware Markov Decision Process Contingency Management Autonomy for Uncrewed Aircraft Systems". In: *AIAA Journal of Aerospace Information Systems (JAIS)* 21.3 (2024). DOI: 10.2514/1.I011235. URL: 🔗

[J2] **Qi Heng Ho**, **Zachary N. Sunberg**, and Morteza Lahijanian. "Sampling-based Reactive Synthesis for Nondeterministic Hybrid Systems". In: *Robotics and Automation Letters (RA-L)* 9.2 (2024). DOI: 10.1109/LRA.2023.3340029. URL: 🔗

[J3] **Michael H. Lim**, **Tyler J. Becker**, Mykel J. Kochenderfer, Claire J. Tomlin, and **Zachary N. Sunberg**. "Optimality Guarantees for Particle Belief Approximation of POMDPs". In: *Journal of Aritificial Intelligence Research* 77 (2023). DOI: 10.1613/jair.1.14525. URL: 🔗

[J4] Benjamin W. Blonder, **Michael H. Lim**, **Zachary Sunberg**, and Claire Tomlin. "Navigation between initial and desired community states using shortcuts". In: *Ecology Letters* 26.4 (2023). DOI: 10.1111/ele.14171. URL: 🔗

[J5] **Zachary Sunberg** and Mykel Kochenderfer. "Improving Automated Driving through Planning with Human Internal States". In: *IEEE Transactions on Intelligent Transportation Systems* 23.11 (2022). DOI: 10.1109/TITS.2022.3182687. URL: 🔗

[J6] Shakeeb Ahmad, **Zachary N. Sunberg**, and J. Sean Humbert. "End-to-End Probabilistic Depth Perception and 3D Obstacle Avoidance using POMDP". in: *Journal of Intelligent & Robotic Systems* 103.2 (2021), pp. 1–18. DOI: 10.1007/s10846-021-01489-w

[J7] Patrick Slade, **Zachary Sunberg**, and Mykel J. Kochenderfer. "Estimation and Control Using Sampling-Based Bayesian Reinforcement Learning". In: *IET Cyber-Physical Systems: Theory and Applications* 5 (1 2020). DOI: 10.1049/iet-cps.2019.0045. URL: 🔗

[J8] Maxim Egorov, **Zachary N. Sunberg**, Edward Balaban, Tim A. Wheeler, Jayesh K. Gupta, and Mykel J. Kochenderfer. "POMDPs.jl: A Framework for Sequential Decision Making under Uncertainty". In: *Journal of Machine Learning Research* 18.26 (2017), pp. 1–5. URL: 🔗

[J9] **Zachary Sunberg**, Suman Chakravorty, and Richard Scott Erwin. "Information Space Receding Horizon Control for Multisensor Tasking Problems". In: *IEEE Transactions on Cybernetics* 46.6 (2016), pp. 1325–1336. URL: 🔗

[J10] **Zachary N. Sunberg**, Nathaniel R. Miller, and Jonathan D. Rogers. "A Real-Time Expert Control System For Helicopter Autorotation". In: *Journal of the American Helicopter Society* 60.2 (2015), pp. 1–15. ISSN: 2161-6027. DOI: 10.4050/JAHS.60.022008. URL: 🔗

[J11] **Zachary Sunberg**, Suman Chakravorty, and Richard Scott Erwin. "Information Space Receding Horizon Control". In: *IEEE Transactions on Cybernetics* 43.6 (2013), pp. 2255–2260. DOI: 10.1109/TSMCB.2012.2236313. URL: 🔗

[J12] **Zachary Sunberg** and Jonathan Rogers. "A Belief Function Distance Metric for Orderable Sets". In: *Information Fusion* 14.4 (2013), pp. 361–373. ISSN: 1566-2535. DOI: 10.1016/J.INFFUS.2013.03.003. URL: 🔗

Peer Reviewed Journal-Equivalent Conference Publications

Journal-equivalent conference publications have rigorous peer review of the entire article, an acceptance rate of approximately 30% or less, and are recognized to be as important as journal papers in the field.

[JC1] **Qi Heng Ho**, **Tyler Becker**, **Benjamin Kraske**, **Zakariya Laouar**, Martin S. Feather, Federico Rossi, Morteza Lahijanian, and **Zachary N. Sunberg**. "Recursively-Constrained Markov Decision Processes". In: *The 40th Conference on Uncertainty in Artificial Intelligence*. 2024. URL: 🔗

[JC2] **Qi Heng Ho**, Martin S. Feather, Federico Rossi, **Zachary N. Sunberg**, and Morteza Lahijanian. "Sound Heuristic Search Value Iteration for Undiscounted POMDPs with Reachability Objectives". In: *The 40th Conference on Uncertainty in Artificial Intelligence*. 2024. URL: 🔗

[JC3] Matt-Heun Hong, **Zachary Sunberg**, and Danielle Szafir. "Cieran: Designing Sequential Colormaps with a Teachable Robot". In: *Human Factors in Computing Systems (CHI)*. 2024. DOI: 10.1145/3613904.3642903

[JC4] **Himanshu Gupta**, Bradley Hayes, and **Zachary Sunberg**. "Intention-Aware Navigation in Crowds with Extended-Space POMDP Planning". In: *Autonomous Agents and Multi-Agent Systems (AAMAS)*. 2022. DOI: 10.48550/arXiv.2206.10028. URL: 🔗

[JC5] John Mern, Anil Yildiz, **Zachary Sunberg**, Tapan Mukerji, and Mykel J. Kochenderfer. "Bayesian Optimized Monte Carlo Planning". In: *AAAI Conference on Artificial Intelligence (AAAI)*. 2021. DOI: 10.1609/aaai.v35i13.17411

[JC6] **Michael H. Lim**, Claire J. Tomlin, and **Zachary N. Sunberg**. "Sparse Tree Search Optimality Guarantees in POMDPs with Continuous Observation Spaces". In: *International Joint Conference on Artificial Intelligence (IJCAI)*. 2020. DOI: 10.24963/ijcai.2020/572

[JC7] **Lasse Peters**, David Fridovich-Keil, Claire Tomlin, and **Zachary Sunberg**. "Inference-Based Strategy Alignment for General-Sum Differential Games". In: *International Conference on Autonomous Agents and Multiagent Systems (AAMAS)*. 2020. DOI: 10.48550/arXiv.2002.04354. URL: 🔗

[JC8] **Zachary N. Sunberg** and Mykel J. Kochenderfer. "Online Algorithms for POMDPs with Continuous State, Action, and Observation Spaces". In: *International Conference on Automated Planning and Scheduling (ICAPS)*. Delft, 2018. DOI: 10.1609/icaps.v28i1.13882. URL: 🔗

Peer Reviewed Conference Publications

Peer reviewed conference publications are selected based on peer review of the entire article, but are considered less rigorous and selective than journal-equivalent conference publications.

[C1] **Zakariya Laouar**, **Qi Heng Ho**, Rayan Mazouz, **Tyler Becker**, and **Zachary N. Sunberg**. "Feasibility-Guided Safety-Aware Model Predictive Control for Jump Markov Linear Systems". In: *IEEE International Conference on Intelligent Robots and Systems (IROS)*. Accepted. 2024

[C2] Hunter M Ray*, **Zakariya Laouar***, **Zachary N. Sunberg**, and Nisar Ahmed. "Human-Centered Autonomy for Autonomous sUAS Target Search". In: *IEEE International Conference on Robotics and Automation (ICRA)*. (* equal contribution). 2024. DOI: 10.48550/arXiv.2309.06395

[C3] Sampada Deglurkar, **Michael H. Lim**, **Johnathan Tucker**, **Zachary N. Sunberg**, Aleksandra Faust, and Claire J. Tomlin. "Compositional Learning-based Planning for Vision POMDPs". In: *Learning for Dynamics & Control (L4DC)*. 2023. DOI: 10.48550/arXiv.2112.09456. URL: 🔗

[C4] **Qi Heng Ho**, **Zachary N. Sunberg**, and Morteza Lahijanian. "Planning with SiMBA: Motion Planning under Uncertainty for Temporal Goals using Simplified Belief Guides". In: *IEEE International Conference on Robotics and Automation (ICRA)*. London, England, UK, May 2023. DOI: 10.1109/ICRA48891.2023.10160897. URL: 🔗

[C5] **Benjamin D. Kraske**, Anshu Saksena, Anna L. Buczak, and **Zachary Sunberg**. "Explanation through Reward Model Reconciliation using POMDP Tree Search". In: *IEEE International Conference on Assured Autonomy (ICAA)*. 2023. DOI: 10.1109/ICAA58325.2023.00027. URL: 🔗

[C6] **Qi Heng Ho**, Roland B. Ilyes, **Zachary Sunberg**, and Morteza Lahijanian. "Automaton-Guided Control Synthesis for Signal Temporal Logic Specifications". In: *IEEE Conference on Decision and Control (CDC)*. 2022. DOI: 10.1109/CDC51059.2022.9993090. URL: 🔗

[C7] **Qi Heng Ho**, **Zachary N. Sunberg**, and Morteza Lahijanian. "Gaussian Belief Trees for Chance Constrained Asymptotically Optimal Motion Planning". In: *IEEE International Conference on Robotics and Automation (ICRA)*. 2022, pp. 11029–11035. DOI: 10.1109/ICRA46639.2022.9812343

[C8] **Zachary Nolan Sunberg**, Kathryn Anne Wingate, and Lara Buri. "Fair Senior Capstone Project Teaming based on Skills, Preferences, and Friend Groups". In: *ASEE Annual Conference*. 2021. DOI: 10.18260/1-2--37187. URL: 🔗

[C9] **Michael H. Lim**, Claire J. Tomlin, and **Zachary N. Sunberg**. "Voronoi Progressive Widening: Efficient Online Solvers for Continuous Space MDPs and POMDPs with Provably Optimal Components". In: *Conference on Decision and Control (CDC)*. 2021. DOI: 10.1109/CDC45484.2021.9683490. URL: 🔗

[C10] Shakeeb G. Ahmad, **Zachary Sunberg**, and Sean Humbert. "APF-PF: Probabilistic Depth Perception for 3D Reactive Obstacle Avoidance". In: *American Control Conference (ACC)*. 2021. DOI: 10.23919/ACC50511.2021.9482894

[C11] Ekhlas Sonu, **Zachary Sunberg**, and Mykel J. Kochenderfer. "Exploiting Hierarchy for Scalable Decision Making in Autonomous Driving". In: *Intelligent Vehicles Symposium*. Changshu, 2018. DOI: 10.1109/IVS.2018.8500681

[C12] **Zachary N. Sunberg**, Christopher J. Ho, and Mykel J. Kochenderfer. "The Value of Inferring the Internal State of Traffic Participants for Autonomous Freeway Driving". In: *American Control Conference (ACC)*. Seattle, 2017. DOI: 10.23919/ACC.2017.7963408. URL: 🔗

[C13] Patrick Slade, Preston Culbertson, **Zachary Sunberg**, and Mykel J. Kochenderfer. "Simultaneous Active Parameter Estimation and Control using Sampling-based Bayesian Reinforcement Learning". In: *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*. 2017. DOI: 10.1109/IROS.2017.8202242. URL: 🔗

[C14] **Zachary Sunberg**, Mykel J. Kochenderfer, and Marco Pavone. "Optimized and Trusted Collision Avoidance for Unmanned Aerial Vehicles using Approximate Dynamic Programming". In: *IEEE International Conference on Robotics and Automation (ICRA)*. Stockholm, 2016. DOI: 10.1109/ICRA.2016.7487280. URL: 🔗

[C15] **Zachary Sunberg**, Suman Chakravorty, and Richard Erwin. "Information space sensor tasking for Space Situational Awareness". In: *American Control Conference (ACC)*. June 2014, pp. 79–84. DOI: 10.1109/ACC.2014.6858922

[C16] **Zachary Sunberg**, Nathaniel Miller, and Jonathan Rogers. "A Real Time Expert Control System for Helicopter Autorotation". In: *70th Forum of the American Helicopter Society*. Montreal, 2014

Conference Publications with Abstract-only Review

[A1] **Johnathan Tucker**, **Jackson Wagner**, and **Zachary Sunberg**. "Adaptive Stress Testing Applied To Space Domain Awareness Systems". In: *Advanced Maui Optical and Space Surveillance Technologies (AMOS)*. 2022. URL: 🔗

[A2] **Tyler Becker** and **Zachary Sunberg**. "Imperfect Information Games and Counterfactual Regret Minimization in Space Domain Awareness". In: *Advanced Maui Optical and Space Surveillance Technologies (AMOS)*. 2022. URL: 🔗

[A3] Hunter M. Ray, Nicholas Conlon, **Zachary Sunberg**, and Nisar R. Ahmed. "User Preference Elicitation for Unmanned Aircraft System Collaborative Search". In: *AIAA SCITECH Forum*. 2022, p. 2343. DOI: 10.2514/6.2022-2343

[A4] **Zachary Sunberg** and Jonathan Rogers. "A Fuzzy Logic-Based Controller for Helicopter Autorotation". In: *AIAA Aerospace Sciences Meeting*. Grapevine, 2013. DOI: 10.2514/6.2013-1150

Journal and Journal-equivalent Papers Under Review or Near Submission

[X1] **Tyler Becker** and **Zachary Sunberg**, "Bridging the Gap between Partially Observable Stochastic Games and Sparse POMDP Methods", In preparation for submission to Autonomous Agents and Multi-Agent Systems (AAMAS), recently declined from Advances in Neural Information Processing Systems (NeurIPS).

[X2] **Qi Heng Ho**, Kiril Solovey, **Zachary Sunberg**, and Morteza Lahijanian, "Gaussian Belief Trees: Generalizing State Space Motion Planners for Chance Constrained Motion Planning under Uncertainty", In preparation for submission to IEEE Transactions on Robotics.

[X3] **Austin Monell** and **Zachary Sunberg**, "The V-twin Configuration for Airborne Wind Energy", In preparation for submission to Wind Energy Science.

[X4] **Tyler Becker** and **Zachary Sunberg**, "Partially Observable Stochastic Games in Space Domain Awareness", In preparation for submission to Advances in Space Research.

Open Source Software

POMDPs.jl [2015 – present]
`https://github.com/JuliaPOMDP/POMDPs.jl`
Interface for defining continuous and discrete, fully and partially observable Markov decision processes along with a suite of state-of-the art solvers written in Julia and C++ [J8]. 33 direct package contributors, 44 dependent packages, 650 GitHub stars, 430 monthly downloads according to `juliahub.com`.

ProjectAssigner.jl [2020]
`https://github.com/zsunberg/ProjectAssigner.jl`
Software for optimally assigning student teams to projects based on preferences, friend groups, and skills [C8]. Used to assign senior project groups in the AES department since 2020.

Research Funding

Funding sources are classified by my role:
o "PI" ($839k total awards; $788k my share): I am the sole or lead principal investigator for the entire project;
o "CU PI" ($4.5m total awards; $1.4m my share): I am the lead investigator at CU, but the overall PI is at another institution;
o "Co-I" ($8.3m total awards; $1.2m my share) I am a co-investigator, but there is another ranking PI at CU.
The first amount listed is the total award amount; if applicable, the second amount is the share specifically for the ADCL.

PI: CAREER: Game-theoretic Online Planning in Partially Observable Domains [2024 – 2029]
National Science Foundation
$599,985

CU PI: DECODE AI: Deception and Counter-Deception in Artificial Intelligence [2024 – 2028]
Office of Naval Research
$4,150,000 (total award) | $1,014,000 (my share); PI: Matthew Hale, Georgia Tech, Co-Is: Ufuk Topku, UT Austin; Ruimeng Hu, UCSB

CU PI: Collaborative Research: Alternative Leaf Water use Strategies in Hot Environments [2023 – 2024]
National Science Foundation
$944,823 (total award) | $99,976 (my share), PI: Ben Blonder, UC Berkeley; (I did not participate in securing this grant, but was subcontracted to work on it later.)

PI: Human Centered Autonomy for Dynamic sUAS Target Search Operations [2023 – 2024]
NSF Center for Autonomous Air Mobility and Sensing (CAAMS) Sub-award
$111,000 (total award) | $60,000 (my share, approx.); Co-I: Nisar Ahmed, CU Boulder

Co-I: Multi-Phenomenological, Autonomous . . . Decision Support [2023 – 2028]
Air Force Office of Scientific Research
$5,000,000 (total award, approx.) | $500,000 (my share, approx.), PI: Marcus Holtzinger, CU Boulder; Co-Is: K. Terry Alfriend (TAMU), Scott Palo, Kyle DeMars (TAMU), John Junkins (TAMU), Karen Feigh (Georgia Tech) | Full title: Multi-Phenomenological, Autonomous, and Understandable SDA and XDA Decision Support

Co-I: IUCRC Phase I: Center for Autonomous Air Mobility and Sensing (CAAMS) [2022 – 2027]
National Science Foundation
$2,210,225 (total award) | $0 (my direct share - all funds shared for travel and administrative costs), PI: Eric Frew, CU Boulder; Co-Is: Nisar Ahmed, Morteza Lahijanian, and Sriram Sankaranarayanan, CU Boulder; This grant establishes the IUCRC; sub-awards funded through industry contributions are listed separately.

Co-I: Dispersed Autonomy for Marsupial Aerial Robot Teams [2022 – 2025]
National Science Foundation | National Robotics Institute (Collaborative Research)
$1,045,429 (total award) | $300,000 (my share, approx.), PI: Eric Frew; Co-Is: Brian Argrow, Adam Houston (University of Nebraska, Lincoln)

PI: HIPPO (Human-Informed Planning with Probabilistic Observations) [2022-2023]
NSF Center for Autonomous Air Mobility and Sensing (CAAMS) Sub-award
$68,000

CU PI: SURP: Fast planning under uncertainty with operational and safety guarantees [2022-2024]
NASA Jet Propulsion Laboratory
$120,000 (total award) | $100,000 (my share), PI: Federico Rossi, JPL; Co-I: Morteza Lahijanian, CU Boulder

CU PI: Elektra: Naval Defensive Resource Allocation through POMDP Optimization [2021 – 2023]
Office of Naval Research (Subcontract of Johns Hopkins University Applied Physics Lab)
$169,805 | Subcontract on larger award of unknown total amount

Co-I: L3Harris Modern Analytics for Mission Applications (LMA2) [2021-2023]
L3-Harris Technologies
$1,495,048 (total award) | $350,000 (my share, approx.), PI: Marcus Holzinger, CU Boulder (I did not participate in securing this grant, but began work on it later.)

CU PI: Full Stack Planning and Control under Uncertainty [2021 – 2022]
NSF Center for Unmanned Aircraft Systems (C-UAS) Sub-award
$130,000 (total award) | $65,000 (my share), Co-PI Ella Atkins, Univ. of Michigan

PI: POMDP Algorithms for In-flight Learning in Emergencies [2020 – 2021]
NSF Center for Unmanned Aircraft Systems (C-UAS) Sub-award
$60,000

Declined Proposals

(I have no proposals currently pending.)

PI: Online POMDP Planning for Active Competence in Autonomous Vehicles [2023]
General Motors
$24,466 (total award) | $24,466 (my share) | Co-Is: Stefano Bonasera and Daniel Marsillach (General Motors)

CU-PI: Draper Scholar Program: Online AUV Task Planning for Persistent Undersea Surveillance [2023]
The Charles Stark Draper Laboratory
$500,000 (total award, approx.) | $500,000 (my share, approx.) | PI: Michael B. Gratton (Draper)

Co-I: MARDET: Multi-Agent Robotic Disaster Exploration and Triage [2023]
Defence Advanced Research Projects Agency
$2,249,993 (total award) | $500,000 (my share, approx.) | PI: Steve McGuire (University of California, Santa Cruz); Co-Is: Christoffer Heckman and Sean Humbert (CU Boulder); Danielle Caroll, (Orbital Biodesign)

Co-I: In the moment (ITM): Aligned Algorithmic Aide (ALAI) [2022]
Defence Advanced Research Projects Agency
$6,200,000 (total award) | $450,000 (my share) | PI: Brett Israelson (Raytheon); Co-Is: Barclay Brown (Collins Aerospace); Edward Boyer (The Ohio State University); Nisar Ahmed (CU Boulder)

PI: CAREER: Active competence through online Bayesian reasoning [2021]
National Science Foundation
$599,341 | Full title: CAREER: Towards reliable autonomy in open environments: active competence through online Bayesian reasoning

Co-I: RACER-Sim [2021]
Defence Advanced Research Projects Agency
Budget details are controlled unclassified information (CUI) | PI: Christoffer Heckman; Co-I: Zachary Manchester (CMU)

PI: Hazard mitigation for self-piloted vehicles... [2020]
National Aeronautics and Space Administration
$806,411 (total award) | $400,000 (my share, approx.) | Full title: Hazard mitigation for self-piloted vehicles through POMDP planning and formal controller synthesis | Co-I: Majid Zamani

PI: Enabling rapid and flexible medical planning research with POMDPs.jl [2020]
Chan Zuckerberg Initiative
$91,053

Co-I: AVATAR-ACE (AViator-Agent Trusted AI for Real-time Air Combat Engagements) [2020]
Defence Advanced Research Projects Agency
$5,000,000 (total award, approx.)| My share: $660,000 (approx.) | PI: Krishna Kalyanam (Palo Alto Research Center); Co-Is: Roni Stern, Shiwali Mohan, Wiktor Piotrowski (PARC); John Boehm (Advanced Strategic Insight); Andrew Van Timmeren (Vechter Technologies); Nisar Ahmed (CU Boulder)

Invited Talks and Panels

[I1] **Autonomy Talks Series, Massachusetts Institute of Technology (MIT)** (*Online*)**:** "Breaking the curse of dimensionality in POMDPs with sampling-based online planning". 2024. `https://www.youtube.com/watch?`

v=XDIyXOtanjk

[I2] **University of California, San Diego:** "Breaking the curse of dimensionality in POMDPs with sampling-based online planning". 2024

[I3] **University of Illinois Urbana-Champaign (UIUC):** "Safe and efficient autonomy in the face of uncertainty". 2022

[I4] **University of Texas at Austin:** "Safe and efficient autonomy in the face of uncertainty". 2022

[I5] **Korea Advanced Institute of Science and Technology (KAIST)** (*Online*)**:** "Safe and efficient autonomy in the face of state and interaction uncertainty". 2022

[I6] **AIAA Rocky Mountain Annual Technical Symposium:** "Machine Learning in Aerospace Systems". 2021 (panel)

[I7] **NASA Jet Propulsion Lab,** *Pasadena, CA***:** "Scalable online POMDP planning for safe and efficient autonomy". 2021

[I8] **Johns Hopkins University Applied Physics Lab,** *Laurel, MD***:** "Some Recent Advances in Online POMDP Algorithms". 2021

[I9] **SRI International,** *Palo Alto, CA***:** "Safety and Efficiency for Autonomous Vehicles through Online Learning". 2019

[I10] **Washington State University,** *Pullman, WA***:** "Safety and Efficiency for Autonomous Vehicles through Online Learning". 2019

[I11] **University of Colorado,** *Boulder, CO***:** "Safety and Efficiency for Autonomous Vehicles through Online Learning". 2019

[I12] **Renault-Nissan Research,** *Sunnyvale, CA***:** "Safety and Efficiency in Autonomous Vehicles through POMDP Planning". 2018

[I13] **Lyft Level 5,** *Palo Alto, CA***:** "Safety and Efficiency in Autonomous Vehicles through Planning with Uncertainty". 2018

[I14] **Makani,** *Alameda, CA***:** "Algorithms for Uncertain, Non-convex Control Problems in the Real World". 2018

[I15] **Indeed,** *San Francisco, CA***:** "Safety and Efficiency in Autonomous Vehicles through Planning with Uncertainty". 2018

Other Presentations

JuliaCon 2021: "POMDPs.jl and Interactive Assignments in Julia". 2021

Julia in Controls Workshop, *ACC, Seattle, WA*: "POMDPs.jl". 2017

Open Source Software for Decision Making (OSS4DM), *Stanford, CA*: "POMDPs.jl - Challenges and Lessons Learned". 2017

Teaching

At CU Boulder

ASEN 3728/3128 Aircraft Dynamics [Fa 2022, Sp 2024]
University of Colorado Boulder, typical enrollment: 140
Required Junior-level course in aircraft dynamics, stability, and control.
Team taught with Prof. Eric Frew in 2022.
Open-source course materials: `https://github.com/zsunberg/Aircraft-Dynamics-Materials`

ASEN 5264 Decision Making under Uncertainty [Sp 2020, Sp 2021, Sp 2022, Sp 2023, Sp 2024]
University of Colorado Boulder, typical enrollment: 30-50
New entry-level graduate course about decision making under uncertainty created by me.
Open-source course materials: `https://github.com/zsunberg/CU-DMU-Materials`
Open-source companion software package: `https://github.com/zsunberg/DMUStudent.jl`

ASEN 6519 Advanced Survey of Sequential Decision Making [Fa 2021, Fa 2023]
University of Colorado Boulder, typical enrollment: 10-15
New advanced graduate course that surveys recent advances in decision making under uncertainty created by me.

ASEN 4018/4028 Senior Design Project [Fa 2020-Sp 2021]
University of Colorado Boulder, typical enrollment: 250-300, team size: 9-12
Capstone senior design course. I mentored two teams and created new optimization-based approach (see Open Source Software) for fairly creating teams based on student preferences [C8].

Prior to CU Boulder

Army High Performance Computing Summer Institute [June 2017]
Stanford University, Stanford, CA
Developed and taught a 5 lecture course about decision making under uncertainty for college students.

Stanford Artificial Intelligence Lab OutReach Summer (SAILORS, now AI4ALL) [2015-2017]
Stanford University, Stanford, CA
Developed and taught a 2 week course and project for high school students that included programming robots for optical line following and using Dijkstra's algorithm to find the shortest path on a road network; only project mentor to serve all three years of the program. `http://ai-4-all.org/`

AA-228/CS-238 Decision Making Under Uncertainty [Autumn 2016]
Stanford University, Stanford, CA
Head course assistant for a class of around 200; developed problems for midterm project; gave guest lectures on the POMDPs.jl framework and autonomous driving research; project software reused at Iowa State University.

Advising and Mentoring

Postdoctoral Scholars

Ofer Dagan [2024 – present]

Graduated Ph.D. Thesis Advisees

Hyun Jae (Michael) Lim (Co-advised with Claire Tomlin at U.C. Berkeley) [2020 – 2023]
AI Scientist, C3.ai

Current Ph.D. Thesis Advisees

Qi Heng Ho (Comprehensive exam spring 2024)	[Fall 2020 – Present]
Tyler Becker (Prelim exam fall 2021)	[Fall 2020 – Present]
Ben Kraske (Prelim exam fall 2021, Received NSF GRFP)	[Fall 2020 – Present]
Zakariya Laouar (Prelim exam fall 2022)	[Fall 2021 – Present]
Himanshu Gupta (Prelim exam fall 2023)	[Fall 2020 (Started as MS) – Present]
Jackson Wagner (Attempting prelim exam fall 2024)	[Summer 2022 – Present]

Graduated M.S. Thesis Advisees

William Pope [Spring 2022 – Fall 2022]
U.S. Space Force Officer

Independent Study Advisees

Johnathan Tucker (Received NSF GRFP under my direction)	[Fall 2020 – Summer 2022]
Saurabh Mishra	[Spring 2020]
Austin Monell	[2023 – 2024]

Ph.D. Comprehensive Exam and Defense Committees

Sangwoo Moon
Charles (Luke) Burks
Neha Garg (Nat. Univ. of Singapore, External Examiner)
Ramya Kanlapuli
Katherine Glasheen
Andrew Mills
Chandrakanth Venigalla
Sam Fedeler
John Jackson
Prashin Sharma (Univ. of Michigan)

Shakeeb Ahmad
John Mern (Stanford Univ.)
Aastha Acharya
Shohei Wakayama
Marcus Lapeyrolerie (Univ. of California, Berkeley, Quals)
John R. Martin
Adam Herrmann
Camron (Alex) Hirst
Hunter Ray

M.S. Thesis Committees

Lasse Peters (TU Hamburg)
Wyatt Raich
Cody Charland
Akash Ratheesh

Jamison Mcginley
Rio McMahon
Eli Kravitz
Abdoulaye Diallo

Department Service

Onboarding mentor for new faculty member [2023–present]
Autonomous Systems Faculty Search Committee [2023–present]
Undergraduate Operations Committee [2023–present]
Graduate Program Committee [2020–2023]
Autonomous Systems Lead
Served on Preliminary Exam Subcommittee, Revised MS Admissions Criteria

Outreach and Inclusion

Smead aerospace career panelist [2023]
Rising Stars in Aerospace organizing committee member [2022]
Speaker for Tuskegee Airmen outreach event at CU [2021, 2022]
Invited Speaker for AIAA Movie Night & Technical Discussion: 2001: A Space Odyssey [2021]

Conference and Workshop Organization

Inference and Decision Making for Autonomous Vehicles (IDMAV) [2023]
Workshop at Robotics: Science and Systems (RSS)
Co-organizer with Christoffer Heckman, Han-Lim Choi (KAIST), and students

Strategic multi-agent interactions: game theory for robot learning and decision making [2022]
Workshop at the Conference on Robotic Learning (CoRL)
Co-organizer with David Fridovich-Keil (Univ. of Texas), Negar Mehr (Univ. of Illinois), and Forrest Laine (Vanderbilt)

Academic Peer Review and Editing

Guest editor for the AIAA Journal of Aerospace Information Systems [2020 – 2022]

Reviewer: I have reviewed manuscripts for the following journals and conferences:

AAAI Conference on Artificial Intelligence
AIAA Journal of Guidance, Control, and Dynamics
AIAA Journal of Aerospace Information Systems
American Control Conference (ACC)
Journal of the American Helicopter Society
Autonomous Robots
Artificial Intelligence
Journal of Artificial Intelligence Research
Field Robotics
IEEE Robotics and Automation Letters
IEEE Conference on Decision and Control (CDC)
IEEE Transactions on Cybernetics

IEEE Transactions on Intelligent Transportation Systems
IEEE Transactions on Intelligent Vehicles
Intelligent Transportation Systems Conference (ITSC)
Intl. Journal of Robotics Research (IJRR)
Intl. Symposium on Robotics Research
Intl. Conference on Robotics and Automation (ICRA)
Intl. Joint Conference on Artificial Intelligence (IJCAI)
Learning for Decision and Control Conference (L4DC)
Operations Research
R (programming language) Journal
Robotics, Science and Systems (RSS)

Proposal Review

NSF CISE Proposal Review Panelist [2023]
Army Research Office (ARO) Proposal Reviewer [2023]