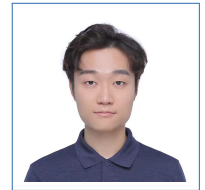


Yunuo Zhang

+1 (615) 877 5371
✉ yunuo.zhang@vanderbilt.edu
🌐 yz1056yz.github.io
🔑 YZ1056YZ
in [yunuo-zhang-497450152](https://www.linkedin.com/in/yunuo-zhang-497450152)
🔍 [Google Scholar](#)



Education

2022–Present **Ph.D. in Computer Science**, *Vanderbilt University*, Nashville, TN, US
Advisor: Prof. Abhishek Dubey

2018–2021 **B.S. in Computer Science**, *Vanderbilt University*, Nashville, TN, US
Double Major: Computer Science, Mathematics

Work Experience

[ScopeLab](#), Institute for Software Integrated Systems, Vanderbilt University Nashville, TN, US

Research Topics: POMDPs, Machine Learning, Robotics

○ UAV Search and Rescue

- Developed a novel "Shrinking POMCP" algorithm that significantly improves UAV search efficiency in time-constrained environments by dynamically guiding drones toward non-sparse belief regions, demonstrating superior performance over traditional methods including standard MCTS, Lawnmower, and Greedy approaches. [\[paper\]](#)
- Designed and implemented a comprehensive simulation framework integrating AirSim-ROS2 with a probabilistic world model for belief maintenance and a neuro-symbolic navigator for obstacle avoidance, enabling realistic testing of UAV path planning algorithms in urban search and rescue scenarios. [\[paper\]](#)

○ Belief Distribution Adaptation

- Developed AIROAS (Annealed Importance Resampling for Observation Adaptation Search), a novel online POMDP solver that addresses particle degeneracy in belief state estimation by constructing bridge distributions between state-transition and optimal distributions. [\[paper\]](#)

○ Decision Making Under Uncertainty

- Developed Policy-Augmented Monte Carlo Tree Search (PA-MCTS), a novel hybrid decision-making approach that efficiently adapts to changing environments by combining previously learned policies with real-time search, demonstrating superior performance over established methods like AlphaZero and DDQN across multiple testing environments while providing theoretical guarantees on bounded error. [\[paper\]](#) [\[code\]](#)
- Developed ADA-MCTS (Adaptive Monte Carlo Tree Search), a novel decision-making algorithm for non-stationary environments that dynamically balances safety and performance by quantifying uncertainty. The approach intelligently transitions from risk-averse exploration to reward-maximizing behavior as it learns, outperforming existing state-of-the-art methods while reducing computational time. [\[paper\]](#) [\[code\]](#)
- Developed an innovative Domain-Knowledge Guided Monte Carlo Tree Search (DG-MCTS) approach for Vehicle-to-Building (V2B) systems that optimizes EV charging/discharging decisions under uncertainty. The algorithm successfully reduced electricity costs while ensuring charging requirements were met, outperforming state-of-the-art methods when validated with real-world data from Nissan Advanced Technology Center - Silicon Valley. [\[paper\]](#)
- Contributed to the development of NS-Gym, the first open-source simulation toolkit specifically designed for Non-Stationary Markov Decision Processes (NS-MDPs). Pioneered a framework that enables systematic algorithm evaluation under changing conditions, addressing a key reinforcement learning research gap by separating environmental dynamics from agent decision-making. [\[paper\]](#) [\[code\]](#)

Publications

POMDPs

- [1] Yunuo Zhang, Baiting Luo, Ayan Mukhopadhyay, and Abhishek Dubey. "Observation Adaptation via Annealed Importance Resampling for Partially Observable Markov Decision Processes". In: *Proceedings of the 35th International Conference on Automated Planning and Scheduling (ICAPS)*. accepted as oral presentation. AAAI Press, 2025. URL: <https://arxiv.org/abs/2503.19302>.
- [2] Yunuo Zhang, Baiting Luo, Ayan Mukhopadhyay, Daniel Stojcsics, Daniel Elenius, Anirban Roy, Susmit Jha, Miklos Maroti, Xenofon Koutsoukos, Gabor Karsai, and Abhishek Dubey. "Shrinking POMCP: A Framework for Real-Time UAV Search and Rescue". In: *2024 International Conference on Assured Autonomy (ICAA)*. 2024, pp. 48–57. DOI: [10.1109/ICAA64256.2024.00016](https://doi.org/10.1109/ICAA64256.2024.00016).

Decision Making Under Uncertainty

- [3] Nathaniel S. Keplinger, Baiting Luo, Iliyas Bektas, Yunuo Zhang, Kyle Hollins Wray, Aron Laszka, Abhishek Dubey, and Ayan Mukhopadhyay. *NS-Gym: Open-Source Simulation Environments and Benchmarks for Non-Stationary Markov Decision Processes*. 2025. arXiv: [2501.09646](https://arxiv.org/abs/2501.09646) [cs.AI]. URL: <https://arxiv.org/abs/2501.09646>.
- [4] Rishav Sen, Yunuo Zhang, Fangqi Liu, Jose Paolo Talusan, Ava Pettet, Yoshinori Suzue, Ayan Mukhopadhyay, and Abhishek Dubey. "Online Decision-Making Under Uncertainty for Vehicle-to-Building Systems". In: *Proceedings of the ACM/IEEE 16th International Conference on Cyber-Physical Systems (ICCPS)*. ICCPS '25. California, USA: Association for Computing Machinery, 2025.
- [5] Baiting Luo, Yunuo Zhang, Abhishek Dubey, and Ayan Mukhopadhyay. "Act as You Learn: Adaptive Decision-Making in Non-Stationary Markov Decision Processes". In: *Proceedings of the 23rd International Conference on Autonomous Agents and Multiagent Systems. AAMAS '24*. Auckland, New Zealand: International Foundation for Autonomous Agents and Multiagent Systems, 2024, pp. 1301–1309. ISBN: 9798400704864.
- [6] Ava Pettet, Yunuo Zhang, Baiting Luo, Kyle Wray, Hendrik Baier, Aron Laszka, Abhishek Dubey, and Ayan Mukhopadhyay. "Decision Making in Non-Stationary Environments with Policy-Augmented Search". In: *Proceedings of the 23rd International Conference on Autonomous Agents and Multiagent Systems. AAMAS '24*. Auckland, New Zealand: International Foundation for Autonomous Agents and Multiagent Systems, 2024, pp. 2417–2419. ISBN: 9798400704864.

Skills

Programming Languages: Python, C++, Julia, LaTeX

Frameworks & Libraries: AirSim, Isaac Lab, OpenAI Gymnasium, Numpy, Pytorch, Tensorflow

Core Coursework

Reinforcement Learning, Statistical Foundations of Deep Learning, Foundations of Machine Learning, Advanced Artificial Intelligence, Algorithms for Decision-Making, Automated Verification, Foundations of Hybrid and Embedded Systems