Vanshaj Khattar

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Research Interests

My research interests lie at the intersection of **machine learning**, **reinforcement learning**, and **optimization**. I am interested in how we can achieve **trustworthy** learning algorithms that are **safe**, **explainable**, and can continually adapt to **non-stationarity** in the real world.

Education

Virginia Polytechnic Institute and State University (Virginia Tech)   *Blacksburg, VA*
Ph.D. Electrical Engineering   *August 2021 - May 2026*
- Advisor: Dr. Ming Jin

Virginia Polytechnic Institute and State University (Virginia Tech)   *Blacksburg, VA*
MS Electrical Engineering   *August 2019 - May 2021*
- Advisor: Dr. Azim Eskandarian

Delhi Technological University   *New Delhi, India*
B.Tech Electrical and Electronics Engineering   *August 2014 - May 2018*
- CGPA: 8.09/10.0

Publications

Conference Publications

Khattar, V., Ding, Y., Sel, B., Lavaei, J. and Jin, M., "A CMDP-within-online framework for Meta-Safe Reinforcement Learning". In The Eleventh International Conference on Learning Representations (ICLR 2023 Spotlight)

Khattar, V. and Jin, M., "Winning the CityLearn challenge: adaptive optimization with evolutionary search under trajectory-based guidance". In Proceedings of the (AAAI 2023 — AI for Social Impact track).

Jin, M., **Khattar, V.**, Kaushik, H., Sel, B. and Jia, R., "On solution functions of optimization: universal approximation and covering number bounds". In Proceedings of the (AAAI 2023).

Meimand, M., **Khattar, V.**, Yazdani, Z., Jazizadeh, F., Jin, M., "TUNEOPT: An Evolutionary Reinforcement Learning HVAC System Controller For Tuning Energy-Comfort Optimization Formulations". (BuildSys 2023).

Khattar, V. and Eskandarian, A., "Stochastic predictive control for crash avoidance in autonomous vehicles based on stochastic reachable set threat assessment". ASME (IMECE 2021).

Khattar, V. and Eskandarian, A., "Reactive online motion re-planning for crash mitigation in autonomous vehicles using bezier curve optimization". ASME (IMECE 2020).

Valluru, S.K., Singh, M., Singh, M. and **Khattar, V.**,, "Experimental validation of PID and LQR control techniques for stabilization of cart inverted pendulum system". In IEEE International Conference on (RTEICT 2018).

Under Review

Sel, B., Al-Tawaha, A., **Khattar, V.**, Wang, L., Jia, R. and Jin, M., Algorithm of thoughts: Enhancing exploration of ideas in large language models. arxiv 2023

Khattar, V. and Jin, M., "Optimization Solution Functions as Deterministic Policies for Offline Reinforcement Learning". (Under review. Link

Journal Publications

Khattar, V. and Eskandarian, A., "Stochastic reachable set threat assessment for autonomous vehicles using trust-based driver behavior prediction". SAE International Journal of Connected and Automated Vehicles. Paper link.

Ongoing research projects

- **Non-stationary reinforcement learning via frequency adaptation.** We handle the non-stationarity in reinforcement learning (RL) by adjusting the RL agent's interaction frequency, where the RL agent attempts to "frame" or perceive the environment as stationary within different phases of non-stationarity within the environment.

- **Intrusion detection in power substations using in-context learning.** A self-training-based in-context learning method is developed for intrusion detection in the IEC–61850 communication protocol, widely used in power substations. The preliminary results show performance boosts on out-of-distribution attack detection, with more than 80% accuracy.

- **Generalization of Learning to Optimize (L2O) via scenario-based approach.** We cast the widely used L2O methods in machine learning as a scenario optimization problem. The generalization of the learned optimizer is studied through the probability of risk and the achievable sample compression size.

Awards & Scholarships

2023	**AAAI 2023 travel scholarship.**, AAAI	*$ 750*
2022	**Member of the winning team ROLEVT at CityLearn challenge 2021.(ROLEVT team)**,	*$ 1500*
2021	**Second position in 2021 Torgersen Graduate Student Research Excellence Award for MS Oral presentation. (Link)**, Virginia Tech	*$ 500*

Presentations

Spring, 2023. *Offline Actor-Critic with Optimization Policies for Demand Response and Urban Energy Management*. PEC Conference at Virginia Tech.

Spring, 2022. *Winning the CityLearn Challenge with Optimization as RL Policies*. PEC Conference at Virginia Tech.

Fall, 2022. *Trustworthy Reinforcement Learning.* Presented to 150+ undergraduates in the undergraduate engineering research seminar, Fall 2022

Fall 2021. *Zeroth-Order Implicit Reinforcement Learning for Distributed Control Systems*. Southeast Control Conference 2021, Virginia Tech.

Technical Skills

Programming languages. Python, C, MATLAB, HTML

Frameworks. PyTorch, Tensorflow, cvxpy, NumPy, Pandas

Peer-Review

Conference reviewer. AISTATS 2022, 2023, 2024

Web features

Fall, 2023. *Featured as a Spotlight at Sanghani Center for Artificial Intelligence and Data Analytics, Virginia Tech. Link*