

Vanshaj Khattar

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Research Interests

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

Education

Virginia Polytechnic Institute and State University (Virginia Tech)

PH.D. ELECTRICAL ENGINEERING

- Advisor: Dr. Ming Jin

Blacksburg, VA

August 2021 - May 2026

Virginia Polytechnic Institute and State University (Virginia Tech)

MS ELECTRICAL ENGINEERING

- Advisor: Dr. Azim Eskandarian

Blacksburg, VA

August 2019 - May 2021

Delhi Technological University

B.TECH ELECTRICAL AND ELECTRONICS ENGINEERING

- CGPA: 8.09/10.0

New Delhi, India

August 2014 - May 2018

Technical Skills

Programming languages. Python, C, MATLAB, HTML

Frameworks. PyTorch, Tensorflow, cvxpy, NumPy, Pandas, Scikit-learn

NLP experience. GPT-2, BERT, Fine-tuning on OpenAI API, Prompt engineering, In-context Learning

Publications

CONFERENCE PUBLICATIONS

Khattar, V.*, Lin, T*, Huang. Y*, Jia, R., Hong, J., Liu C, Vincentelli, A and Jin, M., “CausalPrompt: Enhancing LLMs with Weakly Supervised Causal Reasoning for Non-Language Applications”. (**ICLR 2024 Workshop Paper**)

Khattar, V. and Jin, M., “Optimization Solution Functions as Deterministic Policies for Offline Reinforcement Learning”. (American Control Conference) **ACC 2024**.

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**).

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”. (**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**).

PREPRINT/ UNDER REVIEW

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

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.

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.

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)*

Ongoing research projects

- **Intrusion detection in power substations using in-context learning.** An in-context learning method is developed for intrusion detection in the IEC-61850 communication protocol widely used in digital substations. We use GPT-2 and BERTs to train a generalizable intrusion detector.
- **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.
- **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.