VANSHAJ KHATTAR

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Google Scholar ◇ *Website* ◇ *Github* ◇ *Linkedin*

RESEARCH INTERESTS

My research interests lie at the intersection of **efficient and robust machine learning**, **reinforcement learning**, and **optimization**. I am passionate about use-inspired research and solving real-world problems. More specifically, I am interested in how can we achieve trustworthy reinforcement learning algorithms that are **safe**, **robust**, **explainable**, and can **continually adapt** to non-stationarity in the real world.

EDUCATION

Virginia Polytechnic Institute and State University *August 2021 - Present*
Ph.D. in Electrical Engineering
Advisor: **Dr. Ming Jin**

Virginia Polytechnic Institute and State University *August 2019 - May 2021*
Masters of Science in Electrical Engineering
Advisor: **Dr. Azim Eskandarian**

Delhi Technological University, New Delhi, India *August 2014 - May 2018*
B.Tech in Electrical and Electronics Engineering

RESEARCH PROJECTS

Meta-Safe Reinforcement Learning (RL). Link *April 2022-Oct. 2022*

- Meta-RL settings are extended to safety-critical settings under a CMDP-within-online framework; regret guarantees are obtained for the optimality-gap and constraint violation which scale with task-similarity. **(Accepted in ICLR 2023 as spotlight.)**

Zeroth-order implicit reinforcement learning (ZOiRL). Link *June 2021-Jan. 2022*

- An evolutionary search method (ZOiRL) is proposed to adapt the parameters of the optimization model using trajectory-based guidance; ZOiRL secured first position in the CityLearn challenge 2021. **(Accepted in AAAI 2023 (AI for Social Impact).)**

Learning theoretic properties of solution functions of optimization. Link *Jan. 2022-Aug. 2022*

- Expressibility and learnability of solution functions of optimization class are studied by establishing universal approximation properties and covering number bounds. **(Accepted in AAAI 2023.)**

Optimization policies for robust offline reinforcement learning. *Jan. 2022- present*

- An offline implicit Actor-Critic (iAC) framework is developed that employs optimization solution functions as a deterministic policy (actor) and an approximate Q-value function (critic) to learn the parameters for an optimization model.

- The framework exploits exponentially decaying sensitivity property of optimization policies to be robust against value function estimation errors.

Controller design for crash avoidance in autonomous vehicles. MS Thesis *June 2020- May 2021*

- Designed a trust-based driver behavior prediction method and proposed probabilistic threat assessment techniques using stochastic reachable sets. Link **(Accepted in SAE Journal of Connected and Autonomous Vehicles.)**
- Controller design using Stochastic MPC approach where a chance-constrained problem is formulated for crash avoidance. Link **(Accepted in IMECE 2021.)**
- A cubic Bezier curve trajectory generation method is used for creating a maneuver around the obstacle vehicle. Relative hitting heading angle is considered to account for the crash severity between two vehicles. Link **(Accepted in IMECE 2020.)**

Effect of opioids on the brain dynamics. Link *Feb 2020- Jan. 2021*

- Analysis of collected iEEG data from adult epileptic patients receiving opioid analgesics to control postoperative pain. Changes in power are examined before and after opioid drug administration for 4 patients. **(Abstract accepted in American academy of Neurology.)**

Control system design for Cart Inverted Pendulum System *Aug. 2016- Jan. 2018*

- Tuned PID values for experimental setup using classical control and optimal control (LQR, LQG). Link **(Accepted in RTEICT 2018.)**

AWARDS AND SCHOLARSHIPS

- Member of the winning team ROLEVT in CityLearn challenge 2021.
- Second position in 2021 Paul E. Torgersen Graduate Student Research Excellence Award for MS Oral Presentations. Link
- Recipient of AAAI 2023 student scholarship.

TALKS

- Undergraduate engineering research seminar Fall 2022.
- PEC conference at Virginia Tech, 2022.
- Southeast Control Conference at Virginia Tech, 2021.

TECHNICAL SKILLS

Programming Languages: Python, C, MATLAB, HTML
Frameworks: PyTorch, cvxpylayers, cvxpy, NumPy, SciPy, Pandas

PROFESSIONAL SERVICE

Conference reviewer: AISTATS 2022, 2023