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Announces the Ph.D. Dissertation Defense of

Yanbin Lin

for the degree of Doctor of Philosophy (Ph.D.)

Efficient and Robust Inverse Reinforcement Learning for Complex and Dynamic Environments

October 13, 2025, Monday, 1:00 pm -3:00 pm
Building: EE96, Room: # 405
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ABSTRACT OF DISSERTATION

Efficient and Robust Inverse Reinforcement Learning for Complex and Dynamic Environments

The rapid advance of reinforcement learning has motivated many real-world applications, including robotics, autonomous driving, and intelligent energy. However, selecting a proper reward function for domain applications has been a classical challenge. The inverse reinforcement learning (IRL) method provides a unique angle to recover the reward function from the expert or demonstration. This dissertation develops three novel IRL frameworks to improve efficiency, robustness, and generalization: (1) e-IRL, which performs feature-expectation based reward recovery to avoid costly state visiting frequency estimation and scale to high-dimensional problems; (2) Multi-Virtual-Agent Inverse Reinforcement Learning (MVIRL), a multi-virtual-agent framework that trains weight-shared agents across perturbed environments to learn rewards robust to noise and uncertain factors; and (3) Contrastive Inverse Reinforcement Learning (CIRL), which combines self-supervised contrastive representation learning with maximum entropy IRL by using momentum encoders and reward regularization for sample-efficient, personalized, and more generalizable reward learning. We extend the proposed methods to microgrid optimization and autonomous driving. The results show less utility cost and better human-like driving behavior, respectively, compared to state-of-the-art Imitation Learning (IL)/IRL baselines.

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CONCERNING PERIOD OF PREPARATION
& QUALIFYING EXAMINATION

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Published Papers:

1. Yanbin Lin and Zhen Ni. A Robust Multi-Virtual-Agent Inverse Reinforcement Learning Approach with Data Aggregation for Perturbed Environments. IEEE Transactions on Neural Networks and Learning Systems, vol. 36, no. 8, pp. 15515-15527, 2025.

2. Yanbin Lin, Zhen Ni, and Xiangnan Zhong, Learning from Demonstrations: A Computationally Efficient Inverse Reinforcement Learning Approach with Simplified Implementation, IEEE Transactions on Emerging Topics in Computational Intelligence, vol. 9, no. 5, pp. 3413-3425, Oct. 2025.

3. Yanbin Lin and Zhen Ni, A Visual Feature-Based Inverse Reinforcement Learning Approach for Reward Reconstruction from Image Observations, 2025 International Joint Conference on Neural Networks (IJCNN), 2025, pp. 1-8.

4. Yanbin Lin, Zhen Ni, and Yufei Tang, An Imitation Learning Method with Multi-Virtual Agents for Microgrid Energy Optimization under Interrupted Periods, 2024 IEEE Power & Energy Society General Meeting (PESGM), Seattle, WA, USA, 2024, pp. 1-5.

5. Yanbin Lin, Avijit Das, and Zhen Ni, A Modified Maximum Entropy Inverse Reinforcement Learning Approach for Microgrid Energy Scheduling, 2023 IEEE Power & Energy Society General Meeting (PESGM), Orlando, FL, USA, 2023, pp. 1-5.

6. Yanbin Lin, Zhen Ni, and Xiangnan Zhong, Multi-Virtual-Agent Reinforcement Learning for a Stochastic Predator-Prey Grid Environment, 2022 International Joint Conference on Neural Networks (IJCNN), 2022, pp. 1-8.

7. Yanbin Lin and Zhen Ni, Contrastive Inverse Reinforcement Learning for Highway Driving Behavior Optimization, submitted to ICLR 2026.