

Decentralized MARL and Preference Learning: Balancing Grid Efficiency and Privacy in Demand Response

Thursday, June 20, 2024 1:30 PM (30 minutes)

This talk introduces a decentralized Multi-Agent Reinforcement Learning (MARL) with inverse reinforcement learning for Electricity Demand Response (DR) programs in the residential sector, aiming at grid stability and efficiency while prioritizing user privacy. The approach is for incentive-based DR that addresses the grid's capacity limits and congestion challenges and aligns with the residential consumers' preferences and comfort without reducing their privacy. The approach uses a Disjunctively Constrained Knapsack Problem optimization within a MARL setup to model energy management systems within a household. This optimization is complemented by an inverse reinforcement learning model that generates personalized appliance operation schedules based on historical consumption data, thereby learning user preferences and comfort levels. Studies on the Pecan-street data using 25 households were undertaken. The results demonstrate reductions in the Peak-to-Average ratio (PAR) of energy consumption by 15%.

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