UNIVERSITY OF ALBERTA

CPA Speaker Series- Business Analytics

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Friday, January 19, 2024
9:30 AM - 11:00 AM
Location: BUS 4-04

Deep Reinforcement Learning for Electric Vehicle Fleet Management and Gamified Routing

ABSTRACT

In this presentation, we delve into the realm of deep reinforcement learning (DRL) and its applications in transportation problems, encompassing two distinct projects. The first project tackles the intricate problem of managing a fleet of electric vehicles in a ride-hailing service. Here, the primary objective for the operator is to maximize profit, which involves the strategic assignment of vehicles to incoming requests and the foresighted management of recharging and repositioning for future demands. To address this, we have developed advanced policies using DRL, leveraging Q-value approximations learned through deep neural networks. Our approach stands in comparison to a reoptimization-based policy and against dual bounds on the value of an optimal policy, including the value of an optimal policy with perfect information, which we establish using a Benders-based decomposition. Empirical assessments, utilizing real-world data from Manhattan, New York City, affirm that our DRL-trained policies surpass traditional reoptimization methods in performance and demonstrate scalability to larger instances without the need for retraining. The second project presents a novel modeling technique for research problems, conceptualizing them as Atari-like video games. This method aligns seamlessly with the latest advances in DRL. Our flexible and innovative approach is applicable across a wide array of problem domains and is demonstrated through its application in a well-known vehicle routing problem, i.e., the vehicle routing problem with stochastic service requests. The results from this project, while not groundbreaking, show potential and suggest that this 'gamification' could be a valuable modeling tool for researchers engaged in problems involving sequential decision-making under uncertain conditions.

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