Armin Lotfy

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PROFILE

Machine Learning Engineer specializing in embodied AI and energy management systems for electric vehicles (EVs) and microgrids. Proven expertise in developing and deploying advanced Deep Learning (DL) and Reinforcement Learning (RL) algorithms, such as TD3, PPO, and MARL, for real-time applications. Strong collaborator and researcher with excellent technical documentation skills and a commitment to advancing state-of-the-art machine learning methods.

PROFESSIONAL EXPERIENCE

Researcher Assistant (ML researcher)
Carleton University
2020 – present | Ottawa, Canada

Teaching Assistant
Carleton University
2022 – 09/2024 | Ottawa, Canada

SKILLS

Machine Learning and Deep Learning algorithms
- Machine Learning algorithms (K-means, Regression Trees, PCA)
- Reinforcement Learning algorithms(TD3,MATD3, DDPG, PPO,MAPPO,SAC)
- Deep Learning algprithms (CNN, RNN, LSTM)

Programming & Tools
- Python, MATLAB, TensorFlow, Git, Numpy,Scipy, Pandas, Matplotlib, LaTex, VScode, Linux

Specialized Knowledge
- Deep Learning and Reinforcement modelling, RL-based controllers, Energy Management Strategies (EMS), battery modeling (ECM), battery aging and health management, cell balancing methods

EDUCATION

Ph.D. IN ELECTRONIC DIGITAL ENGINEERING
CARLETON UNIVERSITY
2020 – 2025 | Ottawa, Canada

PROJECTS

Multi-Agent Energy Management System for BEVs
Project: Developed an energy management system using Multi-Agent Reinforcement Learning (MARL) for battery electric vehicles (BEVs).
- Created an environment based on Markov Decision Processes (MDP) and a reward function, implementing two TD3 agents for optimal energy efficiency and battery state-of-charge (SOC) balance.
- Successfully improved BEV driving range through real-time allocation strategies based on battery efficiency.

CTDE Framework for Battery Health Optimization
Designed a Centralized Training with Decentralized Execution (CTDE) framework for SOC and state-of-health (SOH) equalization in multi-agent battery management.
- Leveraged Proximal Policy Optimization (PPO) agents to address multi-objective optimization, balancing current distribution for maximum performance and battery longevity.
- Achieved collaborative agent interaction through a shared reward function to maintain battery health and enhance system efficiency.

Proximal Policy Optimization-Based Power Sharing Controller for Smart Grids:
- Designed and implemented a smart grid controller leveraging Proximal Policy Optimization (PPO), enabling dynamic adjustments to control signals based on real-time network variables.
- Optimized power distribution and improved grid efficiency by incorporating advanced reinforcement learning techniques.
- Enhanced the system's adaptability and responsiveness to fluctuations in grid demand and supply.

PUBLICATIONS

Enhancing Energy Management Strategy for Battery Electric Vehicles: Incorporating Cell Balancing and Multi-Agent Twin Delayed Deep Deterministic Policy Gradient Architecture
IEEE Transaction on Vehicular Technology
2024

Centralized Multi-Agent SOC Control for Battery Health Using Proximal Policy Optimization in EVs
IEEE Transactions on Vehicular Technology
2024
Under review