Armin Lotfy

armin.lotfy@carleton.ca 6132658697 Ottawa, Canada LinkedIn: www.linkedin.com/in/armin-lotfy
GitHub: github.com/arminlotfyFP Portfolio: https://arminlotfyfp.github.io/

SUMMARY

Ph.D. graduate in Electrical Engineering with a focus on Digital Systems, Reinforcement Learning, Deep Learning, and Energy Management for electric vehicles and smart grids. Experienced in developing advanced control strategies using MATLAB/Simulink and Python-based frameworks including TensorFlow, Stable-Baselines3, and Ray.
Proven track record in modeling, simulation, and optimization of RL-based solutions—ranging from single-agent to multi-agent systems—along with CNN-LSTM architectures and state estimation using Extended Kalman Filters. Adept at translating cutting-edge research into practical, high-impact applications across energy and mobility domains

SKILLS

Technical Skills

- **Machine Learning algorithms:**
  K-means Clustering, Regression Trees, Principal Component Analysis (PCA), Predictive Modeling, Time Series Forecasting
- **Reinforcement Learning & Deep Learning algorithms**:
  TD3, MATD3, DDPG, PPO, MAPPO, SAC, CNN, RNN, LSTM
- **Programming & Frameworks**:
  Python, MATLAB, Simulink, TensorFlow, Stable-Baselines3, Ray, NumPy, SciPy, Pandas, Matplotlib, Git, LaTeX, VS Code, Linux Bash, VHDL

Soft Skills

Team-work, collaboration, responsible, Strong communication skills, and enthusiasm

Specialized Knowledge

- Developed intelligent, real-time **energy management controllers** for **Electric Vehicles** (EVs) and **smart grid** applications, with a focus on performance, scalability, and **energy efficiency**.
- Built and validated simulation models for battery **Equivalent Circuit Models (ECMs)** and **supercapacitor** systems to support accurate control and prediction.
- Designed custom reinforcement learning environments for **solving multi-objective optimization** problems in complex, real-world control tasks.
- **AI-based control systems**, p**ower systems operations**

PROJECTS

Multi-Agent Energy Management System for BEVs
IRES Lab
Project: Multi-Agent RL-Based Energy Management System for BEVs

- Develop and implement an **Energy Management System (EMS)** for **Battery Electric Vehicles (BEVs)** using **Multi-Agent Reinforcement Learning (MARL)** to optimize energy distribution and enhance system efficiency.
- Formulate a custom simulation environment based on **Markov Decision Processes (MDP)** with dynamic states, continuous action spaces, and a tailored reward function.
- Implement and train two **Twin Delayed Deep Deterministic Policy Gradient (TD3)** agents for **optimal control of power flow** and **State of Charge (SOC)** balancing under variable load conditions.
- Reduce initial **12.47% SOC imbalance** to **0.3%** without requiring prior environmental knowledge, demonstrating the **robustness** and **generalizability** of the proposed control framework.

Centralized Multi-Agent SOC Control for Battery Health Using Proximal Policy Optimization in EVs
IRES Lab
Project: Designed and implemented a **Centralized Training with Decentralized Execution (CTDE)** architecture to enable multi-agent coordination for battery State-of-Charge (SOC) and State-of-Health (SOH) equalization in intelligent battery management systems.

- Utilized **Proximal Policy Optimization (PPO)** to solve a **multi-objective optimization** problem, dynamically balancing current allocation across cells to improve both system performance and battery lifespan.
- Formulate a **shared reward mechanism** to promote collaborative behavior among agents for this **multi-objective problem**

Proximal Policy Optimization-Based Power Sharing Controller for Smart Grids:
IRES Lab
Project: Designed and implemented a **smart grid control system** using **Proximal Policy Optimization (PPO)**, enabling real-time adaptation of control signals based on dynamic grid variables.

- Applied advanced RL techniques to **optimize power distribution**, resulting in improved grid efficiency and reduced energy losses.
- Enhanced system **resilience and responsiveness** to demand-supply fluctuations, enabling intelligent decision-making in dynamic energy networks.

Predictive Smart Energy Management for BEVs with Hybrid Storage via Reinforcement Learning
IRES Lab
Project: Developed and trained a **Reinforcement Learning-based controller** for Battery Electric Vehicles (BEVs) with hybrid energy storage systems using **Python**.
- Modeled the dynamic behavior of a **battery-supercapacitor hybrid storage system**, enabling realistic simulation and training of **Soft Actor-Critic (SAC)** algorithms incorporating both historical and predicted future states, enabling more informed decision-making and improved policy performance using Ray library..
- Designed and implemented a **CNN-LSTM predictive model** to forecast future vehicle operating conditions, enhancing the agent's situational awareness and control accuracy.

PROFESSIONAL EXPERIENCE

Researcher Assistant (ML researcher) 2020 – 2025
Carleton University Ottawa, Canada
- Develop RL-based controllers for energy management in EVs
- Implement predictive models for real-time battery state estimation
- Apply RL and DL algorithms using Python and MATLAB/Simulink for control and optimization

Teaching Assistant 2022 – 2024
Carleton University Ottawa, Canada
- Mentored **600+** students in **Mechatronics (Python)**, **Switching Circuits and Digital Design (VHDL)**, **Circuits**

VOLUNTEERING

Member of the Technical Program Committee, IEEE 102nd Vehicular Technology Conference (VTC2025)
IEEE
Served as a T**echnical Program Committee (TPC) Member** for the IEEE 102nd VTC2025

IEEE Vehicle Power and Propulsion Conference (VPPC) 2025 Reviewer
IEEE
Contributed as a Technical Reviewer for IEEE VPPC 2025, an internationally recognized conference in electric mobility and powertrain systems

IEEE Vehicle Power and Propulsion Conference (VPPC) 2022 Reviewer
IEEE
Served as a Technical Reviewer for the IEEE Vehicle Power and Propulsion Conference (VPPC) 2022

PUBLICATIONS

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

Centralized Multi-Agent SOC Control for Battery Health Using Proximal Policy Optimization in EVs 2025
IEEE Transactions on Vehicular Technology

EDUCATION

Ph.D. in Electrical Engineering 2020 – 2025
Carleton University Ottawa, Canada