Thesis Title: Modeling EV Charging Demands on Grid using Deep learning approaches and exploring cost-effective grid integration strategies.

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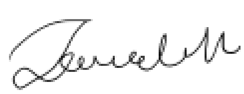
Abstract: This research explores the integration of Electric Vehicles (EVs) into the electric grids, focusing on modeling EV charging demands and assessing cost-effective strategies for grid integration. As EV adoption increases, driven by policy incentives and infrastructure expansion, the study underscores the necessity of accurate EV charging load forecasts to maintain grid stability and efficiency. Utilizing a comprehensive dataset from the program Charge the North conducted by FleetCarma covering 850 EVs in Canada between 2017 and 2019, the research incorporates weather conditions to address their impact on battery performance and charging behavior. Through data preprocessing and outlier management, the study employs XGBoost and Shapley Values for feature selection and further compares various deep learning forecasting models—N-BEATS, N-HiTS, and PatchTST—with PatchTST demonstrating the best performance in predicting EV charging demands.

Additionally, the investigation examines the cost-benefit aspects of various grid integration strategies, including both user-managed and supplier-managed approaches. These strategies span a range of solutions, such as smart charging programs, demand response initiatives, and emerging technologies like battery swapping. Case studies highlight potential consumer benefits and greenhouse gas reductions that can be achieved through optimized charging patterns and effective grid integration strategies. This thesis aims to contribute to the efficient integration of EVs into the grid, ensuring sustainable energy consumption and reliability.



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