Electrical Energy Storage Technology
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Master's Thesis

Development of an Incremental Deep-Learning Model for SOC and SOH Estimation of Batteries

●●●●○ Python
●●○○○ ML/DL
●●●●○ Data Analysis
●●○○○ Research

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Motivation

The continuous advancement of deep learning models offers enormous potential in the accurate prediction and modeling of systems such as batteries. In particular, the N-Beats approach has proven to be promising in capturing complex time-dependent patterns. The goal of this master's thesis is to use this model to determine the state of charge (SOC) and state of health (SOH) of batteries. To improve the model's adaptability and accuracy, the network will be incrementally retrained by gradually incorporating new datasets or data parts.

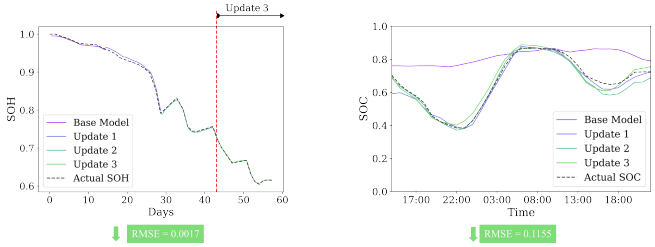

Figure 1: The figure on the left illustrates the SOH (State of Health) trend over the entire testing period, showing the impact of periodic updates on the prediction paths. On the right, the SOC (State of Charge) trajectories are overlaid within a selected segment of the load profile, which repeats over time.

Objective

The main objective of this master's thesis is to develop an incremental N-Beats model capable of accurately predicting the state of charge (SOC) and state of health (SOH) of batteries. The model will be progressively enhanced with new data to improve its predictive accuracy and adapt to future data updates. Another objective is to create a framework that efficiently integrates new data into the existing model without compromising model integrity.

Tasks

- literature review on Deep Learning, with a focus on the N-Beats architecture and incremental learning techniques.
- Development of a baseline model for predicting SOC and SOH using the N-Beats approach.
- Implementation of an incremental learning approach to progressively expand the model with new datasets.
- Validation and evaluation of the model in terms of accuracy and efficiency with the incorporation of new data.
- Documentation of results and creation of a framework for future use and extension of the model.

Start: by agreement
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