BattDeg

Predicting battery degradation using machine learning

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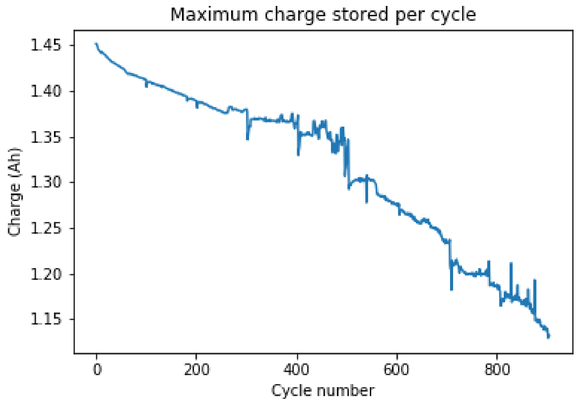
Introduction

Lithium-ion batteries degrade over time with use in any application, be it consumer electronics like cell-phones and laptops or electric vehicles. The exact cause of battery degradation is not well understood. The degradation has been known to vary with battery chemistries, operating conditions like charge-discharge rate, temperature etc.



Knowing about battery degradation can help system designers avoid over-stacking batteries and allow the fleet operators better manage their resources.

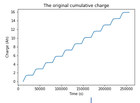
Objective: To predict the degradation of the battery using few cycles of battery use data.

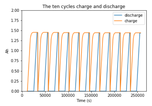
Data: We used the CS2, CX2, and PL Samples dataset from the CALCE website. These have different form factors, capacities, charge/discharge rates, SOC windows, same chemistry (NMC).

Procedure

Data Wrangling

Get segregated data from different file formats and pre-process to get per cycle capacities





Modeling

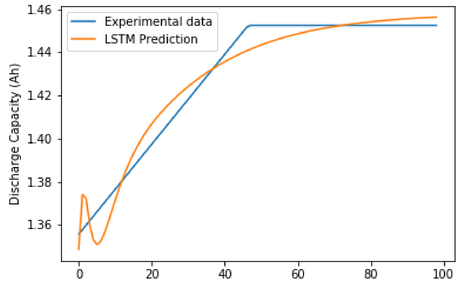
seq2seq Timeseries Prediction Modeling in Keras with Tensorflow backend using encoder-decoder LSTM

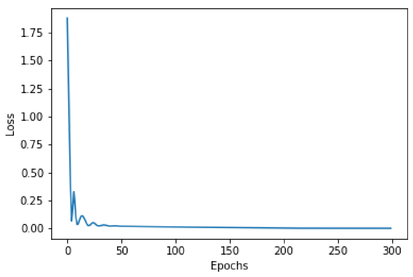
Forecasting

Feed the prediction model a sequence with few timesteps to predict the degradation for future timesteps

Results

- **Fitting:** The timeseries prediction fits well for a segment of dataset and predicts the next timestep using just historical discharge capacity.





Future Work

- **Scope:** Allow battery degradation prediction for different chemistries and ambient temperature.
- **Features:** Allow re-training the model as additional data becomes available.
- **UI:** Create a web-UI that allows users to interact with package from any OS/device.

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Dataset were taken from publicly available battery cycling data from the University of Maryland's Center for Advanced Life Cycle Engineering (CALCE).

Only open source packages were used in this work.