Li-Ion Battery Degradation Machine Learning Model

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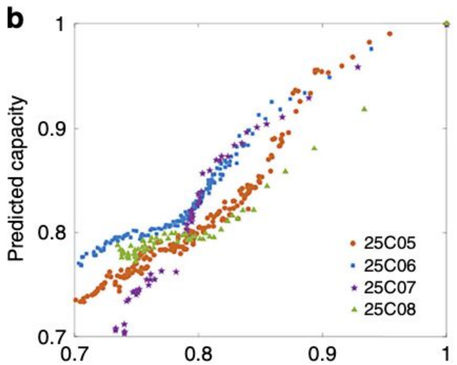
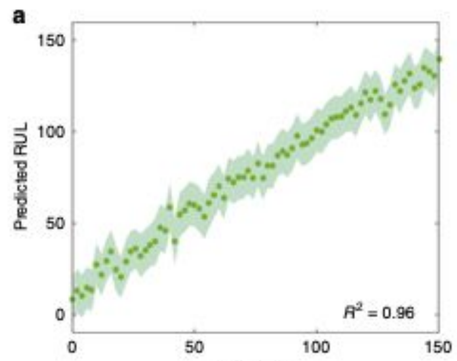
Can we predict battery degradation without having to cycle batteries hundreds of times?

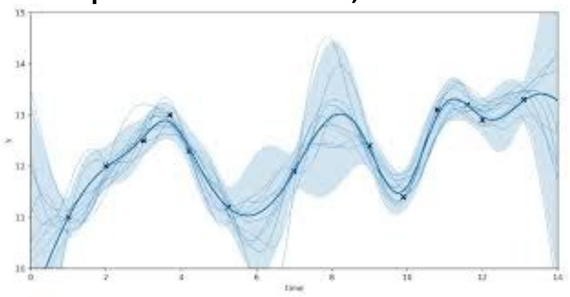
Previous Research used EIS Data from Li-ion coin cell batteries to predict capacity with Gaussian Process regression (GPR)





Goal: Apply previous methods to larger Li-ion batteries, which are used in Teslas (more industry relevant)

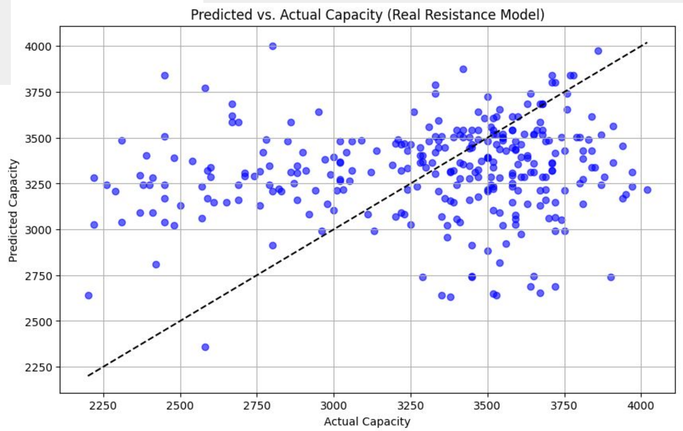
Obstacles: Understanding/processing data; optimization, GPR is $O(n^3)$ - the algorithm execution time is proportional to the input size cubed, kernel development

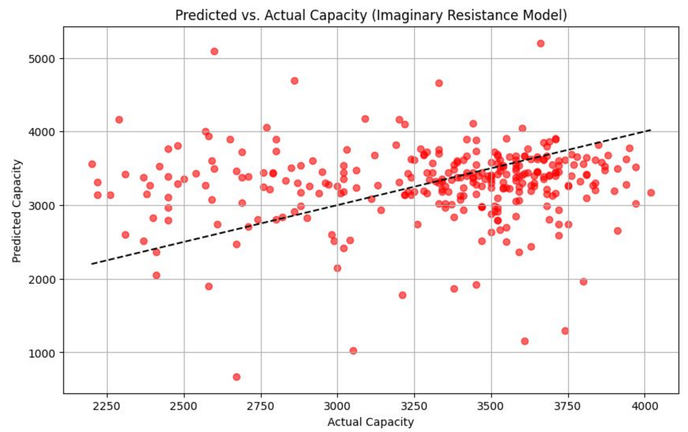


GPR gives a probability to all possible functions that could pass through our data

Results thus far

Two models; imaginary and real resistance





Each point is predicted vs actual capacity based on a specific resistance input

Dotted line would be a perfect prediction; combining imaginary and real resistance into 1 input could help model accuracy

Future Work

Data Processing: Filtering the data to only include relevant portions of the EIS Testing

Algorithm optimization: kernel optimization, other possible regression algorithms

Input: Defining and feeding the model better inputs to make predictions

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Acknowledgements:

Zhang, Y., Tang, Q., Zhang, Y., Wang, J., Ulrich Stimming, & Lee, A. A. (2020). Identifying degradation patterns of lithium ion batteries from impedance spectroscopy using machine learning. *Nature Communications*, *11*(1). https://doi.org/10.1038/s41467-020-15235-7

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