Assignment

Case Study: Battery Data Analysis and Degradation Modelling Task

Background:

The datasets contain the measurement data of battery testing. Some of the manufacturer information that is needed for performing analysis :

- Cell capacity : 2.3 Ah
- Operational Temperature : 25°C
- C-rate = Current(A) / Cell Capacity (Ah)
- Dataset Variables:
- Data_Point : S.No
- Test_Time(s): Time step (1s)
- Current(A): Charging / Discharging Current (+ Ve charge, -Ve :discharge)
- Capacity(Ah): CurrentIntegral (Current *time(hrs) (ah)
- Voltage(V) : Cell/Battery Voltage (Operational range: 2.9V - 4.2V)
- Energy(Wh): Energy (Voltage * Capacity)
- Temperature(℃) : --
- Date_Time : Timestamp
- Cycle_Index : Cycle Count (1 charge + 1 discharge = 1 cycle)

Problem Statement:

Create a jupyter notebook.

1. Import the 2 datasets and join them as one file.
2. Analyse each variable such as voltage, time, current, capacity, energy, cycle_Index
3. Perform the exploratory data analysis (EDA : Univariate, Bivariate etc) and clean the data.
4. Extract charging phase,discharge phase related data. (Charge when current > 0 & vice versa)
5. Calculate the charge_capacity,discharge capacity for every cycle . (Capacity(k+1) = Capacity(k) + Current(k+1) * (time(k+1) - time(k))/3600)
6. Create a new variable c-rate. (see formula above)

7. Perform visualizations (Charge capacity vs Voltage , Charge capacity vs Cycle count etc. vice versa with discharge)
8. Explain the influence of c-rate on the charge_capacity and what differences you observe in charging and discharging phase capacity over cycles.
9. Use ML methods like poly. regression to extrapolate the total Charge capacity w.r.t cycle count.for every c-rate.
10. Calculate State of Health (SoH) from the charge capacity of each cycle and try to visualize the degradation behaviour.
11. You are free to select any methodology you feel suitable to perform data analysis and visualizations.
12. Write your thought process behind every step you follow briefly.

Create your own Git repository and Share your repository with us once it is done.

Good luck.

Due date: : 3 days (maximum) from date of receipt