Technical University of Munich
TUM School of Engineering and Design
Chair of Automotive Technology

Semester‘s Thesis / Master‘s Thesis

# Benchmarking of Deep Learning Based Anomaly Detection in Battery Aging Test Using Machine Learning

## Motivation:

Increasing electrification in the mobility sector is creating new challenges along the entire the entire development and validation process for new vehicles. The battery as currently the most expensive component in an electric vehicle, is of particular importance.
In order to verify the diverse requirements, the li-ion traction batteries are tested extensively. Especially cycle life tests are expensive due to the lengthy allocation of many expensive resources such as battery testers, climate chambers, and testing personnel. Due to these limitations, only a limited number of operational conditions can be tested. Any errors that go unnoticed during the study’s execution can result in the discarding of individual test runs, jeopardizing the study’s overall validity. As such, it is crucial to detect any anomalies and take appropriate counter-measures to prevent repeating individual test runs.

## Thesis topic:

The basis for this work is a deep learning-based anomaly detection. This existing method is to be benchmarked against a novel anomaly detection based on classical machine learning approaches. For this purpose, a new method is to be developed and implemented. The work is completed with a comparison of the two methods and a critical discussion of the results.

## What you get:

- Contribute to scientific research in the field of sustainable mobility and embrace this opportunity as a launchpad for a fascinating journey in the industry.
- In case of excellent working performance: Opportunity for a co-authorship in a scientific paper.

## Requirements:

- Passion for e-mobility and lithium-ion batteries
- Ideally initial experience in machine learning
- Initial programming experience in Python
- Independent and strategic way of working
- Very good German or English language skills

## Work packages:

- Literature research and presentation of the state of the art on the subject of time-series anomaly detection of Li-ion batteries.
- Examination of currently implemented anomaly classification and feature choice.
- Selection of appropriated (ML-based) anomaly detection algorithms based on the literature research and implementation in Python.
- Comparison of the detection performance of the implemented anomaly detectors and conducting a sensitivity analysis of the detection-parameters.
- Validation of the obtained results on a second dataset covering a different cycle life aging study.
- Documentation of the approach and results.

I look forward to receiving your application with a CV and a current overview of grades (+ any other documents).
**The thesis can be written either in German or English.**

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## Start date:

ASAP

## Workplace:

FTM, Garching Forschungszentrum. The thesis can also be done in home office.