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Research thesis

Power electronic

Real-time Temperature Estimation framework for Power Electronics based on TSEPs data

Abstract:

The accurate estimation of junction temperature is crucial for power electronics to monitor and control thermal stress. Temperature-Sensitive Electrical Parameters (TSEPs) offer a promising solution for temperature estimation, but they often suffer from noise, anomalies, and drift over time due to degradation of power devices, which can significantly impact the reliability of temperature estimates. This research proposes to investigate advanced techniques for anomaly detection, drift detection, and denoising of TSEPs sensor data to enhance the accuracy of temperature estimation using neural networks (NNs).

Tasks:

- Familiarization and literature research on TSEPs, denoising, anomaly detection, and drift detection.
- Analysis and selection of suitable denoising and anomaly detection algorithms, comparing various aspects such as accuracy of TSEP-based temperature estimation, response time, and algorithm complexity.
- Implementation and evaluation of the selected algorithms for TSEPs signal processing.
- Development of an NN or other machine learning regression model for TSEP-based temperature estimation. This model will be used to compare and evaluate different denoising methods and demonstrate the influence of data drift on the accuracy of temperature estimation.
- Conception of an approach for data drift detection.
- Documentation and presentation (in either German or English).

Useful Background Knowledge:

- MATLAB or Python;
- Understanding of power electronics;
- Knowledge in signal processing and machine learning.