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”FLEET#5 - Performance study of DTW-based spike measurement anomaly detection in sensors on real world tests.”

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Anomaly detection in sensor data plays a crucial role in various applications, including predictive maintenance, quality control, and prototype testing. The objective is to identify patterns that deviate from the expected results in the time series. This can be achieved through statistical analysis that exposes outliers or using domain knowledge to understand the expected values. Additionally, machine learning models can learn normal sensor behavior and detect anomalies. In the automotive industry, improving the efficiency and effectiveness of prototype testing is essential to reducing errors. This is a complex challenge due to harsh testing conditions and the complexity of some tests, such as the need to monitor over 50 channels simultaneously during an NVH vehicle validation test. Furthermore, typical vehicle tests must be performed on specific test tracks or benches, with limited access time, making it imperative to avoid repeating tests due to a defective acquisition. This study focuses solely on one specific type of anomaly, known as €œSpikes€⊠, which are sharp outlier values with no correlation to surrounding samples. In addition, is important to highlight that its only of interest any issue regarding the acquisition chain (sensors, cables, recording device), the object under test and the specific test procedures or maneuvers are not considered. Therefore, it is assumed that this anomaly detection algorithm must be capable of detecting spikes disregarding the application. The study presents a novel Dynamic Time Warping (DTW) technique for detecting these spikes in real-time, multi-channel acquisitions during automotive testing. The technique has been validated on a 24-signal dataset, consisting of 12 anomalous and 12 non-anomalous signals with varying dynamic ranges, patterns, lengths, and sensor types. The results show the tool’s accuracy in avoiding false positives, such as mistaking spikes for other physical impulses during the test, like tires squeaking, or any other physical impulse coming from the engine or other sub-component of the vehicle under test. Moreover, the study demonstrates the ability of the Dynamic Time Warping technique to effectively detect spikes in sensor data, leading to improved efficiency and effectiveness in prototype testing in the automotive industry.

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