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EventDetector: A Python Package for Time Series Event Detection

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Event detection in time series data plays a crucial role in various domains, including finance, healthcare, environmental monitoring, cybersecurity, and science. Accurately identifying and understanding events in time series data is vital for making informed decisions, detecting anomalies, and predicting future trends. Extensive research has explored diverse methods for event detection in time series, ranging from traditional threshold-based techniques to advanced deep learning approaches. However, a comprehensive survey of existing methods reveals limitations such as lack of universality, limited robustness, or challenges in ease of use. To address these limitations, we propose a novel framework that leverages a universal method based on sliding windows and a Gaussian optimization process, capable of detecting events in any type of time series data. This universal approach allows the framework to be applied to any domain, making it adaptable to different types of events in various time series datasets. To enhance robustness, our framework incorporates a stacked ensemble learning metamodel that combines deep learning models, including classic feed-forward neural networks (FFNs) and state-of-the-art architectures like Self-Attention. By leveraging the collective strengths of multiple models, this ensemble approach mitigates individual model weaknesses and biases, resulting in more robust predictions. To facilitate practical implementation, we have developed a Python package to accompany our proposed framework. We will present the package and provide a comprehensive guide on its usage, showcasing its effectiveness through real-world datasets from planetary science and financial security domains.

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