REALTIME-AT: IMPROVED ONLINE ANOMALY DETECTION IN STREAMING MULTIDIMENSIONAL TIME SERIES

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ABSTRACT

Currently, there is a growing significance of real-time data monitoring and analysis on multivariate time series data with the rapid increase of infrastructure complexity. Detecting anomalies now plays a crucial role in risk, resource and cost management in domains ranging from industrial networks to financial markets. While machine learning-based anomaly detection algorithms show great potential, many of them are designed to run in an offline environment, and adapting those models in an online setting remains a challenge. A novel algorithm by Xu et al., Anomaly Transformer, shows impressive offline performance; however, it is not fit for online use.

To solve this challenge, we introduce RealTime-AT, an optimised improvement of Anomaly Transformer designed for online anomaly detection. We redefine the sliding window mechanism to ensure the model continuously processes the most recent relevant data points, leading us to more accurate anomaly identification. RealTime-AT's core uses a novel dual-buffer system to handle streaming online data, enhancing its real-time capabilities.

Experiments show that RealTime-AT maintains comparable accuracy and other anomaly detection metrics to Anomaly Transformer. More significantly, while maintaining similar performance, it noticeably reduces computational resource demands. This optimisation carries vital importance in resource-constrained real-time environments.

Keywords: Real-time anomaly detection, Online streaming data, Multivariate time series, Machine learning