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Adaptive-Delta ADWIN for Real-Time Intrusion Detection in Evolving Network Streams

Tuesday, 2 December 2025 16:00 (30 minutes)

In dynamic network environments, intrusion detection systems (IDS) must adapt to traffic network patterns despite the challenge of concept drift. Traditional drift detection methods, such as ADWIN, DDM, and others, face a challenge between sensitivity and stability, resulting in both delayed traffic attack detection and abnormal false alarms. To address this issue, we propose a novel framework - Adaptive-Delta ADWIN, which adjusts the ADWIN detector's delta parameter using two lightweight online controllers: Volatility Controller (VC) which adapts to fluctuations in prediction error, and Alert-rate Controller (ARC), which control the frequency of drift alarms. We merge the adaptive detector into streaming ensemble of Hoeffding Adaptive Trees and evaluate its performance against a fixed-delta baseline. The proposed metrics: accuracy, ROU-AUC, F1-score are monitored in real time performance. The results from the experiment demonstrate the effectiveness and responsiveness of the Adaptive-Delta ADWIN framework in handling concept drift while reducing false alarms and balancing sensitivity with stability in IDS streaming environments.

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