V264c Comprehensive Transient Flare Detection on Light Curves with a Lightweight Model

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Time series anomaly detection (TSAD) aims to identify unexpected behaviors by comparing observed and predicted patterns. Many studies in TSAD with complex architectures, such as Transformer and Generative Pre-trained Transformer (GPT) models, often require substantial computational resources and high-end GPUs for training. Due to the high computational demands of Transformer- and GPT-based models, recent research has turned to lightweight or simplified architectures as an alternative solution. In this study, we propose a novel TSAD method based on a lightweight architecture using a single linear model. We conduct a comprehensive evaluation, comparing our proposed method with existing Transformer and GPT-based models for TSAD. Our experiments focus on detecting both synthetic Kepler flares and real M-dwarf flares in light curves captured by the Tomo-e Gozen camera mounted on the Kiso Schmidt telescope. To ensure a reliable and robust performance assessment, we utilized the Volume Under the Surface for Receiver Operating Characteristic (VUS-ROC) metric, rather than traditional metrics such as the F1-score or standard ROC curve. Results demonstrate that our method achieves competitive VUS-ROC performance while significantly reducing computational cost compared to existing methods, including Anomaly-Transformer and fine-tuned GPT-2 models.