

Enhancing GRB Detection: Machine Learning Optimization of Triggerless Data Analysis Algorithms for LHAASO-WCDA

Detecting Gamma-Ray Burst (GRB) signals from triggerless data poses significant challenges due to high noise levels, a problem similarly encountered in the Large High Altitude Air Shower Observatory's Water Cherenkov Detector Array (LHAASO-WCDA) triggerless data analysis. This research aims to enhance the GRB triggerless data algorithm that leverages gamma-ray showers' distinct spatial properties. By incorporating advanced machine learning techniques such as Bayesian optimization, we refine the algorithm to detect GRB signals within noisy background signals more effectively. Preliminary findings indicate a marked improvement in the detection of GRB events, suggesting that machine learning methods can substantially enhance existing astrophysical data analysis techniques. These methods could lead to more accurate and reliable identification of GRB signals, thereby contributing to our understanding of these cosmic phenomena.

Keywords: Gamma-Ray Bursts, Triggerless Data, Machine Learning, Bayesian Optimization, LHAASO-WCDA, Noise Reduction, Astrophysical Data Analysis, Gamma-Ray Showers, Signal Detection, Cosmic Phenomena.

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