

GRAIS

Thursday 29 May 2025 09:30 (15 minutes)

The GRAIS project (Gamma-Ray Artificial Intelligence System) aims to develop innovative Deep Learning and Artificial Intelligence (AI) techniques to identify high-energy transient events, such as orphan gamma-ray burst (GRB) afterglows, in data collected by the Fermi Gamma-ray Large Area Space Telescope (GLAST). By leveraging state-of-the-art anomaly detection algorithms tailored to our dataset, we seek to build a model capable of detecting GRBs with atypical characteristics, such as short emission durations or undetected prompt gamma-ray emission. Due to the limited number of observed GRBs, we are also implementing a Generative AI framework to augment the training data by synthesising realistic GRB-like single-photon events, thereby enhancing the performance and robustness of the anomaly detection model.

To date, we have completed a comprehensive exploratory data analysis of both single-photon events detected by the Large Area Telescope (LAT) and catalogued GRB events. We have also defined the architecture for the generative model and developed the clustering algorithm that underpins the anomaly detection model. Ongoing work is focused on finalising both the anomaly detection and generative models, and on fine-tuning the custom evaluation metrics used in the clustering algorithm. These methods have the potential to significantly enhance the discovery of GRBs with diverse properties, offering a novel Deep Learning-driven approach for identifying previously overlooked transient events.

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Session Classification: Bandi a Cascata