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Advanced Particle Classification in Space Missions Using Transformers

The application of advanced artificial intelligence (AI) techniques in astroparticle experiments represents a groundbreaking advancement in data analysis and experimental design. As space missions become increasingly complex, integrating AI technologies is essential for optimizing their performance and enhancing their scientific outcomes. In this study, we propose a fully custom-designed Transformer-based model tailored for calorimeters in space-based experiments. One of the goal for space calorimeter experiment is to distinguish between particle types, such as electrons and protons. By capturing the dependencies within these features, Transformers can achieve robust classifications, even when the data spans thousands of channels or dimensions. By addressing these challenges, we aim to enhance the accuracy and reliability of data interpretation in astroparticle physics through the application of advanced artificial intelligence techniques. Furthermore, this approach has the potential to extend the classification capability across a very broad energy range, spanning from 1 GeV to 100 TeV.

AI keywords

Transformer, supervised algorithm, classification

Primary author: BOSSA, Maria (Istituto Nazionale di Fisica Nucleare)

Co-authors: Dr GARGANO, Fabio (INFN-Bari); Dr CUNA, Federica (Istituto Nazionale di Fisica Nucleare-Sezione di Bari)

Presenter: BOSSA, Maria (Istituto Nazionale di Fisica Nucleare)

Track Classification: Foundation Models