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Semi-Supervised Permutation Invariant Particle-Level Anomaly Detection

Thursday 7 November 2024 09:00 (20 minutes)

The development of analysis methods that can distinguish potential beyond the Standard Model phenomena in a model-agnostic way can significantly enhance the discovery reach in collider experiments. However, the typical machine learning (ML) algorithms employed for this task require fixed length and ordered inputs that break the natural permutation invariance in collider events. To address this limitation, we have designed a semi-supervised anomaly detection tool that takes a variable number of particle-level inputs and leverages a signal model to encode this information into a permutation invariant, event-level representation via supervised training with a Particle Flow Network (PFN). We then utilize this encoding as input to an autoencoder to perform unsupervised ANomaly deTEction on particLe flOw latent sPacE (ANTELOPE), classifying anomalous events based on a low-level and permutation invariant input modeling. In this talk, the ANTELOPE architecture will be presented, and its performance will be demonstrated on the LHC Olympics dataset. Future outlook and evolutions of the tool will be discussed.

Track

Anomaly detection

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