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Type: **Poster**

Machine Learning-Driven Anomaly Detection in Dijet Events with ATLAS

This contribution discusses an anomaly detection search for narrow-width resonances beyond the Standard Model that decay into a pair of jets. Using 139 fb−1 of proton-proton collision data at sqrt(s) = 13 TeV, recorded from 2015 to 2018 with the ATLAS detector at the Large Hadron Collider, we aim to identify new physics without relying on a specific signal model. The analysis employs two machine learning strategies to estimate the background in different signal regions, with weakly supervised classifiers trained to differentiate this background estimate from actual data. We focus on high transverse momentum jets reconstructed as large-radius jets, using their mass and substructure as classifier inputs. After a classifier-based selection, we analyze the invariant mass distribution of the jet pairs for potential local excesses. Our model-independent results indicate no significant local excesses and we inject a representative set of signal models into the data to evaluate the sensitivity of our methods. This contribution discusses the used methods and latest results and highlights the potential of machine learning in enhancing the search for new physics in fundamental particle interactions.

Significance

This presentation shows the latest machine learning (ML)-driven anomaly detection search using data recorded with the ATLAS detector. The search significantly advances the field of ML-driven anomaly detection at the LHC and demonstrates how various state of the art methods can be applied to real data to gain valuable physics insights.

References

https://arxiv.org/abs/2502.09770

Experiment context, if any

ATLAS Experiment

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Session Classification: Poster session with coffee break

Track Classification: Track 2: Data Analysis - Algorithms and Tools