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Robust anomaly detection using NuRD

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Anomaly, or out-of-distribution, detection is a promising tool for aiding discoveries in particle physics. However, existing detection methods perform detection against only a single background process, primarily using boosted objects. Moreover, most algorithms can depend on nuisance features such as jet mass to falsely tag known physics as an anomaly or ignore new physics as an already known background process. In this work, we build detection algorithms for anomalous particle decays against multiple background types. In addition, we generalize the notion of decorrelation to the multi-background setting by combining representation learning techniques for robustness to nuisances and classifier-based out-of-distribution detection algorithms. We demonstrate the benefit of such nuisance-aware out-of-distribution detection algorithms on a high-dimensional dataset of particle decays at the Large Hadron Collider.

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