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Unsupervised machine learning for data quality monitoring of hadronic jets in the CMS experiment

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In high-energy physics experiments like the Compact Muon Solenoid (CMS) at the Large Hadron Collider (LHC), ensuring data quality is crucial for accurate physics analyses. Traditional methods for data quality monitoring (DQM) rely heavily on manual inspections, which can be time-consuming and prone to human bias. To address these challenges, we explore the application of unsupervised machine learning for automating the DQM process. Specifically, we leverage anomaly detection techniques to identify patterns in data and detect deviations that may indicate data quality issues. Using methods such as autoencoders, our approach is designed to work with the high-dimensional data produced by CMS, allowing us to identify anomalies without the need for labeled datasets. Preliminary results on observables pertaining to hadronic jets show that our models can identify problematic data runs and flag potential anomalies with high accuracy, complementing existing DQM procedures. This approach provides a scalable solution that enhances the speed and reliability of DQM in the CMS experiment, ultimately contributing to more efficient data analysis workflows and improved physics results.

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