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AutoDQM: An Automated Tool for Data Quality Monitoring in CMS

The Large Hadron Collider (LHC) generates vast amounts of data, making efficient data quality monitoring (DQM) essential for ensuring reliable detector performance and accurate physics analysis. AutoDQM, an anomaly detection system, was developed to address this challenge. It applies statistical techniques such as beta-binomial probability tests alongside principal component analysis and neural network autoencoders to detect irregularities in detector performance. Using unsupervised machine learning, it can identify previously unseen anomalies. Applied to the CMS 2022 proton-proton collision dataset, AutoDQM identified anomalous "bad" data affected by detector malfunctions 4–6 times more frequently than normal data, demonstrating its effectiveness as a general data quality monitoring tool. By improving data reliability, AutoDQM enhances the precision and trustworthiness of physics analysis in high-energy experiments.

Significance

References

Experiment context, if any

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