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Resilience of Quark-Gluon Tagging

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Discriminating quark-initiated from gluon-initiated jets is an extremely challenging yet important task in high-energy physics. Recent studies have shown that the discriminating features between quark and gluon jets produced by the Monte Carlo generator Pythia differ significantly from the features produced by Herwig. To understand this simulation-dependent discrepancy, we propose a Bayesian version of ParticleNet (a state-of-the-art graph neural network that treats jets as particle clouds). Our Bayesian ParticleNet (BPN) shows similar performance to the deterministic ParticleNet, while providing additional information about uncertainties. We use the uncertainty estimates provided by our Bayesian ParticleNet to study the resilience/robustness of quark-gluon tagging and assess the differences between Pythia and Herwig jets.

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