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(R) Generative Neural Networks for Reconstructing Parton-Level Jet Showers after Hadronization

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Recreating realistic parton-level event configurations from jets is a crucial task for various physics analyses. However, hadronization processes cannot be computed using perturbative QCD. Therefore, it has been traditionally intractable to reconstruct parton-level events after hadronization.

We present a generative machine learning approach for reconstructing jet showers at the parton level from hadron-level jets. In particular, we utilize state-of-the-art generative models and vector representations of jets $\mathcal{J} = \left\{n, (p_i^\mu, \eta_i, \phi_i)_{i=1}^n\right\}$, where n is the particle multiplicity. Unlike traditional regression-based methods that focus on predicting individual particle properties, our method captures the entire parton-level event structure from jet data, offering a physically realistic reconstruction.

For this talk, we look at jets originating from photon-tagged events to maximize partonic structure in a single reconstructed jet, although our method works for any jet multiplicity and process. We evaluate the performance of our method using the energy mover's distance metric, in addition to studying the impact of different sources of background such as underlying events, detector effects, and pileup events.

Track

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