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The Optimal use of Segmentation for Sampling Calorimeters

Tuesday, 7 November 2023 17:00 (15 minutes)

We present a study on the impact of detector granularity on machine-learning-based energy regression for high-granularity sampling calorimeters. As a case study, we simulate the response of a detector similar to the forward calorimeter system intended for use in the ePIC detector, which will operate at the upcoming Electron-Ion Collider. Models using DeepSets and graph neural networks are trained on the simulated calorimeter showers, represented as point clouds. We train several models on detector simulations with different numbers of longitudinal sections to investigate the impact of increased longitudinal information on the model performance, defined in this work as energy scale and resolution for single-particle showers. We then train models on varied levels of calorimeter cell information, to further investigate the impact of longitudinal granularity, as well as the impact of transverse cell information on machine-learning-based energy regression. These results provide a valuable benchmark for ongoing EIC detector optimizations and may also inform future studies involving high-granularity calorimeters in other experiments.

Early Career

Yes

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