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Particle reconstruction in jets with set transformer and hypergraph prediction architectures

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Particle reconstruction is a task underlying virtually all analyses of collider-detector data. Recently, the application of deep learning algorithms on graph-structured low-level features has suggested new possibilities beyond the scope of traditional parametric approaches. In particular, we explore the possibility to reconstruct and classify individual neutral particles in a collimated environment by studying single-jet events in a realistic calorimeter simulation. We develop two novel algorithms which approach reconstruction as a set-to-set task between tracks and calorimeter clusters as input and final-state particles as output. Notably, an algorithm designed to predict hypergraph structure shows superior performance on particle and jet-level metrics –surpassing a parametric particle-flow baseline –and provides a high degree of interpretability.

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