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HEP.TrkX Charged Particle Tracking using Graph Neural Networks

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To address the unprecedented scale of HL-LHC data, the HEP.TrkX project has been investigating a variety of machine learning approaches to particle track reconstruction. The most promising of these solutions, a graph neural network, processes the event as a graph that connects track measurements (detector hits corresponding to nodes) with candidate line segments between the hits (corresponding to edges). This architecture enables separate input features for edges and nodes, ultimately creating a hidden representation of the graph that is used to turn edges on and off, leaving only the edges that form tracks. Due to the large scale of this graph for an entire LHC event, we present new methods that allow the event graph to be scaled to a computationally reasonable size. We report the results of the graph neural network on the TrackML dataset, detailing the effectiveness of this model on event data with large pileup. Additionally, we propose post-processing methods that further refine the result of the graph neural network, ultimately synthesizing an end-to-end machine learning solution to particle track reconstruction.

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Session Classification: Computing, Analysis Tools, & Data Handling

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