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Accelerating Graph-Based Tracking with Symbolic Regression

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Tracking, the reconstruction of particle trajectories from hits in the inner detector is a computationally intensive task due to the large combinatorics of detector signals. Recent efforts have proven that ML techniques can be successfully applied to the tracking problem, extending and improving the conventional methods based on feature engineering. However, the inference of complex networks can be too slow to be used in the trigger system. Quantising the network and deploying it on an FPGA is feasible but challenging and highly non-trivial. An efficient alternative can employ symbolic regression (SR), which already proved its performance in replacing a dense neural network for jet classification. We propose a novel approach that uses SR to replace a graph-based neural network. Using a simplified toy example, we substitute each network block with a symbolic function, preserving the graph structure of the data and enabling message passing. This approach significantly speeds up inference on a CPU without sacrificing much accuracy.

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