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Reconstructing Particle Tracks in One Go with a Recursive Graph Attention Network

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Track reconstruction is a crucial task in particle experiments and is traditionally very computationally expensive due to its combinatorial nature. Many recent developments have explored new tracking algorithms in order to improve scalability in preparation of the HL-LHC. In particular, Graph neural networks (GNNs) have emerged as a promising approach due to the graph nature of particle tracks. Most of these GNN-based methods implement a three-step algorithm, including graph construction, edge classification, and graph segmentation. Others perform object condensation (OC) after the graph construction stage followed by a clustering of the detector hits. In this presentation, we consider a one-shot OC approach which reconstructs particle tracks directly from a set of hits (point cloud) by recursively applying Graph Attention Networks with an evolutional graph structure. This approach simplifies the procedure compared to the three-step approaches and also allows to further regress the hit properties. Preliminary studies on the trackML dataset show physics and computing performance comparable to current production algorithms for track reconstruction.

Significance

This presentation presents a novel approach for track finding and provides several advantages to the standard tracking algorithm as well as the currently most common ML-based approach. We demonstrate the idea and show very promising results. This novel approach can potentially replace the current method in the future.

References

This is our very first result.

Experiment context, if any

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Session Classification: Track 2: Data Analysis - Algorithms and Tools

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