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HEP.TrkX project: DNNs for HL-LHC online and offline tracking

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Particle track reconstruction in dense environments such as the detectors of the HL-LHC is a challenging pattern recognition problem. Traditional tracking algorithms such as the combinatorial Kalman Filter have been used with great success in LHC experiments for years. However, these state-of-the-art techniques are inherently sequential and scale poorly with the expected increases in detector occupancy in the HL-LHC conditions.

The HEP.TrkX project is a pilot project with the aim to identify and develop cross-experiment solutions based on machine learning algorithms for track reconstruction. Machine learning algorithms bring a lot of potential to this problem thanks to their capability to model complex non-linear data dependencies, to learn effective representations of high-dimensional data through training, and to parallelize easily on high-throughput architectures such as GPUs.

This contribution will describe our initial explorations into this relatively unexplored idea space. We will discuss the use of recurrent (LSTM) and convolutional neural networks to find and fit tracks in toy data and LHC-like data generated with ACTS.

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Track Classification: 0 : Algorithms and theoretical analysis