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TrackFormers 2: Enhanced Transformer-Based Models for High-Energy Physics Track Reconstruction

High-Energy Physics experiments are rapidly escalating in generated data volume, a trend that will intensify with the upcoming High-Luminosity LHC upgrade. This surge in data necessitates critical revisions across the data processing pipeline, with particle track reconstruction being a prime candidate for improvement. In our previous work, we introduced "TrackFormers", a collection of Transformer-based one-shot models that effectively associate hits with expected tracks. In this study, we extend our earlier efforts of model development by incorporating loss functions that account for inter-hit correlations, conducting detailed investigations into (various) Transformer attention mechanisms, and a study on the reconstruction of higher-level objects. Furthermore, we discuss new datasets that allow the training on hit level for a range of physics processes. These developments collectively aim to boost both the accuracy and the potential efficiency of our tracking models, offering a robust solution to meet the demands of next-generation high-energy physics experiments.

Secondary track

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