

Ariadne: PyTorch Library for Particle Track Reconstruction Using Deep Learning

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Particle tracking is a fundamental part of the event analysis in high energy and nuclear physics (HENP). Events multiplicity increase each year along with the drastic growth of the experimental data which modern HEP detectors produce, so the classical tracking algorithms such as the well-known Kalman filter cannot satisfy speed and scaling requirements. At the same time, breakthroughs in the study of deep learning open an opportunity of application of high-performance deep neural networks for solving tracking problems in a dense environment of experiments with heavy ions. However, there are no well-documented software libraries for deep learning track reconstruction yet. We introduce Ariadne, the first open-source library for particle tracking based on the PyTorch deep learning framework. The goal of our library is to provide a simple interface that allows one to prepare train and test datasets and to train and evaluate one of the deep tracking models implemented in the library on the data from your specific experiment. The user experience is greatly facilitated because of the system of gin-configurations. The modular structure of the library and abstract classes let the user develop his data processing pipeline and deep tracking model easily. The proposed library is open-source to facilitate academic research in the field of particle tracking based on deep learning.

Primary authors: Mr GONCHAROV, Pavel; Mr SCHAVELEV, Egor (St. Petersburg State University); Ms NIKOLSKAYA, Anastasia (St. Petersburg State University); Prof. OSOSKOV, Gennady

Presenter: Mr GONCHAROV, Pavel

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