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Simultaneous track finding and track fitting by the Deep Neural Network at BESIII

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Track fitting and track hit classification are highly relevant, hence these two approaches could benefit each other. For example, if we know the underlying parameters of a track, then track hits associated with the track can be easily identified. On the other hand, if we know the hits of a track, then we can get underlying parameters by fitting them. Most existing works take the second scheme by classifying track hits and then estimating track parameters.

Inspired by the above observations and the success of multi-task training, we propose a unified framework to address track fitting and track hit classification simultaneously in an end-to-end fashion. The method takes hits from multiple tracks as inputs, where each hit holds 4-dimensional features, including 2D position, hitting time, and deposit charge. We feed these inputs to a backbone network to extract per-hit features. Then the network is divided into two branches. One branch is a reconstruction branch, which estimates the parameters of each track and its existence. The other branch is a track segmentation branch, which takes learned features of PointNet++ and tracks features to determine a hit-wise track assignment. In essence, we can assign each track hit to its potential track to classify track hits. This method allows us to predict the track parameters of a track candidate while conducting per-track hit classification. This study leverages the simulated multi-track samples of the BESIII drift chamber. Preliminary results indicate our framework is able to categorize hits of different tracks and the candidate track parameters simultaneously.

Significance

References

Experiment context, if any

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