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Comparing and improving hybrid deep learning algorithms for identifying and locating primary vertices

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Identifying and locating proton-proton collisions in LHC experiments (known as primary vertices or PVs) has been the topic of numerous conference talks in the past few years (2019-2021). Efforts to search for a variety of potential architectures have yielded potential candidates for PV-finder. The UNet model, for example, has achieved an efficiency of 98% with a low false-positive rate. These results can be obtained with numerous other neural network architectures. It also converges faster than any previous model. While this does not answer the question of how the algorithm learns, it does provide some useful insights into the open question. We present the results from this architectural study of different algorithms and their performance in locating PVs for LHCb data. The goal is to demonstrate progress in developing a performant architecture and evaluate different algorithms' learning.

Experiment context, if any

LHCb pv-finder

References

https://arxiv.org/pdf/1906.08306.pdf
https://arxiv.org/abs/2103.04962

Significance

Provides analysis and comparison of different machine learning algorithms with respect to LHCb primary vertex finding. These results also show a near-upper limit with currently available data.

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