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Advances in developing deep neural networks for finding primary vertices in proton-proton collisions at the LHC

Tuesday 30 January 2024 12:30 (20 minutes)

We have been studying the use of deep neural networks (DNNs) to identify and locate primary vertices (PVs) in proton-proton collisions at the LHC. Earlier work focused on finding primary vertices in simulated LHCb data using a hybrid approach that started with kernel density estimators (KDEs) derived from the ensemble of charged track parameters heuristically and predicted "target histogram"proxies from which PV positions are extracted. We have demonstrated that using a UNet architecture performs indistinguishably from a "flat" convolutional neural network model. We have recently developed an "end-to-end"tracks-to-hists DNN that predicts target histograms directly from track parameters using simulated LHCb data that provides better performance (a lower false positive rate for the same high efficiency) than the best KDE-to-hists model studied. This DNN also provides better efficiency than the default heuristic algorithm for the same low false positive rate.

We are currently instantiating the end-to-end tracks-to-hists DNN within the software stack for Allen, LHCb's GPU-resident, first-level software trigger. In this context we are studying the evolution of the tracks-to-hists DNN performances after various levels of pruning and quantization. We will show that high-level performances are maintained even after substantial reduction of model use of compute resource.

Would you like to be considered for an oral presentation?

Yes

Authors: SOKOLOFF, Michael David (University of Cincinnati (US)); SHINDE, Sara (University of Cincinnati (US)); AKAR, Simon (University of Cincinnati (US))

Co-authors: KAUFFMAN, Elliott (Princeton University (US)); SCHREINER, Henry Fredrick (Princeton University); PETERS, Michael; ELASHRI, Mohamed (University of Cincinnati); GARG, Rocky Bala (Stanford University (US)); TEPE, Will

Presenter: AKAR, Simon (University of Cincinnati (US))

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