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End-to-End Vertex Finding for the CMS Level-1 Trigger

Monday, 3 October 2022 16:00 (15 minutes)

The High Luminosity LHC provides a challenging environment for fast trigger algorithms; increased numbers of proton-proton interactions per collision will introduce more background energy in the detectors making triggering on interesting physics signatures more challenging. To help mitigate the effect of this higher background the highest energy interaction in an event can be found and other detector signatures can be associated with it. This primary vertex finding at the CMS Level-1 trigger will be performed within a latency of 250 ns. This work presents an end-to-end neural network based approach to vertex finding and track to vertex association. The network possesses simultaneous knowledge of all stages in the reconstruction chain, which allows for end-to-end optimisation. A quantised and pruned version of the neural network, split into three separate sub networks, is deployed on an FPGA using the hls4ml tools rerun through Xilinx vitis hls to take advantage of optimised pipelining. A custom hls4ml tool for convolutional neural networks that allows fully parallel input is used to ensure the strict latency requirements are met. Hardware demonstration of the network on a prototype Level-1 trigger processing board will also be shown.

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