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Machine Learning for Online Energy Reconstruction in ATLAS Tile Calorimeter at HL-LHC

The High-Luminosity LHC (HL-LHC) will significantly extend the physics reach of the ATLAS experiment, offering increased sensitivity to rare processes and precision measurements. To cope with the corresponding rise in data rates and radiation levels, major upgrades to the ATLAS experiment are required to maintain its performance. One of these upgrades involves replacing the readout electronics of the Tile Hadronic Calorimeter. A key component is the Tile PreProcessor (TilePPr), built around Kintex Ultrascale FPGAs, which connects the calorimeter's front-end electronics to the first level of the ATLAS trigger. The TilePPr will handle real-time signal reconstruction, providing calibrated data at 40 MHz for each bunch crossing with fixed and low latency.

This contribution focuses on the integration of Machine Learning-based algorithms for energy reconstruction within the TilePPr. Different neural network architectures are being studied to achieve high accuracy while keeping inference fast and resource usage low —both critical for FPGA deployment. Particular attention is given to model optimization techniques to meet the tight timing and resource constraints of real-time processing in a high-throughput environment.

Would you like to be considered for an oral presentation?

Yes

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