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Machine Learning based Data Compression on FPGA with HLS4ML

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Data storage is a major limitation at the Large Hadron Collider and is currently addressed by discarding a large fraction of data. We present an autoencoder based lossy compression algorithm as a first step towards a solution to mitigate this problem, potentially enabling storage of more events. We deploy an autoencoder model, on Field Programmable Gate Array (FPGA) firmware using the hls4ml library. The model is trained to reconstruct a small jet dataset derived from CMS Open Data, as a proof-of-principle. We show that the model is capable of compressing the dataset to nearly half the initial size with a tolerable loss in data resolution. We also open a discussion for future studies that enable testing data compression algorithms under conditions close to online operation of the LHC.

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