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Low Energy LArTPC Signal Detection using Anomaly Detection

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Extracting low-energy signals from LArTPC detectors is useful, for example, for detecting supernova events or calibrating the energy scale with argon-39. However, it is difficult to efficiently extract the signals because of noise. We propose using a 1DCNN to select wire traces that have a signal. This efficiently suppresses the background while still being efficient for the signal. This is then followed by a 1D autoencoder to denoise the wire traces. At that point the signal waveform can be cleanly extracted.

In order to make this processing efficient, we implement the two networks on an FPGA. In particular we use hls4ml to produce HLS from the Keras models for both the 1DCNN and the autoencoder. We deploy them on an AMD/Xilinx Alveo U55C using the Vitis software platform.

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