

FPGA Deployment of PointNET for Use in the KamLAND-Zen Experiment

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While there are several experiments searching for neutrinoless double beta decay ($0\nu\beta\beta$), a rare decay phenomenon, we focus our attention on the KamLAND-Zen experiment, which is a monolithic liquid xenon scintillator detector. Because the events that occur in the detector are indirectly observed, a reconstruction of the event must be done, which is a non-trivial process and is done after all the data is collected. This means that the experiment commits resources towards storing data that is not relevant to the $0\nu\beta\beta$ analysis. To help solve this problem, we propose a toolchain that deploys a machine learning model, PointNET, onto a Field Programmable Gate Array so that a fast inference may be done at the time of data collection. This is the first time that hardware-Algorithm co-design has been brought to the stage of $0\nu\beta\beta$ experiments.

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