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Building Machine Learning Applications for Temporally Segmented High Granular Multi-readout Fiber Calorimeters

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New technologies have enabled the development of granular calorimeters with millions of channels. The signal of the ultra-sampled shower produced by these devices is thought to provide greater discriminating power to event reconstruction. Combining sub-nanosecond digitization with small area photosensors in a fiber calorimeter, we propose an enhancement to the traditional dual readout design that provides benefits of both high-granularity and multi-readout. We show that by applying machine learning techniques, namely Convolutional Neural Networks, Graph Neural Networks, and Recurrent Neural Networks to both a highly granular and proposed fiber calorimeters. We see, for instance, in the simple high granularity setup, the CNN improves reconstructed energy resolution from ~40 to ~33 %/sqrt(E). These results indicate the spatial distribution of energy deposition within the sensitive elements is both identifiable (able to be learned) and representative of underlying physical processes.

TIPP2020 abstract resubmission?

No, this is an entirely new submission.

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