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Neutrino Identification with a Convolutional Neural Network in the NOvA Detectors

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The observation of neutrino oscillation provides evidence of physics beyond the standard model, and the precise measurement of those oscillations remains an important goal for the field of particle physics. NOvA will soon be one of the foremost experiments in that field. Taking advantage of a two-detector technique, a tightly focused off-axis view of the NuMI neutrino beam, and a pair of finely instrumented liquid scintillator detectors, NOvA is in a prime position to contribute to precision measurements of the neutrino mass splitting, mass hierarchy, and CP violation.

A key part of that precise measurement is the accurate characterization of neutrino interactions in our detector. This presentation will describe a convolutional neural network based approach to neutrino interaction type identification in the NOvA detectors. The Convolutional Adaptive Learned Visual Intelligence Network (CALVIN) algorithm is an innovative and powerful new approach to event identification which uses the technology of convolutional neural networks, developed in the computer vision community, to identify events in the detector without requiring detailed reconstruction. We will discuss the core concept of convolutional neural networks, modern innovations in convolutional neural network architecture related to the nascent field of deep learning, and the performance of our own novel network architecture in event selection for the NOvA oscillation analyses.

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