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Particle Identification Using Convolutional Neural Networks in the NOvA Experiment

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In 2016, NOvA was the first HEP experiment to employ a convolutional neural network (CNN) in a physics result, using the CNN to classify neutrino events. The physics analyses performed by NOvA can be improved by further identification and reconstruction of particles in the interaction final states. We have developed the first implementation of a CNN for single particle classification which employs context-enhanced inputs. Using contextual information from the neutrino interaction that produces the particles provides additional information to the training, extending the capabilities of our original classifier. This implementation uses a four-tower siamese architecture for separation of independent inputs and inclusion of contextual information. This classifier distinguishes between electrons, muons, photons, pions, and protons with a global efficiency and purity of 83.7% and 83.5%, respectively. In this talk I will describe our implementation of NOvA's single particle CNN, discuss the advantages of adding context information, provide case-studies of the applications and planned future improvements to the classifier.

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