Contribution ID: **48** Type: **Poster**

Particle Clustering and Flow Reconstruction for Particle Imaging Neutrino Detectors Using Graph Neural Networks

Wednesday, April 22, 2020 8:20 PM (10 minutes)

Machine learning (ML) techniques, in particular deep neural networks (DNNs) developed in the field of Computer Vision, have shown promising results to address the challenge of analyzing data from a big, high resolution particle imaging detector such as Liquid Argon Time Projection Chambers (LArTPCs), employed in accelerator-based neutrino experiments including Short Baseline Neutrino (SBN) program and Deep Underground Neutrino Experiment (DUNE). Convolutional neural networks (CNNs) have been the de-facto choice for image feature extraction tasks, and they are particularly powerful for identifying locally dense features. On the other hand, Graph Neural Networks (GNNs) have been studied actively for analyzing correlation features between distant objects. Example applications for LArTPC detectors include signal correlations between two independent detectors (optical detectors and TPCs), reconstruction of particle hierarchy (e.g. a primary particle vs. secondary radiation), and clustering of particles per primary interaction in a busy "neutrino pile-up" environment, expected at the DUNE near detector under high neutrino beam intensity. In this talk, we present our work on utilizing GNNs in the ML-based full data reconstruction chain for LArTPC detectors.

Consider for young scientist forum (Student or postdoc speaker)

Yes

Second most appropriate track (if necessary)

Enhanced performance of tracking algorithms

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Session Classification: Recording sessions