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Shower Reconstruction in Liquid Argon Time Projection Chambers using Graphical Neural Networks

Liquid Argon Time Projection Chambers (LArTPCs) are a class of detectors that produce high resolution images of charged particles within their sensitive volume. The identification and clustering of electromagnetic (EM) showers in LArTPCs is of central importance to the current and future neutrino physics program. EM activity typically exhibits spatially detached fragments of varying morphology and orientation that are challenging to efficiently assemble using traditional algorithms. Graphical Neural Networks (GNNs) were developed in recent years to find correlations between objects embedded in an arbitrary space. GNNs are studied with the goal of predicting the adjacency matrix of EM shower fragments and to identify the origin of showers, i.e. primary fragments. The energy resolution of the showers assembled with GNNs is presented and the reconstruction of the mass of neutral pions is used as a test case to further validate the algorithm.

Mini-abstract

Graphical Neural Networks offer a promising novel approach to shower reconstruction in LArTPCs

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