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Particle Clustering in LArTPCs with Embedding Learning Convolutional Neural Networks

In this poster, we present a fast and scalable deep learning algorithm for particle clustering in liquid argon time projection chamber (LArTPC) data, as part of the machine learning based reconstruction effort at SLAC. Particle clustering refers to the task of grouping image pixels into particle instances, which is regarded as one of the most challenging tasks in LArTPC data reconstruction. Building on previous works on sparse convolutional neural networks and proposal free instance segmentation, we build an end-to-end trainable particle clustering deep neural network that can learn an embedding of the image pixels to perform point cloud clustering in a transformed space. Using 3D images of LArTPC open dataset, we evaluate the network's purity and efficiency of cluster assignments and assess its overall computing resource usage. The proposed algorithm is applicable to data reconstruction of 2D and 3D imaging LArTPC detectors, including DUNE and SBN programs.

Mini-abstract

Fast and scalable deep neural networks for LArTPC particle clustering.

Experiment/Collaboration

DUNE, SBN

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