Contribution ID: **27** Type: **Plenary**

Graph Neural Network for Three Dimensional Object Reconstruction in Liquid Argon Time Projection Chambers

Wednesday 1 June 2022 16:20 (25 minutes)

The Exa.TrkX project presents a graph neural network (GNN) technique for low-level reconstruction of neutrino interactions in a Liquid Argon Time Projection Chamber (LArTPC). GNNs are still a relatively novel technique, and have shown great promise for similar reconstruction tasks in the LHC. Graphs describing particle interactions are formed by treating each detector hit as a node, with edges describing the relationships between hits. We utilise a multihead attention message passing network which performs graph convolutions in order to label each node with a particle type.

We previously demonstrated promising performance for our network. Using Delaunay triangulation as edge-forming technique, we tested different truth labeling schemes (a "full"version where each particle type is its own category, and a "simple"one that merges some of the categories by similar topologies), as well as different versions with or without edges connecting hits across planes (referred to as 3D and 2D networks, respectively). We found that the best accuracy is achieved by the 2D network, although the 3D network provides higher label consistency across planes.

In this presentation, in addition to reviewing the network properties and goals, we will demonstrate further improvements in various aspects of the work. These include changes to the merging of categories for the simple truth labeling, the addition of an attention mechanism for 3D edges, and optimization of hyper parameters. After these additions, we will discuss further steps and assess the readiness of the network for usage in real-life neutrino experiments.

Consider for young scientist forum (Student or postdoc speaker)

Yes

Authors: AURISANO, Adam (University of Cincinnati); GRZENDA, Daniel (UChicago); CERATI, Giuseppe (Fermi National Accelerator Lab. (US)); LEE, Claire (Northwestern); HEWES, Jeremy Edmund (University of Cincinnati (US)); KOWALKOWSKI, Jim (Fermilab); GUMPULA, Kaushal (UChicago); LIAO, Wei-Keng (Northwestern)

Presenter: GUMPULA, Kaushal (UChicago)

Session Classification: Plenary