



Contribution ID: 15

Type: **Invited talks**

Graph Learning for Explainable Operation of Particle Accelerators- 15'+5'

Thursday 10 April 2025 11:00 (20 minutes)

We describe research in deep learning on graph representations of the injector beamline at the Continuous Electron Beam Accelerator Facility (CEBAF) to develop a tool for operations. We leverage operational archived data –both unlabeled and labeled configurations –to train a graph neural network (GNN) via our methods of self-supervised training and supervised fine tuning. We demonstrate the ability of the GNN to distill high-dimensional beamline configurations into low-dimensional embeddings and use them to create an intuitive visualization for operators. By mapping out regions of latent space characterized by good and bad setups, we describe how this could provide operators with more informative, real-time feedback during beam tuning compared to the standard practice of interpreting a set of sparse, distributed diagnostic readings. We further describe the results of a framework that provides users with explanations for why a configuration changes location in the latent space.

Author: TENNANT, Chris

Co-authors: MOSER, Daniel (Jefferson Laboratory); LI, Jundong (University of Virginia); WANG, Song (University of Virginia); LARRIEU, Theo (Jefferson Laboratory)

Presenter: TENNANT, Chris

Session Classification: Surrogate Modelling and Digital Twins

Track Classification: Surrogate Modelling and Digital Twins