Contribution ID: **192** Type: **Oral Presentation**

Applications of Graph Neural Networks in Particle Physics and Air Quality Systems for PM2.5 forecasting

Wednesday, 5 July 2023 15:20 (20 minutes)

Graph Neural Networks (GNNs) are widely used in particle physics research as a solution to handling complex, sparse, and noisy data. Detectors capture millions of measurements per second, resulting in high-dimensional data that is difficult to analyze.
GNNs allow us to model data as a graph, where each detector component corresponds to a node and edges represent interactions between particles. Message-passing algorithms propagate information throughout the graph, allowing GNNs to capture complex relationships between detector components and learn representations of physical processes.
GNNs are used for particle identification, event reconstruction, and anomaly detection, and can also be used for air quality systems to predict pollutant concentration.
In air quality systems, the graph consists of air monitoring stations measuring pollutant concentration and meteorological data every hour. Each monitoring station corresponds to a node and edges represent how stations interact. The graph is constructed based on how stations transport PM2.5 concentrations to each other. The adjacency matrix defines which nodes are adjacent to each other based on factors that hinder the transport of PM2.5, such as distance, mountain ranges, and elevation differences. Edges contain information about wind speed, wind direction, distance, and the direction of the source station to the sink station.
This improves the accuracy of the prediction.

Apply to be considered for a student ; award (Yes / No)?

Yes

Level for award;(Hons, MSc, PhD, N/A)?

MSc

Primary author: RUDOLPH, Craig (University of the Witwatersrand)

Co-authors: MELLADO, Bruce (University of the Witwatersrand); BASU, PAllab (Senior Lecturer)

Presenter: RUDOLPH, Craig (University of the Witwatersrand)

Session Classification: Applied Physics

Track Classification: Track F - Applied Physics