Contribution ID: **592** Type: **Poster**

A pipeline to test Graph Neural Network algorithms for flavour tagging

Graph Neural Networks-based algorithms are suitable candidates for the efficiency optimization of flavour tagging in High Energy Physics (HEP) research at colliders. The identification of jets originating from b- and c-quarks (flavour tagging) is crucial for many analyses, including searches beyond the Standard Model (SM) signatures and measurements of the properties of SM particles. Each jet can be portrayed by a graph-structure, wherein the associated charged particle tracks correspond to nodes totally connected. By analyzing the graph topology, a wide range of information can be extracted, which are exploited from the network to identify the partonic species of the jets. Following this approach, the contribution presents a pipeline for training and optimization of GNN dedicated to flavour tagging. Similar architectures provide the possibility of explore the input feature ranking and the application of attention mechanism methods to GNNs. The pipeline has been applied on a dataset constituted by a simulated next-to-leading order (NLO) $t\bar{t}$ dataset and, to extend the accessible transverse momentum range, an additional high-p_T $Z'H$ simulated dataset at LO precision. The production of both the datasets has required an integration of multiple frameworks. For the $t\bar{t}$ dataset the necessary matrix elements has been calculated with the MadGraph_aMC@NLO framework, accounting for virtual and real radiation contributions. For both datasets, the events are hadronized with PYTHIA-8.3, following the ATLAS A15 configuration. Finally, to model the response of particle detectors to the final-state particles, the DELPHES-3.5.0 fast simulation of the ATLAS detector has been used. To evaluate the pipeline performance, the results obtained have been compared by those from the ATLAS and CMS experiment. Moreover, the GNN algorithms are compared to the traditional jet tagging methods and the other state-of-the-art GNN-based algorithms. Through this work, we want to contribute to the growing body of research on GNNs in HEP and demonstrate the potential of GNNs for jet tagging.

Collaboration / Activity

TIFPA - University of Trento

Primary author: BRIANTI, Greta (TIFPA)

Presenter: BRIANTI, Greta (TIFPA)

Session Classification: Poster session

Track Classification: Searches for New Physics