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A Comprehensive Comparison of GNN Architectures for Jet Tagging

There has been significant interest and development in the use of graph neural networks (GNNs) for jet tagging applications. These generally provide better accuracy than CNN and energy flow algorithms by exploiting a range of GNN mechanisms, such as dynamic graph construction, equivariance, attention, and large parameterizations. In this work, we present the first apples-to-apples exploration of these mechanisms for jet tagging applications. In particular, we focus on concrete use-cases in a detector environment, and introduce metrics to quantify performance gain vs model size. With this full exploration of the hyperparameter space, we are then in a position to make recommendations for given hardware and latency constraints. Additionally, we investigate specific claims that purport certain GNN mechanisms to be responsible for better performance, and show that in fact state-of-the-art performance can be attained with a subset of these mechanisms and with significantly reduced architectural complexity.

Significance

This is the first full comparison and sensitivity study of GNN architectures and hyperparameters for jet tagging, including new innovations in Lorentz equivariance

References

Speaker time zone

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