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Quantum and quantum inspired computing for jet physics at the LHC

Fabrizio Napolitano



Jets are collimated sprays of hadrons copiously produced at the LHC, and are among the main objects used by the experiments for precision measurements and searches for new physics. In the last decade, machine- and deep learning methods have established themselves as the most performant scientific tools to address the underlying complexity of classification and anomaly detection. Graph- and transformer-based methods are presently the state-of-the-art architectures employed by the experimental collaborations, despite their typically large number of parameters, limited physical insight and sensitivity to systematic effects, especially when operating on low-level features.Quantum computing has emerged as a new computational paradigm also for jet physics, promising simple yet expressive architectures which could yield advantages in terms of parameter efficiency and interpretability.

To achieve a quantum machine learning model on current NISQ hardware, we formulated a quantum encoding on the Lund plane representation of the jet (LP2B). In this seminar, I will start with an introduction to quantum computing for High Energy Physics, discuss the performance of this approach, and robustness to out-of-domain generalization. Finally, I will present highlights of quantum-inspired tensor network architecture formulated on the same inductive bias, retaining expressivity while avoiding the limitations of present days quantum computing.