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Quantum Machine Learning algorithms in the latent space of HEP events

Friday, 13 May 2022 09:30 (25 minutes)

We present a study, based on supervised and unsupervised quantum machine learning algorithms, with the goal of proposing a new strategy for anomaly detection at the LHC. This study focuses on designing an algorithm capable of finding hidden patterns in the jet data. The algorithm is structured as a sequence of a classic and a quantum machine learning algorithm: the classic algorithm is the encoder of an autoencoder, used to reduce the dimensionality of the problem to a manageable level. The reduced latent space representation is then given as input to a Quantum Support Vector Machine (QSVM) and unsupervised quantum clustering algorithm, trained to learn a metric of the distance between jets which can be used to isolate anomalous jets. We experiment with a supervised approach and different quantum clustering algorithms, benchmarking their performance against their classical counterparts on several new physics scenarios. We also study the dependence of the algorithm performance on the number of latent-space dimensions.

Primary authors: WOZNIAK, Kinga Anna (University of Vienna (AT)); Ms PULJAK, Ema (Universitat Autonoma de Barcelona (ES)); BELIS, Vasilis (ETH Zurich (CH)); DISSERTORI, Guenther (ETH Zurich (CH)); GROSSI, Michele (CERN); PIERINI, Maurizio (CERN); VALLECORSA, Sofia (CERN)

Presenter: WOZNIAK, Kinga Anna (University of Vienna (AT))

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