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Machine learning based model-independent searches at the LHC with autoencoders

Friday 16 December 2022 14:00 (1 hour)

Due to the ongoing absence of various well-motivated beyond (the) Standard Model (BSM) signals at the Large Hadron Collider, there is a renewed interest in model-independent search strategies. Autoencoders are a class of neural networks that can learn the properties of complex high-dimensional distribution utilising an information bottleneck, first mapping the input to a lower-dimensional latent representation and then reconstructing the input features from the reduced information. They have been proposed for various model-independent searches at the LHC. In this talk, we will discuss Graph Autoencoders that can learn inductive jet representations without explicit usage of a graph readout operation. When trained to reconstruct only QCD jets, these graph autoencoders with "edge-reconstruction" networks can learn to differentiate various signal jets.
Although classical autoencoders have advantages, quantum computing technology promises to leverage quantum mechanical properties like entanglement and superposition to speed up various computational problems. Quantum machine learning based on Noisy-intermediate-scale-quantum devices is particularly efficient in learning from a low amount of data. We will also discuss quantum autoencoders based on variational quantum circuits for the problem of anomaly detection at the LHC and compare their performance and training efficiency with similarly expressive bit-based classical autoencoders.

Session

Beyond the Standard Model

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