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Machine Learning Prediction and Compression of Lattice QCD Observables

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In lattice QCD simulations, a large number of observables are measured on each Monte Carlo sample of the QCD universe, called gauge configuration. Since the measured observables share the same background gauge configuration, their statistical fluctuations are correlated with each other, and analyzing such correlation is a well-suited problem for machine learning (ML) algorithms. In this talk, I will present two ML applications to lattice QCD problems: (1) prediction of unmeasured-but-computationally-expensive observables from the cheap observables on each gauge configuration, and (2) compression of lattice QCD data using D-Wave quantum annealer as an efficient binary optimization algorithm. For both applications, a bias correction algorithm is applied to estimate and correct the systematic error due to inexact ML predictions and reconstruction.

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