The 38th International Symposium on Lattice Field Theory

JULY 26-30 2021, ZOOM/GATHER@MIT

Contribution ID: **279** Type: **Oral presentation**

Prediction and compression of lattice QCD data using machine learning algorithms on quantum annealer

Thursday 29 July 2021 22:15 (15 minutes)

We present regression and compression algorithms for lattice QCD data utilizing the efficient binary optimization ability of quantum annealers. In the regression algorithm, we encode the correlation between the independent and dependent variables into a dictionary optimized for sparse reconstruction. The trained correlation pattern is used to predict lattice QCD observables of unseen lattice configurations from other observables measured on the lattice. In the compression algorithm, we define a mapping from lattice QCD data of floating-point numbers to the binary coefficients that closely reconstruct the input data from a set of basis vectors. Since the reconstruction is not exact, the mapping defines a lossy compression, but, a reasonably small number of binary coefficients are able to reconstruct the input vector of lattice QCD data with the reconstruction error much smaller than the statistical fluctuation. In both applications, we use D-Wave quantum annealers to solve the NP-hard binary optimization problems of the machine learning algorithms.

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Session Classification: Algorithms (including Machine Learning, Quantum Computing, Tensor Networks)

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