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Machine learning estimator for the trace of inverse Dirac operator

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In lattice QCD calculations, the trace of operator products involving the inverse Dirac operator is often necessary for evaluating various observables, such as cumulants of the chiral order parameter and conserved charge fluctuations. Since the Dirac operator is represented by a large sparse matrix on the lattice, the exact calculation of the trace is typically impractical. Instead, it is commonly estimated by solving systems of linear equations for stochastic sources, which remains computationally demanding, particularly when dealing with numerous sources.

As an alternative approach to trace estimation, we explore a method of adapting a regression algorithm that enables us to predict the relationship between variables. By successfully capturing the correlation between the traces and other observables, it is anticipated that the desired quantity can be inferred without solving linear equations.

In this poster, we present our preliminary results of utilizing the boosting tree algorithm to predict the trace of a power of the inverse Dirac operator. Additionally, we discuss the effectiveness of this method in computing observables, comparing it to the conventional approach.

Topical area

Algorithms and Artificial Intelligence

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