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Bond-weighting method for the Grassmann tensor renormalization group

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Bond-weighted tensor renormalization group (BTRG) is a novel tensor network algorithm to improve the accuracy in calculating the partition functions of the classical spin models. We extend the BTRG to make it applicable for the fermionic system, benchmarking with the two-dimensional massless Wilson fermion. We show that the accuracy with the fixed bond dimension is improved also in the fermionic system and provide numerical evidence that the optimal choice of the hyperparameter in bond weights is not affected by whether the system is bosonic or fermionic. In addition, by monitoring the singular value spectrum, we find that the scale-invariant structure of the renormalized Grassmann tensor is successfully kept by the bond-weighting method.

Topical area

Theoretical Developments

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