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Learning tensor networks from noisy functions

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Recently, tensor networks have expanded beyond their initial application in quantum state compression, finding versatile uses in other fields of physics including image compression [1], turbulence [2], and quantum field theory [3,4]. Among these applications, it has been revealed that tensor networks can efficiently compress functions with a low-rank structure into an operable format. Particularly, the Quantics Tensor Cross Interpolation (QTCI) [5] method has received significant attention. QTCI is a technique that discretizes a function as a tensor and interpolates it by selecting important evaluation points, allowing the efficient transformation of the function into an operable format, i.e., tensor train. However, when function evaluations are contaminated with noise, such as in quantum computing, QTCI can suffer from the problem of overfitting.

In this study, we propose a robust QTCI method for functions containing noise, enabling more accurate learning of noise-free functions. Furthermore, by applying this method to a ground-state energy solver using quantum computing [6], we demonstrate that the proposed method can improve accuracy in terms of the number of samples required compared to the simplified Monte Carlo method employed in the previous research.

[References]

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