Integration of maximum likelihood estimation for reducing the variance of ZNE

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Quantum Error Mitigation (QEM) [1] strategies are critical for dealing with noise in quantum computing systems in the Noisy-Intemediate Scale Quantum (NISQ) era. Especially, zero noise extrapolation (ZNE) is one of the most promising QEM techniques for computing noise free expectation values [2]. However, conventional ZNE methods usually require a significant sampling overhead [1, 3], as a result of the increased estimation variance that arises from the extrapolation to the zero noise limit.

In this study, we propose to leverage Maximum Likelihood (ML) estimation techniques to deal with this problem by accounting for sample variance in extrapolation. By integrating ML estimation into the ZNE framework, we aim to improve both the accuracy and efficiency of error mitigation strategies in noisy quantum systems. The main idea revolves around making a priori guesses of the sampling variance of the noisy measurements so that the function fitting protocol takes into account such variability by means of an ML estimator.

References

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