Quantum-assisted dimension estimation of an interacting qubit system[1] AKIRA SONE, PAOLA CAPPELLARO, Massachusetts Inst of Tech-MIT — The dimension estimation of an interacting qubit system is a crucial task since the dimension determines the quantum computation complexity or the precision in quantum sensing. Various protocols have been developed for dimension witnesses, which put a lower bound in the dimension by the measurement of the collective observables. However, their experiment implementation is practically demanding especially in multiple qubit systems. In our recent work [Phys. Rev. A 96, 062334 (2017)], we proposed a more practical strategy to estimate the dimension of an interacting qubit system, which relies on the coupling between a local quantum probe and the target system, instead of directly measuring the unknown target system. We assume that the interaction model is priorly given and all qubits are correlated with the probe through the time evolution. We employed realization theory to verify that the dimension of the target system can be exactly estimated from the model order of the system. We also derived the exact relation between dimension and model order for finite one-dimensional spin chain systems with nearest-neighboring interaction.

Akira Sone
Massachusetts Inst of Tech-MIT

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