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Quantum Information and Computation

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Recovering quantum information via classical channels

Abstract:

Quantum secret sharing is an important multipartite cryptographic protocol in which a quantum state (secret) is shared among a set of n players. The secret is distributed in such a way that it can only be recovered by certain authorized subsets of players acting collaboratively. The recovery procedure assumes that all players are interconnected through quantum channels, or, equivalently, that the players are allowed to perform non-local quantum operations. However, for practical applications, the consumption of quantum communication resources such as entanglement or quantum channels needs to minimized.

We provide a novel scheme in which quantum communication is replaced by local operations and classical communication (LOCC). Our protocol is based on embedding a classical maximum distance separable (MDS) code into a quantum error correcting code and employing the properties of the latter. Our scheme is appealing for real-world scenarios where the implementation of two-qubit gates is challenging. We illustrate the results by simple examples. Our methods constitute a first step towards attacking the important problem of decoding quantum error correcting codes by LOCC.

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