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The Essentially Entangled Component of Multipartite Mixed Quantum States

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Abstract:

One of the main open problems in the theory of entanglement is the efficient detection and characterization of multipartite entanglement of density matrices representing open quantum systems undergoing non-unitary evolution. In this poster, we present a density matrix decomposition of a multipartite quantum system of a finite dimension into two density matrices: a separable one and an essentially entangled one, which contains no product states components. This convex decomposition can be achieved in practice with the help of an algorithm based on linear programming, which in the general case scales polynomially with the dimension of the system. We prove that the rank of the essentially entangled component is always lower than that of the initial density matrix and we give an upper bound for this rank. We illustrate the algorithm at an example of a composed system of total dimension 12 undergoing loss of coherence due to classical noise and we trace the time evolution of its essentially entangled component. Interestingly, while we observe a weight loss of the essentially entangled component with time, its average entanglement content is not affected by the coherence loss.

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