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•Editorial•
Editor's Focus

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A quantum analogy of cocktail party problem

The cocktail party problem is a selective attention problem in classical information processing, which has been extensively studied in computer science and neuroscience for decades. It considers the scenario in which signals are emitted from several different independent sources, and detectors detect different mixings of these signals, and target the recovery of individual sources from the information of detectors, regardless of how these signals are mixed as a prior.

In this work, titled "*The quantum cocktail party problem*" [1], the authors ask the question of whether there is a quantum analogy of the cocktail party problem. They propose to replace classical signals with quantum wave functions (or a density matrix of a pure state) emitted from different sources. The wave functions from different sources are partially orthogonal. Thus, different detectors can observe a density matrix of a mixed state, for instance, by quantum state tomography [2], and these density matrices are the mixing of the pure state density matrices. Similar to the classical cocktail party problem, the quantum analogy aims to recover each pure state from the detectors, irrespective of how they are mixed as a prior.

The authors not only propose a physical realization of this problem but also present both classical and quantum methods to solve this problem. Interestingly, they find that solving the quantum cocktail party problem can be mapped to finding the ground state of an Ising type Hamiltonian, which may be solved more efficiently by quantum simulation or quantum annealing. Therefore, it is possible to take the advantages of this quantum approach.

Since the classical cocktail party problem is quite important in computer science and has broad application in classical information processing, such as speech recognition, it is conceivable that this quantum version of the cocktail party problem would be quite useful in quantum information processing, including in multi-objective optimization in quantum parameter estimation [3], quantum hamiltonian identification [4], quantum connectivity optimization [5], quantum machine learning [6], solving set of linear equations [7] and quantum object identification [8], among others.

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