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# Quantum Advantage in Shared Randomness Processing

Randomness appears both in classical stochastic physics and in quantum mechanics. In this work, we address a computational scenario of shared randomness processing where quantum sources manifest clear-cut precedence over the classical counterpart. For proper apprehension of the quantum advantage we formulate a resource theoretic framework for shared randomness processing. The advantage is operationally viable as it is manifested in the optimal classical vs quantum payoffs of a game involving two players. In distributing shared randomness between distant parties, we also exhibit advantage of quantum channel over its classical counterpart though the classical capacity of the former is fundamentally constrained by Holevo bound. Surprisingly, the advantage persists even when the channel has zero quantum capacity and classical capacity much less than unity. The noisy channel examples also facilitate noise-robust empirical setups to verify the obtained quantum advantage.

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