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Gentle Measurement of Quantum States and Differential Privacy

Abstract:

We prove a new connection between gentle measurement (where one wants to measure \( n \) quantum states, in a way that damages the states only by a little) and differential privacy (where one wants to query a database about \( n \) users, in a way that reveals only a little about any individual user). The connection is bidirectional, though with loss of parameters in going from DP to gentle measurement. Exploiting this connection, we present a new algorithm for approximating the outcomes of many measurements on a collection of quantum states, a task called "shadow tomography". The new algorithm has the advantages of being gentle and online (the measurements can be chosen adaptively).

Joint work with Scott Aaronson.

No prior knowledge about quantum mechanics or computing will be assumed.