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Shadow Tomography of Quantum States: Progress & Prospects

Given an unknown quantum state rho, and a known list of two-outcome measurements E_1,...,E_M, "shadow tomography" is the task of estimating the probability that each E_i accepts rho, by carefully measuring only a few copies of rho.

In 2018, I gave the first nontrivial protocol for this task. In 2019, Guy Rothblum and I exploited a new connection between gentle measurement of quantum states and the field of differential privacy, to give a protocol that requires fewer copies of rho in some cases, and has the additional advantage of being online (that is, the measurements are processed one at a time).

Huge challenges remain in making shadow tomography practical with near-term devices; extremely recently Huang, Kueng, and Preskill took some promising steps in that direction.

I'll survey these developments and the challenges that remain.

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https://arxiv.org/abs/2002.08953

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