

Maximum-Likelihood Quantum Tomography beyond Petz Recovery

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The Petz recovery map is a leading candidate for a quantum analogue of Bayes' theorem, providing a generalized reversal of noninvertible quantum channels. In the classical setting, Jacobs showed that the Bayes-Jeffrey update always improves the prior by decreasing its divergence from the observed distribution. We prove an analogous monotonicity result for quantum-to-classical channels, a setting closely related to POVM measurements. This result leads naturally to a fixed-point iterative algorithm for full quantum state tomography. For general quantum channels, we show that the Petz recovery map requires a correction, and we propose a modified update governed by the inverse Kubo-Mori operator.