Effecient Bitwise Majority Voting for Hidden Information Recovery in Tensor Network Simulated δ-Peaked Circuits

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Abstract

This paper will investigate the surprising efficacy and efficiency of bitwise majority voting as a tool for extracting hidden bitstrings from -peaked quantum circuits—circuits where a single bitstring appears with high probability and all others are exponentially suppressed. Despite the general intractability of simulating such circuits, we empirically demonstrate that sampling a small number of ouputs (17 samples for a 60 qubit circuit) and performing majority voting across bit positions reliably recovers the hidden bitstring. This technique was first proposed by Buhrman et al. in Quantum majority vote. Our study successfully demonstrates the recovery of hidden bitstrings from circuits with up to 60 qubits using tensor network simulation methods (Quimb and Cotengra), circumventing the need for full post-processing or explicit statevector reconstruction. This insight enables faster heuristic recovery for verification tasks and provides a bridge between classical post-processing and quantum measurement analysis.