Day 1

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Title:Programmable Quantum Annealers as Noisy Gibbs Samplers

Abstract:

Drawing independent samples from high-dimensional probability distributions represents the major computational bottleneck for modern algorithms, including powerful machine learning frameworks such as deep learning. We study the sampling properties of physical realizations of quantum annealers which are implemented through programmable lattices of superconducting flux qubits. Comprehensive statistical analysis of the data produced by these quantum machines shows that quantum annealers behave as samplers that generate independent configurations from low-temperature noisy Gibbs distributions. We show that the structure of the output distribution probes the intrinsic physical properties of the quantum device such as effective temperature of individual qubits and magnitude of local qubit noise, which result in a non-linear response function and spurious interactions that are absent in the hardware implementation. We anticipate that our methodology will find widespread use in characterization of future generations of quantum annealers and other emerging analog computing devices.