Egor Tiunov

Title: Simulating Coherent Ising Machine for Training Neural Networks

Abstract:

Finding ground states of the classical Ising Hamiltonian is an essential problem for different applications ranging from phase transitions to machine learning. Different physical platforms were built to solve this problem. They potentially demonstrate significant advantage in computation time compared to classical digital annealing algorithms. The Coherent Ising Machine (CIM) is an optoelectronic physical simulator that was created to find ground states for all-to-all connected spin systems. The most recent publication on the subject reports a annealing of an Ising system with the dimension up to 2000 spins and attributed the computational speedup to built-in quantum features that realize quantum parallel search. We simulate the CIM on a classical computer and obtain the same level of speedup, which shows that no quantum features are responsible for the latter. On the other hand, the physics of different simulators inspires the development of a new class of classical annealing algorithms. They allow finding a close approximation to the minimum of Ising Hamiltonian faster than existing methods. The rapid solutions open up a new road in machine learning algorithms based on sampling.