Quantum vs classical optimization: A status update on the arms race

Helmut G. Katzgraber

Department of Physics & Astronomy, Texas A&M University
Santa Fe Institute, New Mexico

To date, a conclusive detection of quantum speedup remains elusive. However, recent results from quantum Monte Carlo simulations, as well as the D-Wave 2X quantum annealer show a scaling that clearly outperforms state-of-the-art classical simulated annealing. In this talk an overview of recent benchmarks, as well as attempts to "tickle" any quantumness out of quantum annealing machines is given. Furthermore, we present a generic framework to validate benchmarks and to detect parameter regimes where quantum annealing might excel over classical heuristics. As such, we provide capabilities to aide in the search for the "killer" application for quantum optimization technologies. Finally, an overview of different sequential, non-tailored, as well as specialized tailored classical state-of-the-art algorithms is given. Current quantum annealing technologies must outperform these to claim the crown in the race for quantum speedup.

Work done in collaboration with F. Hamze (D-Wave Systems Inc), Sergei Isakov (Google Inc.), S. Mandra (Harvard), H. Munoz-Bauza (Texas A&M University), H. Neven (Google), A. Ochoa (Texas A&M University), A. Perdomo-Ortiz (NASA), S. Schnabel (Leipzig University), W. Wang (Texas A&M University) Z. Zhu (Texas A&M University)