J Laser Opt Photonics 2017, 4:2(Suppl)
DOI: 10.4172/2469-410X-C1-012

Quantum neural network for combinatorial optimization and boltzmann sampling

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Many combinatorial optimization problems can be mapped onto ground-state-search problems of the Ising model or more general neural network. However, physical Ising machines are often based on localized spins, resulting in limited number of spin-spin couplings and severe scalability problems. We report 100–2,000 spin networks with all-to-all connections using time-multiplexed optical parametric oscillator pulses and measurement and feedback control. The developed machine can outperform simulated annealing in terms of accuracy and computation time for dense graphs.

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