

Quantum annealing, its theory and several applications in industry

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Abstract:

First we introduce a concept of the quantum annealing. The quantum annealing solves the quadratic unconstrained binary optimization problem, which corresponds to the energy function of the Ising spin glass. In the quantum annealing, quantum fluctuation drives the binary variables.

When we slowly tune the strength of the quantum fluctuation, we can always find the ground state

The Ising spin glass is a fundamental model to describe the complex phenomena.

Its energy function includes various typical hard optimization problems.

Thus, the quantum annealing, in the other words, solves the hard problem by nature.

Then the hard optimization problems often appear in industry.

In this sense, the quantum annealing is expected to solve various practical optimization problems.

We performed several applications in collaboration with various companies.

Second, we show these examples to demonstrate usefulness of quantum annealing.

Quantum annealing can perform not only solving the optimization problem but also application to the machine learning.

Third, we introduce the examples such as Boltzmann machine learning and classification problems.



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