Abstract

Mohamed E.Tamazin

A Classification Technique for Condensed Matter Phases Using a Combination of PCA and SVM

In quantum mechanical systems with exponentially large Hilbert space, the need to represent and identify states of quantum many-body system with few variables is of significant importance. The representation and identification of the states are based on the spin configurations of the ferromagnetic Ising model without knowledge of the respective Hamiltonian. The state identification process is of high importance in quantum technology applications and testing such as D-wave machine comparison to classical optimization algorithms using large number of qubits. This paper proposes a new method to classify phases and phase transitions in condensed matter systems, which can further be used in quantum technologies to identify the state of qubits. The proposed method is based on the combination of Principle component analysis (PCA) and support vector machine (SVM). The simulation results of the proposed method show that the trained model is able to identify the phase and phase transition with high accuracy in different Ising spin topologies with a variety of lattice sizes, while reducing the dimensionality of the feature space compared to existing optimization methods.