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[地図]

Machine Learning Disordered Topological Phases by Statistical Recovery of Symmetry

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In machine learning, computational algorithms are constructed and executed to optimize the quantified objective of the problem to be solved. The surging development of the state-of-the-art techniques has led condensed matter physicists to realize the effectiveness of the tools in their own research field, such as phase classification [1,2,3] and solving quantum many-body problem [4,5].

Firstly we start with basic information to understand the classification by the artificial neural network (ANN), which maps out in our work the quantum phase diagram of disordered topological superconductor in class DIII. Given the disorder that keeps the discrete symmetries of the ensemble as a whole, translational symmetry which is broken in the quasiparticle distribution individually is recovered statistically by taking an ensemble average. By using this, we classify the phases by the ANN that learned the quasiparticle distribution in the clean limit and show that the result is totally consistent with the calculation by another independent approach.

If all three phases, namely the Z2, trivial, and the thermal metal phases appear in the clean limit, the machine can classify them with high confidence over the entire phase diagram. If only the former two phases are present, we find that the machine remains confused in the certain region, leading us to conclude the detection of the unknown phase which is eventually identified as the thermal metal phase.

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