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Probing Topological Properties of 3D Lattice Dimer Models with Neural Networks

Abstract:
We consider a simple problem, demonstrating that neural networks can be successfully used to give new insights in statistical physics. Specifically, we consider a 3D lattice dimer model, which consists of sites forming a lattice and bonds connecting the neighboring sites, in such a way that every bond can be either empty or filled with a dimer, and the total number of dimers ending at one site is fixed to one. Dimer configurations can be viewed as equivalent if they are connected through a series of local flips, i.e. simultaneous 'rotation' of a pair of parallel neighboring dimers. It turns out that the whole set of dimer configurations on a given 3D lattice can be split into distinct topological classes, such that dimer configurations belonging to different classes are not equivalent. In this talk, I will identify these classes using neural networks and demonstrate that they can be successfully used to identify new topological phases in condensed matter systems whose existence can be later verified by other (e.g. analytical) techniques.

Monday, September 23, 2019
4:30 PM in SCI 242

Refreshments will be served at 4:20 in SCI 242