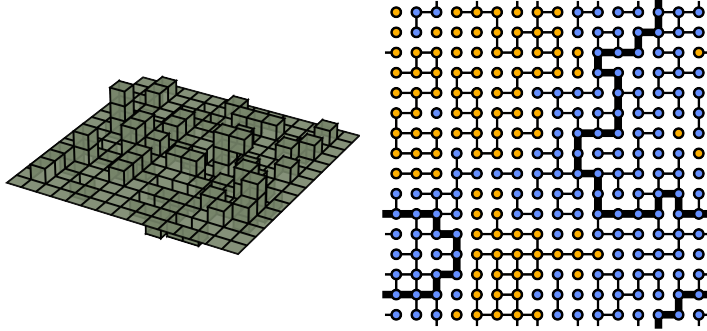


Homological generalization for random graphs

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Abstract

Random graph models are the beating heart of modern discrete probability and statistical physics. Using lattice graphs to prototype atomic systems, the random cluster model (RCM) prescribes a probability distribution over sublattices, capturing mathematical celebrities like Bernoulli percolation, the FK Ising model, and the Potts model. Whether on its own or coupled with the Potts model, the RCM is a powerful tool for studying the geometry and phase transitions of random graphs. By re-imagining our graphs as cubical complexes, we can describe general versions of these models in (co)homological terms; linear algebra and persistent homology let us translate popular Monte Carlo sampling algorithms in kind. In this talk, we cover the models' foundations, topological idiosyncrasies, interdisciplinary questions, and the challenges of computational simulation at scale.

Keywords: Random graph, discrete probability, statistical physics, random cluster model (RCM), Bernoulli percolation, Potts model.