

An Overview of Mean Field Theory in Combinatorial Optimization Problems

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Abstract

In the last two decades, there has been significant interest in using mean field theory coming from statistical physics in combinatorial optimization, neural networks, image processing, and engineering. This has led to the development of powerful optimization techniques such as neural networks (NNs), simulated annealing (SA), and mean field annealing (MFA). MFA combines many characteristics of SA and NNs. MFA replaces the stochastic nature of SA with a set of deterministic equations named as mean field equations. The mean field equations depend on the energy function of the NNs and are solved at each temperature during the annealing process of SA. MFA advances to the optimal solution in a fundamentally different way than stochastic methods. The use of mean field techniques for the combinatorial optimization problems are reviewed extensively in this study.