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Biased landscapes in random Constraint Satisfaction Problems

The typical complexity of Constraint Satisfaction Problems (CSP) can be studied using random ensembles of instances. One observes threshold phenomena when the density of constraints increases, in particular a clustering phase transition at which typical solutions shatter into disconnected components. We introduce a bias that breaks the uniformity among solutions CSP, and look at the evolution of the clustering threshold under this bias, focusing on the bicoloring of k -uniform random hypergraphs. For small values of k , we show that this bias can delay the clustering transition to higher densities of constraints, and that it has a positive impact on the performances of Simulated Annealing algorithm to find a solution for a given instance of the bicoloring problem. In the large k limit, we compute the asymptotic expansion of the clustering threshold for the uniform and the biased measure, and characterize the gain obtained with our implementation of the bias.