

Thresholds for Random Geometric k -SAT

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We study two geometric models of random k -satisfiability which combine random k -SAT with the Random Geometric Graph: boolean literals are placed uniformly at random or according to a Poisson process in a cube, and for each set of k literals contained in a ball of a given radius, a clause is formed. For $k = 2$ we find the exact location of the satisfiability threshold (as either the radius or intensity of the Poisson process varies) and show the threshold is sharp; for $k \geq 3$ we give bounds on the threshold that differ by a constant factor; and for one of the two models we prove that the threshold is in fact sharp for all $k \geq 2$.

The primary motivation for this work is to understand the ‘universality class’ of the random k -SAT phase transition. Other properties of the Erdős-Rényi random graph, particularly the giant component and connectivity, have been understood in many different models, from random graphs of given degree sequence, to Achlioptas processes, to the RGG, and found to have certain universal qualitative features. In this work we investigate the qualitative properties of the satisfiability transition in the random geometric setting.

(Based on joint work with Milan Bradonjić)