Discriminative Properties of the Smooth Convex Quadratic Approximation of a 3-SAT Problem

Hans van Maaren[1]

This study continues investigations on smooth convex models for the satisfiability Problem, as introduced in [2] and further elaborated in [3]. Here we shall focus on the parameters used in these models. The discriminative properties of the second order Taylor expansions of these models, evaluated at the strategic centre of the cube, are shown to depend on the parameter settings used.
We shall establish two concentric convex quadratic regions in $\mathbb{R}^N$, N being the number of variables of the CNF formula (3-SAT) considered, the inner one containing only satisfiable vertices (that is truth assignments), the outer one (weakly) separating the satisfiable vertices from the majority of the non satisfiable ones. These quadratic approximations of 3-SAT formulae explain some threshold phenomenae which were only discovered [1] experimentely sofar. Also they give rise to new such threshold features and they appear to determine a clause weighting strategy in a natural way.

[1] O. Dubois, Balanced 3-SAT formulae. Presented at DIMACS 1996.

[2] H. van Maaren, J.F. Groote and M. Rozema (1995). Verification of propositional formulae by means of convex and concave transforms. Techn. rep. TU Delft, nr. 95-74.

[3] H. van Maaren, On the use of second order derivatives for the satisfiability problem. Presented at DIMACS 1996.

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