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Maximum Persistency in Energy Minimization

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The talk addresses combinatorial problems that can be formulated as minimization of a partially separable function of discrete variables. This includes such problems as vertex packing, pseudo-Boolean optimization, 0-1 polynomial programming, weighted constraint satisfaction and energy minimization in graphical models. For polyhedral relaxations of these problems it is generally not true that variables which are integer in the relaxed solution will retain the same values in an optimal discrete solution. Those which do are called persistent. Such persistent variables define a part of a globally optimal solution. Once identified, they can be excluded from the problem, reducing its size.

In this talk I pose the problem of determining the maximum subset of persistent variables identifiable from a linear relaxation. Since deciding whether a given partial assignment is globally optimal is NP-hard, a tractable persistency technique has to be based on tractable sufficient conditions. Different sufficient conditions were proposed in computer vision, bioinformatics and discrete optimization. A generalized sufficient condition is introduced which builds on a given polyhedral relaxation. It turns out that the maximum persistent subset qualifying this sufficient condition can be found in polynomial time for any polyhedral relaxation. This maximum provides a provably larger reduction of the problem than ad hoc or optimizing techniques based on weaker conditions.

Bettina Klinz