Local Minisat

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Abstract. Local Minisat is a Minisat 2007 based solver that implements local inner-outer geometric series restarts. Experiments on hundreds of industrial benchmarks show that this restart technique is better than previously-published global restart techniques.

Local Minisat is a variation of the MINISAT 2007 [ES06] solver with an improved restart technique, as described in [RS08]. Here we repeat the essentials from that reference.

Most or even all competitive DPLL-based SAT solvers have a "restart" policy, by which the solver is forced to backtrack to decision level 0 according to some criterion. Although not a sophisticated technique, there is mounting evidence that it has crucial impact on performance [Hua07]. All existing techniques rely on a global criterion such as the number of conflicts learned as of the previous restart, and differ in the method of calculating the threshold after which the solver is forced to restart. This approach disregards, in some sense, the original motivation of focusing on 'bad' branches. It is possible that a restart is activated right after going into a good branch, or that it spends all of its time in a single bad branch. A possibly better strategy is to localize the measure of difficulty of branches, and restart when the branch is more difficult than some threshold. Each of the global strategies can be applied locally, because we can count the number of conflicts under each branch easily, as follows. For each decision level d we maintain a counter $c(d)$, which is initially (when a decision is made at that level) set to the global number of conflicts. When backtracking back to that level, we examine the difference between the current global number of conflicts, and $c(d)$. This difference reflects the number of conflicts that were encountered above level d, since the last time a decision was made at this level. If this difference is larger than some strategy-dependent threshold, we restart. In LocalMinisat we implemented a local version of Biere's inner-outer geometric series [Bie08], the description of which follows.

Inner-Outer geometric series takes three parameters: x, y, z. Restarts follow what can be seen as a two dimensional pattern that increases geometrically in both dimensions. The inner loop multiplies a number initialized to x, by z, at each restart. When this number is larger than a threshold y, it is reset back to x and the threshold y is also multiplied by z (this is the outer loop). Hence, both the inner and outer loops follow a geometric series, and the whole series creates an oscillating pattern. Our local version of this strategy uses the parameters $x = 100, y = 1000, z = 1.1$.

References

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