Super-resolution for MAX-SAT

November 17, 2006

We use $N$ to keep track of the best assignment so far. $N$ is a complete assignment, and is assigned arbitrarily at the beginning.

1. Unit-Propagation:

\[
M \triangledown F, C + k \triangledown N \Rightarrow Mk \triangledown F, C + k \triangledown N
\]

if $C + k$ is a super-resolvent, and

\[M \vdash \neg C, \text{ and } k \text{ is undefined in } M.\]

or if $C + k$ is not a super-resolvent, and

\[M \vdash \neg C, \text{ and } k \text{ is undefined in } M, \text{ and } \text{unsat}(M \neg k; F, C + k) \geq \text{unsat}(N; F, C + k).\]

2. Semi-Super-resolution:

\[
I \triangledown F \triangledown N \Rightarrow I \triangledown F, (\text{the disjunction of the negated decision literals in } I) \triangledown N
\]

if $R = \text{Contradiction}(I, F) \neq \emptyset$, and

\[\text{unsat}(IR; F) \geq \text{unsat}(N; F).\]

Informal: Intuitively, since $R$ is driven by $I$ through unit-propagation, thus, the fact that "unsat(IR; F) $\geq$ unsat(N; F)" implies that we have made a mistake by setting the partial interpretation to $I$, which is the reason why we add the negated decision literals in $I$ to $F$ so that we won’t make the same mistake again.

$\text{Contradiction}(I, F)$: there has been a sequence of transitions from the state $I \triangledown F \triangledown N$ by Unit-Propagation to a state $IR \triangledown F \triangledown N$ at this point where some clause(s) is unsatisfied by $(IR)$. Contradiction returns $R$ if there is a contradiction and $\emptyset$ otherwise.
3. Decide:
\[ M||F||N \Rightarrow Mk^*||F||N \]

if \( k \) is undefined in \( M \), and \( k \) and \( \neg k \) occur in some clause(s) of \( F \).

4. Finale:
\[ M||F||N \Rightarrow M||F||N \]

if \text{unsat}(M; F) = \text{unsat}(N; F), and \( M \) is complete, and \( M \) contains no decision literals.

5. Restart:
\[ M||F||N \Rightarrow \emptyset||F||N \]

6. Update:
\[ M||F||N \Rightarrow M||F||M \]

if \( M \) is complete, and \text{unsat}(M; F) < \text{unsat}(N; F).
Check whether \text{unsat}(M; F) = 0, if so, we terminate.

7. Subsumption:
\[ M||F, SR_1, SR_2||N \Rightarrow M||F, SR_2||N \]

if \( SR_1 \) and \( SR_2 \) are super-resolvents, and \( SR_2 \) is a subset of \( SR_1 \).