CLab: a C++ Library for Fast Backtrack-Free Interactive Product Configuration

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Product configuration is a successful application area of constraint programming. CLab [1, 2] is an open source C++ library for building fast backtrack-free interactive product configurators. It contains functions that support a two-phase approach to interactive product configuration described by Hadzic et al. [3]. In the first phase, a Binary Decision Diagram (BDD) representing the set of valid configurations is compiled offline. In the second phase, this BDD is accessed by the online interactive product configurator. The library has two major functions: one that builds the BDD from a declarative product model (M_1), and one that computes the set of possible ways a current partial configuration can be extended to a valid product (M_2). The latter function is fast (polynomial) and used to make the interactive product configuration process complete and backtrack-free. It allows the user to choose freely between any possible continuation of the partial configuration. The approach is illustrated by the procedure

Interactive-Configuration(C)
1 $\quad S \leftarrow M_1(C)$
2 $\quad$ **while** $|S| > 1$
3 $\quad\quad$ **do choose** $(x_i = v) \in M_2(S) \quad \triangleright M_2(S) = \{a : c \in S, a \in c\}$
4 $\quad\quad\quad S \leftarrow \{c \in S : (x_i = v) \in c\}$.

Line 1 denotes the offline phase, where a BDD S of the solution space is computed from the product model C. Line 2-4 denote the online phase. In each iteration, the user chooses a value v of a product variable x_i that belongs to the set of possible assignments (Line 3). The solution space is then reduced accordingly (Line 4). Future work includes adding explanation facilites to CLab.

References

1. Jensen, R.M.: CLab user manual. Technical Report ITU-TR-2004-46, IT University of Copenhagen (2004)
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3. Hadzic, T., Subbarayan, S., Jensen, R.M., Andersen, H.R., Møller, J., Hulgaard, H.: Fast backtrack-free product configuration using a precompiled solution space representation. In: Proceedings of the International Conference on Economic, Technical and Organizational aspects of Product Configuration Systems, DTU-tryk (2004) 131–138

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