M.S. Capstone Abstract: Oxidizing Decision Diagrams with RSDD

Matthew Wang

June 2023

Abstract

RSDD is a knowledge compilation library written in Rust. Among other features, it can compile and manipulate Binary Decision Diagrams (BDDs) and Sentential Decision Diagrams (SDDs). First, we introduce basic concepts in the field of knowledge compilation and representation. Then, this paper highlights three core contributions to RSDD. First, we discuss a refactoring of the entire knowledge compilation library to properly use Rust's trait system; this unifies BDDs and SDDs, improves memory safety guarantees, and allows for more rapid experimentation via cleaner specialization. Then, we introduce *semantic hashing*, a probabilistic equivalence test for SDDs that provides an alternative to canonicalization. We show that even a naive implementation of probabilistic tests have promising results for certain classes of CNFs and SDDs. Finally, we outline three separate supporting software projects: a WebAssembly compilation target and online web demo, a head-to-head benchmark suite against other knowledge compilers, and a user-facing documentation site with interactive demos and tutorials.

Note: the most recent version of this document can be found at https://github.com/mattxwang/capstone.