On Dependent Outputs in Reactive Synthesis

Given a Linear Temporal Logic (LTL) formula over input and output variables, reactive synthesis requires us to design a deterministic Mealy machine that gives the values of outputs at every time step, such that the LTL formula is satisfied. In this paper, we investigate the notion of dependent outputs in the context of reactive synthesis. Inspired by successful pre-processing techniques in Boolean functional synthesis, we define dependent outputs in reactive synthesis as outputs that are uniquely determined, given an assignment to all other variables and the history so far. We describe an automata-based approach for finding a set of dependent outputs. Using this, we show that dependent outputs are surprisingly common in reactive synthesis benchmarks. Next, we develop a novel framework that exploits dependent outputs in solving a synthesis that exploits dependent variables can solve some problems beyond the reach of existing techniques. Furthermore, we observe that among benchmarks with dependent outputs, if the count of non-dependent variables is low (≤ 3 in our experiments), our method outperforms state-of-the-art tools for synthesis.

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