ASR: Abstraction Subspace Reduction for Exposing Atomicity Violation Bugs in Multithreaded Programs

**ABSTRACT**

Many two-phase based dynamic concurrency bug detectors predict suspicious instances of atomicity violation from one execution trace, and examine each such instance by scheduling a confirmation run. If the amount of suspicious instances predicted is large, confirming all these instances becomes a burden. In this paper, we present the first controlled experiment that evaluates the efficiency, effectiveness, and cost-effectiveness of reduction on suspicious instances in the detection of atomicity violations. A novel form of reduction technique named ASR is proposed. Our empirical analysis reveals many interesting findings: First, the reduced sets of instances produced by ASR significantly improve the efficiency of atomicity violation detection without significantly compromising the effectiveness. Second, ASR is significantly more cost-effective than random reduction and untreated reduction by 8.5 folds and 60.7 folds, respectively, in terms of mean normalized bug detection ratio. Third, six ASR techniques can be significantly more cost-effective than the technique modeled after a state-of-the-art detector.

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Supervisor: Dr W K Chan
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All are welcome!