Typically-Correct Derandomization for Small Time and Space

Abstract:

Suppose a language \( L \) can be decided by a bounded-error randomized algorithm that runs in space \( S \) and time \( n \cdot \text{poly}(S) \). We give a randomized algorithm for \( L \) that still runs in space \( O(S) \) and time \( n \cdot \text{poly}(S) \) that uses only \( O(S) \) random bits; our algorithm has a low failure probability on all but a negligible fraction of inputs of each length. An immediate corollary is a deterministic algorithm for \( L \) that runs in space \( O(S) \) and succeeds on all but a negligible fraction of inputs of each length. We also discuss additional complexity-theoretic applications of our technique.