Amplification and Derandomization Without Slowdown

Abstract:
We show techniques for decreasing the error probability of randomized algorithms and for converting randomized algorithms to deterministic (non-uniform) algorithms. Unlike most existing techniques that involve repetition of the randomized algorithm and hence a slowdown, our techniques produce algorithms with a similar run-time to the original randomized algorithms. The amplification technique is related to a certain stochastic multi-armed bandit problem. The derandomization technique -- which is the main contribution of this work -- points to an intriguing connection between derandomization and sketching/sparsification. We demonstrate the techniques by showing applications to max-cut on dense graphs, approximate clique, constraint satisfaction problems on dense bipartite graphs, and list decoding to unique decoding for Reed-Muller code. This is joint work with Ofer Grossman.