On the Theory of Average Case Complexity

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Abstract

This paper takes the next step in developing the theory of average case complexity initiated by Leonid A. Levin. Previous works [Levin 84, Gurevich 87, Venkatesan and Levin 88] have focused on the existence of complete problems. We widen the scope to other basic questions in computational complexity. Our results include:

- the equivalence of search and decision problems in the context of average case complexity;
- an initial analysis of the structure of distributional-NP under reductions which preserve average polynomial-time;
- a proof that if all distributional-NP is in average polynomial-time then non-deterministic exponential-time equals deterministic exponential time (i.e., a collapse in the worst case hierarchy);
- definitions and basic theorems regarding other complexity classes such as average log-space.

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