

基于免疫 B-Cell 算法求解可满足性问题的性能分析

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摘要: 可满足性问题(SAT) 是计算机科学和人工智能研究中的核心 NP-完全问题.构造了两类 SAT 问题实例, 易解和难解实例.从理论上分析了 B-Cell 算法求解这两个实例的运行时间, 并证实了 B-Cell 算法在某些问题上有效而在一些问题上无效.进一步提出了一个简单的基于免疫的多目标优化算法(IBM0), 对于一个双目标的 SAT 问题, 证明了 IBM0 能够有效地找到整个 Pareto 前沿.这些分析结果从理论上证实和说明了人工免疫系统的有效性.

关键词: 人工免疫系统; B-Cell 算法; 多目标优化; 可满足性问题; 运行时间分析

Performance Analysis of Immune Inspired B-Cell Algorithm for the SAT

Problem

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Abstract: The satisfiability problem is a basic core NP-complete problem in computer science and artificial intelligence. We construct two classes of SAT instances, and analyze the runtime of the B-Cell algorithm for these two instances. We proved that there exist situations where the BCA is efficient or inefficient. On the other hand, we develop a simple immune-based multi-objective optimizer (IBM0) and reveal that IBM0 can find the whole Pareto front for a bi-objective sat problem in expected polynomial runtime. These analysis results exemplify and strengthen the usefulness of artificial immune systems from a theoretical perspective.

Key words: artificial immune system (AIS) ; B-Cell algorithm; multi-objective optimization; satisfiability problem; runtime analysis

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