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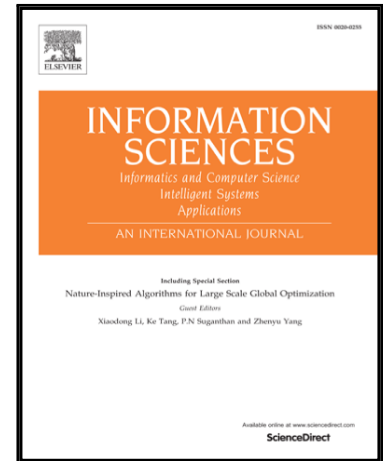
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An Experimental Study of Hyper-Heuristic Selection and Acceptance Mechanism for Combinatorial t -way Test Suite Generation

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Abstract

Recently, many meta-heuristic algorithms have been proposed to serve as the basis of a t -way test generation strategy (where t indicates the interaction strength) including Genetic Algorithms (GA), Ant Colony Optimization (ACO), Simulated Annealing (SA), Cuckoo Search (CS), Particle Swarm Optimization (PSO), and Harmony Search (HS). Although useful, meta-heuristic algorithms that make up these strategies often require specific domain knowledge in order to allow effective tuning before good quality solutions can be obtained. Hyper-heuristics provide an alternative methodology to meta-heuristics which permit adaptive selection and/or generation of meta-heuristics automatically during the search process. This paper describes our experience with four hyper-heuristic selection and acceptance mechanisms namely Exponential Monte Carlo with counter (EMCQ), Choice Function (CF), Improvement Selection Rules (ISR), and newly developed Fuzzy Inference Selection (FIS), using the t -way test generation problem as a case study. Based on the experimental results, we offer insights on why each strategy differs in terms of its performance.

Keywords: Software Testing; t -way Testing; Hyper-Heuristics; Meta-Heuristics; Fuzzy Inference Selection;

1. Introduction

Testing is an important process in software development to help identify areas where the software is not performing as expected. This process is often expensive owing to the time taken to execute the set of test cases. It has been a research focus to find suitable sampling strategies to generate a small yet efficient set of test cases for testing a software system.

Over the years, a plethora of sampling strategies has been proposed in the literature (including that of boundary value analysis, equivalence partitioning, and decision tables; to name just a few). Although useful for some classes of software testing problems, these sampling strategies have not been designed to effectively deal with faults due to interaction. For this reason, many (sampling) t -way strategies (where t indicates the interaction strength) have been proposed in the scientific literature. Some early algebraic based t -way strategies exploit exact mathematical properties of orthogonal arrays. These t -way strategies are often fast and produce optimal solutions, yet, they impose restrictions on the supported configurations and interaction strength. The emergence of computational based t -way strategies ease these restrictions allowing for the support for arbitrary configuration at the expense of producing high quality solutions rather than guaranteed optimal solutions.

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