Assessing the Chaotic Map Population Initializations for Sine Cosine Algorithm Using the Case Study of Pairwise Test Suite Generation

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Abstract Sine Cosine Algorithm (SCA) is a new population based meta-heuristic algorithm that exploits both the sine and cosine functions for its update operators. The main strength of SCA is its simplicity and straightforward implementation as well as provides no parameter control adjustment. For these reasons, SCA can be adopted in many optimization problems quickly and without much tuning. Despite the aforementioned advantages, SCA convergence can still be problematic depending on the initial starting positions of initial populations. In this work, we propose to assess the effectiveness of pseudo random (i.e., Random) as well as three chaotic map initializations (i.e., sine map, circle map, and logistic map) for SCA using the pairwise test case generation as our case study. The original SCA with random initialization (R_SCA) is outperformed on the adopted experiments by the proposed logistic map SCA (LM_SCA), circle map SCA (CM_SCA) and singer map SCA (SM_SCA).

Keywords Sine cosine algorithm · Chaotic maps · Pairwise testing

1 Introduction

Optimization is indispensable as almost all problems in science, engineering, industry and even in an individual's life are optimization problems. In optimization, the goal is achieving certain objectives or optimizing quantities such as time, profit and quality. Finding solutions under some restrictions to optimally use resources such as money and time is needed as in real-world scenarios, these and many other resources are always deficient [1, 2]. Nowadays, metaheuristic algorithms are recognized as an important tool for searching best solutions to optimization problems [3].

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