A Comparative Study on three Component Selection Mechanisms for Hyper-Heuristics in Expensive Optimization

ABSTRACT

Numerous studies in optimization problems often lead to tailoring a specific algorithm to adapt to the problem instances, especially in expensive optimization problems. The focus of these researches is often to challenge and outperform another algorithm in the specific problem instant. Once the problem instants changes, more tailoring of the algorithm has to be done in order for the algorithm to perform at an optimum level. Expensive optimization often requires a large amount of resources to run on such as computational power, high run-time budget and consumes a lot of time. As such, tailoring an algorithm to perform well in expensive optimization requires a lot of expertise and time. Hyper-heuristics is an approach that utilizes a set of Low-Level Heuristic (LLH) and a selection mechanism to solve expensive optimization problems. The main aim of using hyper-heuristics is to be able to apply a general yet efficient optimizationalgorithm to all expensive problem instances with very minor or minimal tweaks. In this study, three different selection mechanisms for Hyper-heuristics are introduced and compared against one of the top performing expensive optimization algorithms known asthe Mean-Variance Mapping Optimization (MVMO) as described in the CEC 2015 and 2016 expensive optimization competitions. Three variants of hyper-heuristics were used in this study, Simple Random All Moves Acceptance (SRAMA), Tabu-Search All Moves Acceptance (TSAMA) and Random Gradient Descent All Moves Acceptance (RGDAMA). The set of LLH will also include a simplified version of MVMO. The performance of hyper-heuristics is highly encouraging against a specifically tailored algorithm for CEC test set of expensive optimization problems.