

A Novel Hybrid Cultural Algorithms Framework with Trajectory based Search for Global Numerical Optimization

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Abstract: In recent years, Cultural Algorithms (CAs) have attracted substantial research interest. When applied to highly multimodal and high dimensional problems, Cultural Algorithms suffer from fast convergence followed by stagnation. This research proposes a novel hybridization between Cultural Algorithms and a modified multiple trajectory search (MTS). In this hybridization, a modified version of Cultural Algorithms is applied to generate solutions using three knowledge sources namely situational knowledge, normative knowledge, and topographic knowledge. From these solutions, several are selected to be used by the modified multi-trajectory search. All solutions generated by both component algorithms are used to update the three knowledge sources in the belief space of Cultural Algorithms. In addition, an adaptive quality function is used to control the number of function evaluations assigned to each component algorithm according to their success rates in the recent past iterations. The function evaluations assigned to Cultural Algorithms are also divided among the three knowledge sources according to their success rates in recent generations of the search. Moreover, the quality function is used to tune the number of offspring these component algorithms are allowed to contribute during the search. The proposed hybridization between Cultural Algorithms and the modified trajectory-based search is employed to solve a test suite of 25 large-scale benchmark functions. The paper also investigates the application of the new algorithm to a set of real-life problems. Comparative studies show that the proposed algorithm can have superior performance on more complex higher dimensional multimodal optimization problems when compared with several other hybrid and single population optimizers.