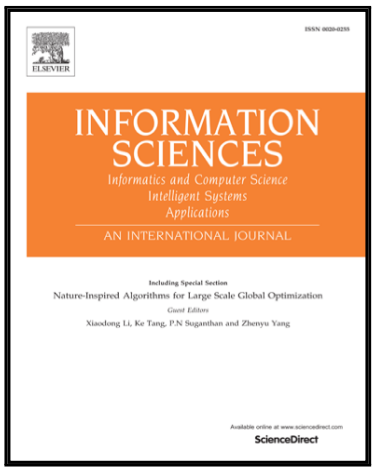

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PII: S0020-0255(16)31589-4
DOI: 10.1016/j.ins.2018.01.005
Reference: INS 13359

To appear in: *Information Sciences*

Received date: 10 November 2016
Revised date: 26 July 2017
Accepted date: 4 January 2018

Please cite this article as: Shin Siang Choong , Li-Pei Wong , Chee Peng Lim , Automatic Design of Hyper-heuristic based on Reinforcement Learning, *Information Sciences* (2018), doi: 10.1016/j.ins.2018.01.005

Automatic Design of Hyper-heuristic based on Reinforcement Learning

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Abstract

Hyper-heuristic is a class of methodologies which automates the process of selecting or generating a set of heuristics to solve various optimization problems. A traditional hyper-heuristic model achieves this through a high-level heuristic that consists of two key components, namely a heuristic selection method and a move acceptance method. The effectiveness of the high-level heuristic is highly problem dependent due to the landscape properties of different problems. Most of the current hyper-heuristic models formulate a high-level heuristic by matching different combinations of components manually. This article proposes a method to automatically design the high-level heuristic of a hyper-heuristic model by utilizing a reinforcement learning technique. More specifically, Q-learning is applied to guide the hyper-heuristic model in selecting the proper components during different stages of the optimization process. The proposed method is evaluated comprehensively using benchmark instances from six problem domains in the Hyper-heuristic Flexible Framework. The experimental results show that the proposed method is comparable with most of the top-performing hyper-heuristic models in the current literature.

Keywords: hyper-heuristic, Q-learning, automatic design, cross-domain heuristic search.

1. Introduction

An optimization model involves finding the feasible solutions from a finite set of solutions that exist in the search space, and then identifying only the optimal solution. There are some exact optimization models that

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