

P.O.Box 8718, Beijing 100080, China	Journal of Software Oct. 2005,16(10):1691-1698
E-mail: jos@iscas.ac.cn	ISSN 1000-9825, CODEN RUXUEW, CN 11-2560/TP
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Approximate-Backbone Guided Fast Ant Algorithms to QAP

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Received 2003-07-28; Accepted 2004-01-06

Abstract

Quadratic Assignment Problem (QAP) is one of the classical combinatorial optimization problems and is known for its diverse applications. This paper presents a new fast ant heuristic for the QAP, the approximate-backbone guided fast ant colony algorithm (ABFANT). The main idea is to fix the approximate-backbone which is the intersection of several local optimal permutations to the QAP. After fixing it, the authors can smooth the search space of the QAP instance without losing the search capability, and then solve the instance using the known fast ant colony algorithm (FANT) which is one of the best heuristics to the QAP in the much smoother search space. Comparisons of ABFANT and FANT within a given iteration number are performed on the publicly available QAP instances from QAPLIB. The result demonstrates that ABFANT significantly outperforms FANT. Furthermore, this idea is general and applicable to other heuristics of the QAP.

Zou P, Zhou Z, Chen GL, Jiang H, Gu J. Approximate-Backbone guided fast ant algorithms to QAP. *Journal of Software*, 2005,16(10):1691-1698.

DOI: 10.1360/jos161691

<http://www.jos.org.cn/1000-9825/16/1691.htm>

摘要

QAP(quadratic assignment problem)问题是经典的组合优化问题之一,广泛应用于许多领域中.针对QAP问题,提出了一种新的蚁群算法——近似骨架导向的快速蚁群算法(ABFANT).该算法的基本原理是通过对局部最优解的简单相交操作得到QAP问题实例的近似骨架(approximate-backbone),利用这些近似骨架可以极大地缩小QAP问题的搜索空间,而同时不降低搜索的性能,最后对这个缩小后的搜索空间,直接用当前求解QAP问题最好的启发式算法之一——快速蚁群算法(FANT)求解得到问题的解.在QAPLIB中的典型实例上的实验结果表明,近似骨架导向的快速蚁群算法明显优于快速蚁群算法.此外,指出基于近似骨架的算法思想可以很容易地被移植到其他求解QAP问题的启发式算法中.

基金项目: Supported by the National Grand Fundamental Research 973 Program of China under Grant No.G1998030403 (国家重点基础研究发展规划(973))

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