

A PARALLEL ANT COLONY OPTIMIZATION ALGORITHM BASED ON FINE-GRAINED MODEL WITH GPU-ACCELERATION

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ABSTRACT. *Fine-grained parallel ant colony optimization algorithm (FGACO), though a popular and robust strategy for solving complicated optimization problems, is sometimes inconvenient to use as its population size is restricted by heavy data communication and the parallel computers are relatively difficult to use, manage, maintain and may not be accessible to most researchers. In this paper, we propose a FGACO method based on GPU-acceleration, which maps parallel ACO algorithm to GPU through the compute unified device architecture (CUDA). The analytical results demonstrate that the proposed method increases the population size, speeds up its execution and provides ordinary users with a feasible FGACO solution.*

Keywords: Ant colony optimization algorithm, Parallel process, GPU, CUDA, Fine-grained

1. Introduction. Ant Colony Optimization (ACO) is one of the most powerful methods available for solving hard combinatorial optimization problems [1]. In the past few years, ACO algorithms have been successfully applied in many different application areas owing to its robustness and simplicity [2,3]. Although ACO algorithms are rather effective in solving many practical problems, they have to run a long time to find solutions for huge problems. To overcome this limitation, researchers have proposed some methods for improvement, such as the improved ant colony system [4] and the new rank-based ant system using different sensitive ants [5]. Recently a more promising approach has attracted a lot of attention which parallelizes these algorithms for parallel, distributed and networked computers [6-10].

Fine-grained parallel ACO algorithm (FGACO) is an important model of parallel ACO algorithms [6]. It has advantages of maintaining better global search ability, inhibiting premature and keeping the utmost parallelism. The current FGACO is mostly implemented on parallel, distributed and networked computers. Despite all its merits, FGACO has brought the users a lot of inconvenience due to the following drawbacks: (1) FGACO for complicated optimization problems often requires hundreds of ants, and the heavy data communication is hardly acceptable in most parallel machines; (2) Parallel machine equipments are relatively more difficult to use, manage and maintain; and (3) some people may not have access to this kind of computers.