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# Optimization of Cloud Database Route Scheduling Based on Combination of Genetic Algorithm and Ant Colony Algorithm

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## Abstract

For the cloud database route scheduling problem, this paper designed a cloud database route scheduling algorithm according to the dynamic combination of the genetic algorithm and ant colony algorithm. The initial solution got by the Genetic Algorithm was transformed into the pheromone initial value, which was needed by ant colony algorithm, then the optimal solution by the ant colony algorithm was obtained. Genetic control function was set up to control the opportunity of two algorithm's fusion. This paper proposed a reasonable algorithm, which could find the required database rapidly and effectively, reduce the dynamical load of cloud database routing, and improve the efficiency of cloud computing.

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*Key words:* Genetic algorithm; Ant colony algorithm; Cloud database; Dynamic routing scheduling;

## 1. Introduction

Cloud computing is a computer network model, which is combined by the traditional computer technology (such as Grid Computing, Distributed Computing, Parallel Computing, Utility Computing, Network Storage Technology, Virtualization, Load Balance and so on) and the network technology. It integrates multiple low cost computers into a powerful computing capability system through the network, and distribute these powerful computing capabilities among those terminal users by business models, such as SaaS, PaaS, IaaS, MSP. Cloud database is the data storage and retrieval resource of the cloud computing. Thus, how to quickly and reasonably find out the best suited to applications's database is always the different point.

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## 2 Cloud database

Cloud database system is composed of several sites, which are also called nodes. Nodes are linked in the communication network, and each one has its own database, central processing unit (CPU), terminal and local database management system (LDMS). Therefore, cloud database system can be regarded as a union of a series of centralized database systems, which are unified logically, but distributional physically. Cloud database consists of an immense amount of data systems. A part of them are stored on the cloud, while some others are constituted by some small and medium-sized service providers's servers. This part of servers will continuously join or exit from the cloud with the operational state of these companies. Sudden failures may occur in nodes and links, and new node or link may also connect to the cloud database at all times. The distributivity, dynamics, global balance and scalability of the cloud database make the cloud database to be an extremely large storage resource, but then, they also bring great difficulties to the routing prediction and recognition.

## 3 Dynamic Combination of Genetic Algorithm and Ant Colony Algorithm

### 3.1 Genetic Algorithm

Genetic algorithm, which comes from Genetics and Darwin industry, is a widely used searching method. It can be used for combinatorial optimization, pattern recognition, machine learning, planning strategy and information processing. This algorithm has many advantages, such as: doing a global search quickly and well; simple process of utilizing the evaluation function to search; randomness iterated by probability mechanism; well associativity of combining with other optimization techniques.

However, It can't make extensive use of the feedback information from the system, and would make the blindness of search. Meanwhile, when the solving progress reaches a certain range, more redundancy iterations are needed, then the speed of the convergency to the optimal solution will drop quickly, which lead to solve the optimal solution inefficiently.

### 3.2 Ant Colony Algorithm

The ant colony algorithm based on swarm intelligence is a new bionic evolutionary algorithm developed in recent years. It simulates the ant's foraging behaviour to solve the complicated combinatorial optimization problem. It has a positive feedback system, and can converge the optimal solution by continuously updating pheromones; it has global stochastic optimization characteristics, and is a distributed optimization method, that is useful for parallel computing; it is a global optimal method, which can be used to solve both the single-objective optimization problem and the multi-objective optimization problem<sup>[1]</sup>.

Disadvantage: At the beginning, pheromones are insufficiency, so it will take too long time to seek the accumulated initial pheromones.

### 3.3 Basic principle of dynamic combination between Genetic Algorithm and Ant Colony Algorithm

Through the research and experiment on genetic algorithm and ant colony algorithm, we find out a speed-time curve of genetic algorithm and ant algorithm just like Fig.1 shows. For genetic algorithm, there is a higher speed of the convergency to optimal solution during the preliminary stage ( $t_0 \sim t_a$ ), but it will significantly reduce after  $t_a$ . However, during the preliminary stage ( $t_0 \sim t_a$ ) of ant algorithm, the searching speed is very slow for lacking of pheromones, then after pheromones reach a certain degree (after  $t_a$ ), the speed of convergency to optimal solution improves quickly. The basic principle of dynamic combination between genetic algorithm and ant colony algorithm is that we can utilize genetic algorithm to get initial

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