Enhancing the Behavior of the Ant Algorithms to Solving Network Planning Problem

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Abstract

This paper introduces an enhancements to Ant Colony system, which is considered one of the most successful ant algorithms used to solve combinatorial optimization problems. Network Planning is the problem of how to plan the infrastructure network in the new city. This paper deals with optimization algorithms for network design problem. The objective is to design a distribution network at a minimum cost that satisfies the demand and constraints required by the subscribers. This approach uses the idea of an ant group to represent a solution and can assist the solution of large networks that cannot normally be solved to optimality. The algorithmic implementation of the proposed algorithm is described and computational experience is reported. Results demonstrate the effectiveness and flexibility of the modifying algorithm. Comparisons with related work are presented showing the advantages of the purposed algorithm introduced in this paper.

1. Introduction

The field of "ant algorithms" studies models derived from the observation of real ant's behavior, and uses these models as a source of inspiration for the design of novel algorithms for solution of optimization and distributed control problems [1].

Ant colony algorithms are a subset of swarm intelligence and consider the ability of simple ants to solve complex problems by cooperation. The interesting point is, that the ants do not need any direct communication for the solution process, instead they communicate by *stigmergy*. The notion of stigmergy means the indirect communication of individuals through modifying their environment. Several algorithms which are based on ant colony problems were introduced in recent years to solve different problems , e.g. optimization problems [2].

The network planning process has to consider a variety of constraints including: policy of administrations, planning objective, etc, there is no universal method that is applicable to all network planning problems. Due to the complexity of this process artificial intelligence (AI) has been successfully deployed in a number of areas [3] - [7].

The problem of Network Planning can be formulated as follows:

"Given a geographic map of the city in the form of its streets, intersection nodes coordinates and the distribution of the subscribers load within that city, the available cable size and the corresponding cost for each size, determine the minimum cost of network that connects those subscribers in order to achieve a specified performance".

The process of network planning is divided into several sub-problems:

(1) Exchange location planning.
(2) Construction of subscriber lines from exchange to subscribers to satisfy as optimization criterion.

The Enhancing the Behavior of the Ant Algorithms is purposed to Solve the problem of constructing the subscriber lines from exchange to subscribers.

The remainder of this paper is organized as follows. In section 2 we present the basics and the background of ant colony optimization meta heuristic. In section 3 we present the purposed algorithm in detail. A case study is presented in section 4, Section 5 discuss related work. The paper concludes is presented in section 6.

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