2nd INTERNATIONAL CONFERENCE ON
RESEARCH IN SCIENCE AND TECHNOLOGY
Istanbul-Turkey 14 March 2016
RSTCONF
دومین کنفرانس بین المللی
پژوهش در علوم و تکنولوژی
ترکیه - استانبول ۲۴ اسفند ۱۳۹۴

A Solution for Faster Implementation of Ant Colony Algorithm

Sajjad Mehizadeh
Graduate student computer - Azad University Larestan
ssmehizadeh@gmail.com

ziad badehian
ziadbadehian@gmail.com

Abstract

Designing discrete transportation is to choose a possible subset of possible projects proposed in a transportation network to minimize the total travel time of network users. This problem exists in the complexity class of NP-Hard problems in which there is no effective algorithm for the exact solution in a large scale. This article seeks to examine and use a meta-heuristic algorithm in the transportation discrete network design problem. In this article, tips are proposed for better implementation of ant colony algorithm. It seems that the implementation of the algorithm will be improved by observing the steps mentioned in the article of speed and time.

Of course, judgment and general comparison of the behavior of the algorithm and the steps mentioned in this article depend on better running on a variety of network.

Keywords: *Designing the transportation discrete network, ant colony* algorithm

Introduction

There is a wide range of infrastructure issues in the field of transportation, telecommunication, industries and military science a collection of network design problems. The problems, as usual with a graph, are shown as a symbol of the network, which has a number of directed and undirected nodes and edges and each edge has some characteristics such as length, capacity and cost. The aim of the network design problems is to select a number of edges in the graph to build or develop the capacity, so that a specific result, such as minimizing the cost of demand transfer between the source and destination is provided. This article is focused from a series of network design problems, on the design of discrete transportation network as a matter of infrastructure decision-making issue.

Specially, the problems of transportation discrete network design can be defined to choose a possible subset of the proposed projects of highway construction in a highway transportation network to achieve a specific purpose. The aim is usually to minimize the total travel time users of the network.

Most network design problems including the problem of transportation discrete network design are the combined problems in NP-Hard complexity class that is impossible to achieve the exact solution in great examples. To solve these combined problems in full-scale, two basic approaches can be considered:

- The use of innovative - meta-heuristic algorithms
- The use of parallel computations

Although in the transport planning a lot of research has been done on the transportation discrete network design problem using innovative- meta-heuristic algorithms, but the method ahead is also a new way to solve better such problems.

Regarding the importance of the tackling the big problems of network design, this research seeks to examine the solution of the mentioned problems by the ant colony algorithm.

The Research Methodology

The previous research has theoretically shown that the transportation discrete network design, even in its simplest form (assuming linearity of high and low levels problems) in terms of the complexity is in the class of is NP-Hard problems. Therefore, many recent studies overlook the exact solution of this problem is overlooked and used the innovative- meta-heuristic solutions. Meta-heuristic algorithms, though they are never a guarantee for optimality of their answer, but they always are as a way to get relatively good answers within a reasonable time.

So far, many meta-heuristic algorithms, such as genetics, forbidden search, simulated heating and cooling, anti colony and and gatering particles have been applied to solve the problem of transportation network design.

In the ant colony algorithm, presented by Mr. Pourzahedi and Abolghasemi, the number of K ant (equal to the number of selected projects), one of them randomly selected a possible subset of projects based on special possibilities of visibility and pheromone assignment and evaluated the answer obtained by solving a problem of traffic assignment. Then, the results of ants evaluation directs the algorithm to the selection of superior projects (with more pheromone and visibility) by increasing pheromone level and the probability of selection in the projects with leading answers.

This process continues until the performance of the behavior algorithm is stopped. In this context, by changing artificially pheromone in favor of poor projects (with less pheromone)

Mr. Pourzahedi and Mr. Abolghasemi leads the algorithms movement to the escape of stopping on the optimal answers.

Parallel Computations

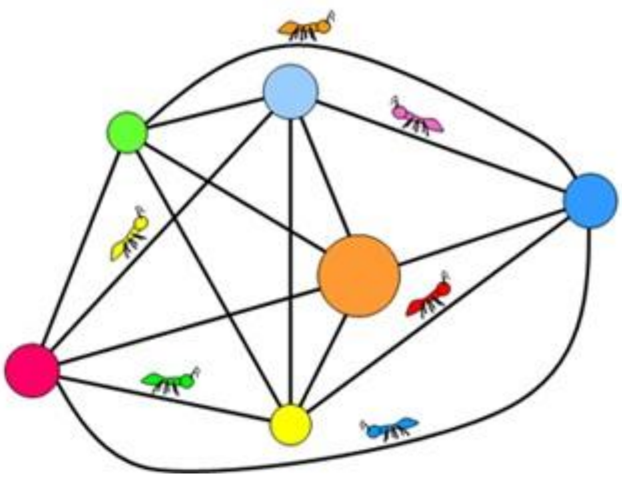
In general the simultaneous use of multiple computational resource to solve a problem is parallel computations and the computational resource in this definition means the processing cores of computers. The parallel or multi-core parallel computations are opposed to sequential or single-core computations as used traditionally. In the single-core computations, computing operation is done, not simultaneously, but in sequentially, one after another over time and significant cost. The need to save time and cost, as well as the need to solve large computational problems in recent years, designing parallel algorithms has been widely accpeted.

There are a variety of patterns to design a parallel algorithm that can be seen in a general classification resulted from responses to two questions:

- When the processors communicate with each other.
- How the processors communicate with each other.

The pattern of Lord of worker is one of the basic patterns at designing parallel algorithms in which all the processors (workers) communicate at a pre-defined time of pre-defined, with a particular processor (master).

One of the important points at designing a parallel algorithm with a master-worker pattern is considering the communication overhead and unemployment overhead, which leads to the wasting of computational resources. The information overload is the information of the time to be used to connect the worker processors with the master processors instead of parallel operation. The greater the volume of data exchange between processors, the communication overhead is increased and the parallel algorithm efficiency is reduced. Also, the unemployment overhead is unemployment overhead duration experienced by some of the worker processors between two communications with master processors. To reduce unemployment overhead, the difference in volume of worker processors operation should be prevented as possible.



To run the algorithm provided by Mr. Pourzahedi and Mr. Abolghasemi, to better solve and minimize the unemployment overhead between the worker processors, the following points should be observed and then we will run the algorithms.

The movement of the ant is started from a particular node to reduce substantially the time to reach the optimal solution. It is very important to determine the starting node, so that if the node is correctly selected, the costs of unemployment overhead and therefore the time to run the algorithm will be substantially reduced.

Determining the starting node is made with respect to the followings:

- The ant starts to move from the node with neighborhood with other nodes.
- If there are several nodes with the same neighbors, select the last system in which the average cost of moving to the neighboring nodes is less than other nodes.

To select other nodes is similarly done. The master processor determines each of the neighboring nodes for the worker processor and wants them to specify the number of neighborhood and the average cost of travel. Then, the master processor will make the necessary decisions based on the information obtained.

In case of any deadlock, the master processor will go back a step, remove the current path and consider the remaining paths based on the above data.

Tables and Figures

If the above steps are observed in the colony algorithm, the obtained results will be shown in Table 1 as follows:

Subject	Font	Size	Type
Paper Title	Times New Roman	16	Bold
Name and Family of Authors	Times New Roman	12	Bold
Affiliation and Email of Authors	Times New Roman	11	Normal
Sections title	Times New Roman	12	Bold
Sections subtitles	Times New Roman	11	Bold
Abstract text	Times New Roman	12	Normal
Keywords	Times New Roman	12	Normal
Main text	Times New Roman	11	Normal
Footnotes	Times New Roman	9	Normal
Title of Tables and Figures	Times New Roman	9	Bold
Text of Tables	Times New Roman	9	Normal
References	Times New Roman	10	Normal
Page number	Times New Roman	10	Normal

It can be concluded that the compliance with the above said in terms of speed and duration, the costs will be less, but if the starting node does not properly and carefully selected, it can affect the performance of all algorithm and fail.

References

1. Zarrinhemr, Amirali, Parvizi Omran, Morteza, Shafahi, Yousef, Seyedabrishami, Seyedehsan, 2015, *Parallelism of ants colony algorithm at designing a transportation discrete network*, Omran Modarres scientific and research journal, No. 15, 2015
2. Alba, E. *Parallel metaheuristics: A new class of algorithms*, Wiley Series on Parallel and Distributed Computing, 2005.
3. Poorzahedy, H., Abulghasemi, F. *Application of ant system to network design problem*, Transportation, 32(3), 2005, 251-273.
4. Garey, M. R., Johnson, D. S. *Computers and intractability: a guide to the theory of NPcompleteness*,W. H. Freeman and Co, New York, 1979.
5. Albayrak, M., Allahverdi, N. (2011).Development a new mutation operator to solve the Traveling Salesman Problem by aid of Genetic Algorithms, Expert Systems with Applications, 38, 1313-1320.