QUICK AND SPEEDY DELIVERY

DAA

Report

Submitted in the partial fulfillment of the requirements for the award of the degree of

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**Declaration**

The Social Internship Report entitled “QUICK AND SPEEDY DELIVERY” is a record of bonafide work of SJ Sumanth(2010030377), K. Sreevarun(20100030451), E. Pavan sai(2010030538), E. Shiva Goud(2010030542),submitted in partial fulfillment for the award of B.Tech in the Department of Computer Science and Engineering to the K L University, Hyderabad. The results embodied in this report have not been copied from any other Departments/ University/ Institute.

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This is to certify that the Social Internship Report entitled QUICK AND SPEEDY DELIVERY” is being submitted by SJ Sumanth(2010030377), K. Sreevarun(20100030451), E. Pavan sai(2010030538), E. Shiva Goud(2010030542), submitted in partial fulfillment for the award of B.Tech in CSE to the K L University, Hyderabad is a record of bonafide work carried out under our guidance and supervision.

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**ABSTRACT**

Now a days we have delivery system in food groceries and other things.

But it is a problem to find a shortest path to cover all required cites or nodes and return back to the initial city. This is the case of a multiple travelling salesman problem (MTSP).for this we can use ACO(ANT COLONY OPTIMIZATION) technique to solve and obtain the shortest path.

ACO is nature inspired algorithm based on the behavior of ants.

T The optimization of logistics distribution can be defined as the multiple traveling salesman problem (MTSP). The purpose of existing heuristic algorithms, such as Genetic Algorithm (GA), Ant Colony Algorithm (ACO), etc., is to find the optimal path in a short time. However, two important factors of logistics distribution optimization, including work time window and the carrying capacity of the vehicle in distribution system, have been ignored. In this paper, we consider the influences of time limitation of modern commercial logistics and carrying capacity of the vehicle on the logistics optimization, and then propose a MTSP with constraints of time window and capacity of each salesman. We design a novel hybrid algorithm by combining the minimum spanning 1-tree with ACO to find the optimal solution. In addition, we improve the pheromone update rules to increase the search efficiency of ACO algorithm. The experiments show that the novel hybrid algorithm achieves a shorter path than the other algorithms.

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Introduction

Logistics distribution industry becomes more and more important due to the rapid development of the e-business. Nowadays, there are many challenges in logistics distribution industry. For example, Nov. 11th is a peak date for online shopping that all the products online have a big discount and people go on a shopping spree, so there are billions of express items needed to be delivered during that time. Therefore, it is important to deliver the products to customer within a short time. Service composition is a way which can combine all the logistics services processes efficiently. Another challenge is the balance between paths and items and it is more difficult.The logistics services process in China is to deliver all items from the head office to each brand. At the same time, the optimization of time cost and road distance, the amount of items, the number of transport vehicles as well as their carrying capacity are taken into account. The associate editor coordinating the review of this manuscript and approving it for publication was Shouguang Wang . MTSP is a generalization of the well-known traveling salesman problem (TSP), where at least two salesmen could be used to deliver items in the solution. Obviously, the logistics distribution question is the same as a multiple traveling salesman problem with constraints. Moreover, MTSP could be extended to a wide variety of vehicle routing problems (VRP) according to incorporating a number of additional side-constraints. In addition, finding a quick and efficient way to transport goods and materials in earthquake relief work or military operation is significant. There are many solutions to solve TSP like Tabu search, simulated annealing, genetic algorithms. The ant colony system (ACS) is improved by this paper which is also a well-behaved solution. It is a kind of the group of metaheuristic methods. This idea was firstly proposed in the early 90s by Dorigo . ACO is generated by simulating the real behavior of ants in nature and it is widely used to solve practical problems Many different transforms of ACO have been proposed. On the basic of these, a new optimal ACO with some improvements is proposed in the paper.

First of all, the minimum spanning 1-tree can be applied to construct the path in MTSP. Secondly, the improved model and pheromone update rules make the algorithm more effective. Our main contributions are as followings: (1) Redefining multiple traveling salesman problem with time window and capacity of each salesman, which comes from real life problem such as logistics industry; (2) Building an improved pheromone model with new pheromone update rules; (3) Combining the minimum spanning 1-tree with ACO based on the relationship between the optimal TSP tours and spanning tree. The rest of the paper is organized as follows. Section II shows the related work about TSP and ACO on solving TSP. In the section III, the definition of MTSP and possible solutions for MTSP are discussed. Section IV discusses the algorithm of ant colony system. Section V proposes an optimal ACO algorithm on the basic of previous section. Section VI shows the evaluation and experiment of the improved algorithm. Section VII concludes the paper and outlines the future work.

RELATED WORK

TSP is a typical branch of metaheuristic algorithm and there is a lot of research on it. We list a number of representative works recently, and there is an overview article by Panwar and Gupta , where earlier works are discussed in detail. They conclude some TSP for solving soft computing techniques.

(1) Ant Colony Optimization has been widely used in proving the complexity of combinatorial problem. The movement of each ant is effected by the intensity of pheromones contained on the path. The ACO algorithm can calculate good results in a short time after a few iterations .

(2) In Ding et al. try to look for the shortest Hamiltonian cycle in all clusters, then remove a selected edge in every cycle to build an intra-cluster path. At last, attach the whole intra-cluster paths in a particular sequence to organize a complete tour. A novel method called Two-level Genetic Algorithm for the Cluster TSP is proposed, which is a good choice to alter an extensive TSP into a CTSP that can be settled by the TLGA. This method is well applied to large-scale TSPs.

(3) In , the conventional particle swarm optimization (PSO) is improved. This method takes the heuristic factor, crossover operator and adaptive disturbance factor into account. Then, the authors propose a novel hybrid discrete PSO algorithm which can improve the search performance in convergent speed and precision. This method can be applied to solve the problem of path optimization in TSP.

(4) In , random keys are introduced to solve the coding problem of genetic algorithm. Random keys play an important role in the problems where permutations of the integers are required as well as feasibility problems caused by traditional one-or two-point crossover. Also, there are some other algorithms related to TSP. For example, in , Xu et al. redefine a general colored traveling salesman problem and propose a Delaunay-triangulation-based Variable Neighborhood Search algorithm. The new algorithm performs well in large-scale problems.

PROBLEM DEFINITION AND FORMULATION

TSP is a typical combinational optimization problem that belongs to NP complete problem . The aim is to find the shortest path by visiting every node once and then returning to the start node in a complete weighted graph G with n nodes and n(n-1) edges. Furthermore, MTSP could use more than one salesman which is different from the TSP with only one salesman. When considering the carrying capacity and time windows, this problem becomes more meaningful in real life. The MTSP with constraints can be defined as follows. First, given a set of nodes, arrange m salesmen at a single depot node. Then, finding tours for all m salesmen, and they all need to start and end at the depot. Meanwhile, the other nodes can be visited exactly once and the cost of visiting all nodes will be least. The two constraints are: every node is visited in a fixed time window and every salesman should take items as many as possible [32]. Specifically, for a city i, the salesman should visit it in a time window Ei, Li , where Ei is the earliest time that the salesman could visit and the salesman should visit city i before Li . And for every salesman, the maximum items they can carry is M. Comparing the TSP with the MTSP, it is obvious that MTSP is more adequate to simulate real life situations, and it is capable of handling plenty of salesmen problem. MTSP can be applied in the following context: print scheduling, workforce planning, transportation planning, mission planning, production planning, satellite systems, etc. Each context includes numerous types of real applications. Consequently, there are various solutions proposed for MTSP. At first, some accurate solutions like cutting plane, branch and bound, and Lagrange relaxation were proposed. Then, heuristics are applied to this problem. Moreover, evolutionary algorithm, simulated annealing, tabu search, genetic algorithms and neural networks also have a good ability on working out the MTSP

ANT COLONY OPTIMIZATION

Ant colony optimization is a heuristic algorithm which is introduced into many combinatorial optimization problems due to it is one of the highest performance computing methods for MTSP . Many efforts have been made on ant colony optimization techniques in different areas.

It takes inspiration from ants’ social behaviors of finding the best way between food and the ant nest. Ants can communicate with each other about amount of food and the distance of route. The process can be divided into two parts and a positive feedback mechanism is applied by the ants randomly and releases pheromone in the routes. A global pheromone updating rule is applied when all ants have finished their tours. Pheromone accumulates at a higher rate on the shorter path, so that more ants begin to choose the shorter path which has a higher intensity 106874 VOLUME 8, 2020 M. Wang et al.: Ant Colony Optimization With an Improved Pheromone Model for Solving MTSP of pheromone. At the second part, ants affect each other by pheromone which is the main factor to lead the ants to find shorter route. Then the process is iterated to find the global optimal solution. In ACO, artificial ant replaces the real ant. They both can affect surrounding environment such as the intensity of pheromone in the path

Implementation

MTSP (multi salesman problem) with ant colony optimization.

n: cities (1 is a start node(default))

m: number of salesman

This mTSP will start num\_of\_ants ant's will start node. And, each ant will make m paths that, each path will contain (n-1) / m cities. So, each ant will make m-salesman path, each path has different nodes.

For example, if n = 10, m = 3, k(num\_of\_ants) = 6,

ant\_1 = [[1, 2, 3, 4], [1, 5, 6, 10], [1, 7, 8, 9]] ant\_2 = [[1, 4, 10, 3], [1, 5, 7, 8], [1, 2, 6, 9]] ... ant\_6 = [...]

And num\_of\_ants made the each m paths, we score the length in each path, and as usually, we make pheromones and accumulate it on the path ant routes.

Select the random cities and make some clusters , i.e division of the graph in to sub graphs. Now, divide and arrange the sales persons and assign them the each clusters , calculate the cost of the route and update the cost matrix. Return the optimal cost.

As ants choose two paths and accordingly they leave pheromone chemical in their path,

for easy to choose for other ants to come.

So, high level of pheromone smaller is the path , lower level of pheromone longer is the path.

The relation is distance is inversely propositional to the pheromone level . In this way the ants choose the path which contains high pheromone level .

Same process is applied to the travelling salesman problem.

Divided clusters are travelled by m salesman then return to the same after visiting the all cities in the assigned cluster. His route cost is updated in the cost matrix.

In this way all clusters are covered and at last the best least cost and the path is returned.

On the same manner the food delivery also can be done. Not only the food delivery any delivery can done using this ACO algorithm .

This project is of food delivery system . So, considering this situation many people make order their food through food apps Zomato /swiggy.

As at staring mentioned ‘n’ cities and ‘m’ travelling sales persons .They make order from different hotels/restaurant’s . S, after placing the order the initial point will the restaurant they have order and their delivery address are the nodes to visit .

Now , the graph/route map is taken according to the delivery address and their distances

and the cost matrix is defined. Now, the graph /route formed is divided into the clusters, and some randomly salespersons are assigned to each route .

They will travel to cover all nodes and no same node or delivery address are visited twice, and they return to the initial node they have started i.e restaurant . Now, each distance they travelled are updated in the cost matrix .

It is similar to the ants they travel to some random paths and leave the pheromone in their path , accordingly to the pheromone level in the path the ants choose their path. In the same way the persons travelled route distance is calculated in each clusters that it has been divided . Now , at last we get the optimal/least distance.

I this way they can choose the least distance route to delivery the food and save their transport cost and time and earn profit .

Results Discussion

Chart

Description automatically generated

Given above graph it is divided into the clusters and at final traversing all the respective clusters returned to the initial city/node and the calculated cost will be printed.

Conclusion and Future Work

In this paper, we have presented a method for solving the multiple traveling salesman problem based on the improved ant colony optimization. The improved ACO has used the relationship between MTSP and 1-MST, and the simplified pheromone diffusion. The new pheromone update rules helped a lot to achieve a better solution. The experiment results have shown that the new method has quick convergence speed and can be well applied to find best solutions. In future, we decide to combine multi-objective TSP with parallel processing Parallel processing can improve algorithm speed and reduce algorithm execution time. This method may be greatly improve the speed of finding best solutions. Furthermore, we will implement an application that cannot only help the logistics distribution industry but also make the transportation in earthquake relief work or military operation easier.Further it can be improvised and solve

REFERENCES

[1] X. Sun, S. Wang, Y. Xia, and W. Zheng, ‘‘Predictive-trend-aware composition of Web services with time-varying quality-of-service,’’ IEEE Access, vol. 8, pp. 1910–1921, Dec. 2020. [2] S. Wang, D. You, and M. Zhou, ‘‘A necessary and sufficient condition for a resource subset to generate a strict minimal siphon in S 4PR,’’ IEEE Trans. Autom. Control, vol. 62, no. 8, pp. 4173–4179, Aug. 2017. [3] S. Pang, M. Wang, S. Qiao, X. Wang, and H. Chen, ‘‘Fault diagnosis for service composition by spiking neural P systems with colored spikes,’’ Chin. J. Electron., vol. 28, no. 5, pp. 1033–1040, Sep. 2019. [4] M. Drigo, V. Maniezzo, and A. Colorni, ‘‘The ant system: Optimization by a colony of cooperation agents,’’ IEEE Trans. Syst. Man, Cybern. B, Cybern., vol. 26, no. 1, pp. 29–41, Feb. 1996. [5] Y. Feng, M. Zhou, G. Tian, Z. Li, Z. Zhang, Q. Zhang, and J. Tan, ‘‘Target disassembly sequencing and scheme evaluation for CNC machine tools using improved multiobjective ant colony algorithm and fuzzy integral,’’ IEEE Trans. Syst., Man, Cybern. Syst., vol. 49, no. 12, pp. 2438–2451, Dec. 2019