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A SURVEY OF SOLVING TRAVELLING SALESMAN PROBLEM USING ANT COLONY OPTIMIZATION

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Abstract - *Travelling salesman problem is studied in the field of combinatorial optimization. TSP being heuristic algorithm tries to find minimum distance between given set of cities by traversing each of these cities only once except the starting city. A lot of techniques have been developed to solve TSP like Ant Colony optimization, Genetic algorithms, neural networks etc. Ant Colony optimization (ACO) being a heuristic algorithm attempts to find optimum solution by mimicking ants finding food as a group. Ants release pheromones on their path, concentration of which suggests shortest path to food. Models have been developed to solve ACO with fixed parameters.*

This paper attempts to survey the set of parameters like "Exponential Weight", "Heuristic exponential Weight", "Evaporation Rate" for this solution based on no of iteration and minimum distance traversed.

Key Words: Ant Colony Optimization algorithm, Combinatorial, Genetic Algorithm, Travelling Salesman Problem, Heuristic.

1. INTRODUCTION

TSP-Travelling Salesman Problem is a problem which is base on the travelling in which the salesman need to visit "n" cities (nodes) by travelling distance (vertexes) to all cites and reaches the starting city, with the minimum cost. TSP can solved with the help of different algorithms such as description method, Tour constructions, Tour improvement, Special cases of the TSP, and Some other heuristic of solving TSP.

Ant Colony Optimization has been involved as the low cost and efficient method for shortest path for travelling. Artificial researcher Marco Dorige described in 1993 a method of heuristically generating "good solutions" to the TSP using a colony called ACS (Ant Colony System). It models behavior observed in real ants to find short paths between food sources and their nest, an emergent behavior resulting from each ant's preference to follow trail pheromones accumulate by other ants. In order to improve the global solving ability and convergence speed, avoid falling into local optimal solution; the basic ant colony optimization (ACO) algorithm is improved to propose an efficient and intelligent ant colony optimization (IMVPACO) algorithm. Adjustment strategy of pheromones are modify in order to better reflect the quality of the solution based on the increment of pheromone.[1]

This paper tried to study optimum parameters for improved ACO.

2. LITERATURE SURVEY

Khushboo Arora [2] "Better Result for Solving TSP: GA versus ACO(march 2016)". The author had done the comparative studies between GA and ACO. Finally the author shows that Genetic Algorithm gives better result in terms of distance travelled for less number of cities but as the author increases the complexity by increasing the number of cities, ACO proves to give better result than Genetic. While considering Execution time as the factor ACO is also proved to be better. Ping Duan[1] "Research on an Improved Ant Colony Optimization Algorithm and its Application (2016)." The research studies on the dynamic movement's rule of ants, Improved updating rules of Pheromones, Adaptive Adjustment Strategy of Pheromone, Dynamic Evaporation Factor Strategy, Boundary Symmetric Mutation Strategy.

In the IMVPACO algorithm, the updating rules and adaptive adjustment strategy of pheromones are modifying. It order to provide better quality of the solution based on the increment of pheromone, the author used dynamic evaporation factor strategy to achieve the finer equalization between the decode efficiency and clear up quality, and effectively pass up falling into local optimum for thrilling the convergence speed. The movements rules of the ants are modifying, to make it changeable for large-scale problem solving, optimize the path and better search efficiency.

Richa Bajaj[3] " A Review on Optimization with Ant Colony Algorithm (july 2016)". The Author Studies about the percussion of some control parameters by implementing ACO algorithm. The quality of the solution is compared with the optimal solution. The study overcomes the problem of Stagnation and congestion by using Multiple Ant-Colony Optimization. In the improved version, of ACO, Multiple Ant-Colony Optimization can change upon more than one optimal past interfaces are identified as compared to only one path, which are accepted to provide formidable throughput and will be able to examine new and better paths even if the network topologies gets interchanged very frequently. This will assign the traffic of burden link to other preferred links.

Hence the throughput of the network is reorganized and the problem of stagnation gets reformed.

Farah Sarwar[4] "Critical Analysis of Hopfield's Neural Network Model for TSP and its Comparison with Heuristic Algorithm for Shortest Path Computation". The paper studied comparison between the heuristic algorithm and the Hopfield's Neural Network for different number of cities. Neural Network was not able to provide the better optimum solution as compared to heuristic algorithm.

Hashim Ali[5] "Solving Traveling Salesman Problem through Optimization Techniques Using Genetic Algorithm and Ant Colony Optimization(jan 2016)". The paper show the studies of TSP solving with heuristic algorithm such as ACO and Genetic Algorithm and comparatively studies between them on square area(10x10) for the no. of cities. Now a days Genetic Algorithm and Ant Colony Optimization calculated in two scheme a) altering number of iteration, b) altering the number of cites to nodes in solution space as input and keeping other parameters constant. Both techniques provide the optimal solution. In starting for less no. of cities G.A. is better, but the complexity increases when no. of cities Increases, the ACO are better approach to solve it.

Er. Priya Darshni[6] "Implementation of ACO Algorithm for Edge Detection and Sorting Salesman Problem(2010)". The paper represents an Ant Colony Optimization-based technique for image edge detection and also provides solution for the Travelling Salesman Problem. The considered method authorized a pheromone matrix that correspond the edge information at each pixel based on the path formed by ants dispatched on the image. The research achieve the complete ACO algorithm for edge detection of the image, And it also actualized for sorting salesman problem.ACO method solves the ambitious computational problems and chooses compendiary route to solve the problem.

Ivan Brinzina Zuzana Cickova [7] "Solving the Travelling Salesman Problem Using the Ant Colony Optimization (sept 2011)". The research is on TSP using ACO. Study the knock of some control parameters by actualize ACO algorithm. The individuality of the solution is analyze with the optimal solution. It can be achieve that the affirmation of solutions depends on the crowd of ants. The lower number of ants allows the specific to change the path often faster. The greater number of ants in community causes the higher accession of pheromone on edges, and thus an indivible keeps the path with higher concentration of pheromone with a high rise probability.

Zar Chi Su Su Hlaing [8] "Solving Traveling Salesman Problem by Using Improved Ant Colony Optimization Algorithm (dec 2011)". The paper shows the changes in ant colony system, dynamic candidate list strategy, proposed approach a) Dynamic Candidate List Strategy b) heuristic parameter updating based on entropy and mergence of local search solution is proposed. Paper presents an access for solving TSP based on improved Ant Colony Algorithm. An improved interpretation of ACO algorithm based on candidate list strategy and also proposed dynamic heuristic parameter updating establish on degeneration and combine of local search solution is purposed. From the experimental results, the considered system is more capable than the ACS algorithm in terms of association speed and the ability to finding better solutions.

M.M.Manjurul Islam[9] "An Implementation of ACO System for Solving NP-Complete Problem; TSP(Dec 2006)" The research paper suggest the studies ant density, ant quantity, ant cycle on different of rho (0.3 to 0.99) and taking fix value of alpha and beta . Main prospect analysis over simulation in different cities to find best path and time. Also found best performance in various component past prior implemented.

Xue Yang [10] "Application of Improved Ant Colony Optimization Algorithm on Traveling Salesman Problem(2016)". The papers studies about the improved ant colony algorithm for solving TSP, Update Strategy of Information Hormone, Selection of Parameters and Local Optimal Search Strategy.

The Author altering the heap of information and seeking for the optimal parameters, it can change up the confluence velocity. The simulation results with a typical TSP problem show that the proposed method can assemble to the global optimal result promptly and speed up the convergence rate.

3. CONCLUSIONS

It is evident that ACO is better than Genetic algorithm, neural networks and other heuristic and non heuristic methods for both static and dynamic configurations. ACO becomes even better on increasing no of ants. In improved ACO modeling parameter constants like exponential weight, heuristic exponential weight, and evaporation constant are fixed. Evaporation constants have been studied and it has been recommended in [9] that it may vary from (0.1-0.99); but other parameters ranges have not been studied. There may be set of parameters giving best performance in terms of cost, time taken and number of iterations needed to arrive at optimum solution.

We can study each parameter one by one keeping others constant for improved ACO, thus arriving at a set of parameter constants. These parameter constants can be studied further to compare cost, time taken and iterations needed to arrive at the optimum solution to Travelling Salesman Problem. This study may give us set of constants which further improves ACO for TSP.

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BIOGRAPHIES

Mithlesh Kumar Kushwaha is born in Jhansi, Uttar-Predesh , India on 1st june 1991. He received a B.Tech. in Information Technology in 2014 from UPTU Lucknow. He joined his M. Tech. in Computer-Science & Engineering in 2015 from AKTU Lucknow. His research interest in Data mining and Data Ware House.

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