

TECHNIQUES FOR SOLVING TRAVELLING SALES MAN PROBLEM

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Abstract

Paper here defines the Travelling Sales Man Problem(TSP) as a problem where Salesman desires to tour around a specified set of cities, and return to the starting city, covering the least total distance. TSP is a NP-hard problem for reducing their complexity we use the different type of techniques. TSP can be solved by multiple techniques such as Parallel search-and-learn technique, Hybrid Method, Neural Network Techniques, Tabu search and Genetic Algorithm. Genetic Algorithm gives the best possible solution for solving TSP problem.

Index Terms: Travelling Sales Man Problem, Genetic Algorithm, Parallel search-and-learn technique, Hybrid Method, Tabu search.

1. INTRODUCTION

A problem is known as NP hard if there exist no poly-time deterministic algorithm for solving the problem. If π is a NP-hard than, in supplementary terminology : π is NP-hard \Leftrightarrow if π can be explained in polynomial time, then $P=NP$. Accordingly, if we could solve one NP-hard crisis quickly, then we could solve any problem, whose result is easy to recognize, using the solution to that one special problem as a subroutine. NP-hard troubles are at smallest amount as tough as several dilemma in NP. TSP is a NP hard problem. TSP is an key aspect for those human being who are mathematicians and computer scientiest. TSP is used for discovering the shortest path cost by traversing all nodes exactly once and returning to the starting node. There are various approaches which solves the TSP problem. These methodes includes Tabu Search, Neual Network, Branch-and-Bound, Parallel Search-and-Learn Technique, Cutting Planes, Genetic Algorithm and Simulated Annealing. Parallel Search-and-Learn procedure can be used to examine maximum portion of the search space to solve tricky combinatorial optimization problems. The Search-and-Learn technique is generally applied to other optimization problems of combinatorial nature. In Neural Network Techniques, model simulates the behavior of human brain to learn and select suitable outcome by making decisions depending on past learning. In hybrid method, the algorithm makes use of both genetic algorithm (GA) and learning algorithm (LA) mutually to search in input state space. It has been discovered that the rate of finding answer increases astonishingly using LA and GA along with in search around process and prevents the algorithm from being spellbound in local minimums. In Tabu search approach, invent from proxy

check methods and cutting plane approaches. In genetic approach, uncomplicated GA plant at random generates a beginning populace of filament, which is referred as DNA pool in addition to afterward relate machinist to produce new-population and optimistically better populations. There are common 3 functions for a GA to work with. The first function is copying a part of series to the next production with some prospect based on their principle function value. The second is Mutation which changes one or more DNA values in a chromosome from its primary position. This can result a fully new DNA values being added the DNA group. By using these replaced DNA values, GA may be give a best solution, which it used previously. The third function, Crossover generates a child gene using two parents. Assuming that new child is always better than the parent.

2. LITERATURE SURVEY

2.1 Parallel search-and-learn technique

Parallel search-and-learn technique is a technique for solving combinatorial problems. It solves problem using parallel processing and search techniques such as branch and bound algorithms' C. P. Ravikumar express a "learning" system which examines a local search procedure where so many primary nodes were produces by using distributed random route [5]. They used Search-and-Learn practice for two different searched: successive version and parallel version. First implements the technique for sequential version which evaluates its process against a big query sizes. Second uses it for parallel policy where it is act as a multiprocessor and gives result as bursting and enlargement sequence of process. In that

Ravikumar take problem for 532-city problem and at the end of his research he gets 28707 tours which are not as much of as 5 hours on the Meiko transputer.

2.2 Neural Network Techniques

Neural Network is just like human brain. Certain kind of neural networks can be used for optimization by take advantage of their inherit capacity and to achieve a constant smallest amount of the task. In that research Dr. S. M. Abdel-Moetty defines that whenever tsp use 8 cities or 9 cities then always 8 cities tor length is greater than 9 cities. Neural Network Technique using energy functions and weight matrix to solve the tsp problem. The energy task should be capable to guide to a constant combination matrix and to direct to the smallest traveling pathway [6]. Dr. S. M. Abdel-Moetty developed an algorithm with N2 neurons where weight matrix will be a four-sided figure pattern of N2*N2 sets. In contrast to the energy gathering, the set template can be situate up and doing as pursue:

$$K_{ij} = -A\delta_{ab}(1-\delta_{ij}) - B\delta_{ij}(1-\delta_{ab}) - C - Ddab(\delta_{j,i+1} + \delta_{j,i-1}) / (2) [\delta_{ij} = 1 \text{ if } i=j \text{ and is } 0 \text{ otherwise}]$$

In NN, Hopfield NN supposes that the human being element maintain their character situation until they are selected for fresh information's. The assortment is prepared indiscriminately. In chronological workstation, Hopfield model cannot participate with conventional methods. This approach also means as "death of the traveling salesman". The Hopfield model and also its stochastic alternative have been useful in several additional areas, such as psychology, reproduction of ensembles of organic neural networks, and hectic activities of neural route.

2.3 Hybrid method

Hybrid method combines the artificial bee colony (ABC) algorithm with Greedy sub tour Crossover (GSX) to increase the accuracy. In this hybrid system, the management method in the ABC algorithm is enhanced in the lead by the Greedy subordinate trip Crossover. The innovative generate scheme is called ABC-GSX. Hybrid method added synthetic Bee group and Greedy Sub tour Crossover (ABC-GSX) [7]. The mapping of restraint of this algorithm for the combinatorial optimization dilemma field was addressing. Traveling Salesman Problem, a traditional optimization problem, was preferred to appraise the usefulness of this mapping and generated technique. In this routine, the utilization route in the ABC algorithm is superior by join GSX. The fallout point toward with the intention of hybrid manner defer further valuable domino effect for TSP, in the midst of an middling qualified inaccuracy lower than 0.8% assortment of possible methods, revise reasonable explanation and prevention of

suboptimal with good way and upbeat to 5,000 nodes, and this split based on linear terminal 0. That way porting the consecutive convention use for the explain illustration with up to 33,810 nodes solution. Ant Bee Colony is foundation on bees foraging performance. ABC was in the beginning deliberated for mathematical optimization troubles.

Anan Banharnsakun, Tiranee Achalakul, and Booncharoen Sirinaovakul proved that if relative error occur than it not more than 2% and in always average relative error not as much of 0.8%. Variety of realistic way out is done by witness bees. At what time the engaged bees come again to their hive, to tell all the information about person solutions with the observer bees. The watcher bees go for these resolution foundations on prospect. Explanation of advanced solution has a superior opening of being preferred by witness bees than ones of poorer solutions. The responsibility of witness bees is to update the solution with latest information. If witness bee and observer bee fond more approximate value in compare to neighborhoods then they replaced it to fitted value. Reassigned employee bee whose present solution is poor randomly search for new solutions.

2.4 Tabu Search Approach

Tabu search (TS) is a restricted search algorithm that can be used for resolve combinatorial optimization troubles. Abu search solves that type of techniques in which best possible arrange and selection of preference is preferred techniques. In that type of techniques traveling salesman problem is come Alfonsas Misevicius, Antanas Lenkevicius, Dalius Rubliauskas prove for the TSP using Tabu search where for finding the new most excellent solution the process took around 10 to 20 hours on 900 MHz's [10]. Tabu search have many features: It complex to examine scientifically. Additional labor is desired for manipulating and executing TS.

Tabu search approach used short term memory organization that avoids the exploration from re-visiting nodes that has visited in the past. In that way a tabu list is implemented where usually every move piles up as a group of illegal moves. Every travels in the tabu list excess the record for an amount of tabu search iterations. This amount is described its tabu tenure [11]. Tabu search may disallow striking travel even when there is no risk of cycling. Stretchy recall used for control the subsequent explanation. In Tabu search main three policy works that are: Forbidding strategy, Freeing strategy and Short-term strategy. In Forbidding strategy manage what come in the tabu list. Freeing strategy manage what come in the tabu list and when. And Short-term strategy manages relationship sandwiched between the forbidding strategy and freeing strategy to pick assessment key.

Tabu Search is a heuristic search which used successfully; it guaranteed an resourceful near-optimal explanation to the TSP. The fundamental stepladder as useful to the TSP which are as follows:

1. Solution Representation: A possible solution is symbolized as a succession of nodes, every node come into view only one time as well as in the order it is appointment. Here primary and the very last visited nodes are preset to 1. In the solution it always understand starting node as 1, which is not specified.

2. Initial Solution: A high-quality practicable, explanation for the TSP can be established hastily with a greedy approach. Process starts with the initial node in the tour, find the nearest node. In that process until all nodes are not visited, and find the adjoining unvisited node from the present.

3. Neighborhood: A given solution shows that a neighborhood is obtained by a couple wise replace of a few nodes in the solution. This solution assurance that any neighborhood to a possible solution is at all times a feasible solution. Neighborhood explanation acquire by transaction.

4. Tabu List: A Tabu structure supplies the integer of iterations for a specified pair of nodes is proscribed from switch over. To avoid the development from cycling in a very small set of answer, a number of characteristic of just visited solutions is pile up in a Tabu List, which prevents their incidence for an incomplete stage. For problem, the characteristic used is a couple of nodes that have been substitute freshly.

5. Aspiration criterion: The decisive factor employs for the current problem of TSP, which permits a move, even if it is tabu, results in a solution with a goal value healthier than that of the existing finest acknowledged explanation.

6. Diversification: Somewhat frequently, the route may get fascinated in a break of local optimum. This diversify control is permitted to work only on incident when no humanizing moves survive. Furthermore, if there is no enhancement in the explanation for a pre-defined digit of iterations, rate of recurrence in sequence can be worn for a pair wise substitute of nodes that have been walk around for the smallest amount digit of times in the exploration space, thus the search process to areas that are mainly unfamiliar distant.

7. Termination criteria: The algorithm comes to an end if a pre-defined digit of iterations is achieved.

2.5 Genetic Algorithm Approach

Genetic Algorithm (GAs) are adaptive heuristic discovery algorithm which premised taking position the evolutionary opinions of usual group as well as of hereditary. The basic perception of GAs is planned to invoke process in estimated organism necessary on behalf of development, individually people with the intention of follow the viewpoint principal display losing by Charles Darwin of endurance of the fittest. Genetic algorithm have three essential aspect (1) illustration of the aim gathering, (2) illustration moreover accomplishment of the genetic demonstration, and (3) explanation and achievement of the genetic operative. Yingying Yu, Yan Chen, Taoying Li provide the solution for tsp where they define the 30 is the ability of the primary population, 500 is highest iterations, 0.9 is the possibility of crossover, and 0.01 is the tempo of mutation. By that generated optimal result and the minimum tour length is 554.851. [8] Genetic Algorithm is an added modus which find the proper solution for and used many type of researches for performing the accurate output. The important improvement of genetic algorithms is their elasticity along with robustness. By means of this scheme after time, the populace motivation optimistically progress work in good manner. The algorithm makes use of roulette wheel based assortment machinery, the utilizing of an inversion operator, fittest strategy and crossover operator.

GAs is constructive and proficient when [2]

- The investigation breathing space is huge, difficult or badly implicit.
- Field facts are thin or professional awareness is complex to instruct to point the exploration gap.
- Any type of mathematical analysis does not exist.
- Usual investigate methods not succeed.

The gains of the GA approach are the simplicity with constraints and objectives in which can grip unreasonable kinds of all such things. GA can be managed as weighted mechanism of the fitness utility which making it easy to adjust the GA scheduler to the exacting necessities of a very spacious assortment of probable objectives.

COMPARISONS

- The standard algorithm (ACS) with the predictable algorithm used along with Hopfield neural network is extremely quick as compared to usual algorithm and giving small output [6].
- Genetic Algorithm is an iterative penetrating scheme in which, normally, it found the nearest solution compare to other approaches but cannot find best solution so

therefore here distinct execution situation for the algorithm [1].

- Genetic Bee Colony Algorithm (RGBCA) is a healthier GA approach for that reason whenever it attach with GA it grows the actual result of the GA [9].
- In GA, discover that it provide finest solutions all time and modernize the constants of weights and illustrate that as the quantity of tour enlarges the number of iteration-required enhances [4].

CONCLUSION

The ease of the report of the problem is -- the Travelling Salesman Problem (TSP) is the majority powerfully intentional troubles in computational arithmetic and up till now no successful explanation process is known used for the common case. Given a gathering of nodes and the rate of travel among all pair of nodes, the traveling salesman problem is to find the cheapest technique of trip all of the nodes and frequently return to starting point. Here each and every one technique have purpose to give maximum tour length with least complexity. By studying all the above mentioned techniques it is concluded that GA is most appropriate method by which we find the low complexity of TSP. In future work I take GA approach which solve the TSP problem using appropriate fitness functions and finally find the least complexity.

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BIOGRAPHIES



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