Travelling salesman problem pdf

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Using 2-Opt based evolution strategy for travelling salesman problem

Kenan Karagul[a] Erdal Aydemir[b] and Sezai Tokat[c]

[a] Department of Logistics, Honaz MYO, Pamukkale University, Denizli, Turkey
Email: kkaragul@pau.edu.tr

[b] Department of Industrial Engineering, Engineering Faculty, Suleyman Demirel University, Isparta, Turkey
Email: erdalaydemir@sdu.edu.tr

[c] Department of Computer Engineering, Engineering Faculty, Pamukkale University, Denizli, Turkey
Email: stokat@pau.edu.tr

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Abstract. Harmony search algorithm that matches the (μ+1) evolution strategy, is a heuristic method simulated by the process of music improvisation. In this paper, a harmony search algorithm is directly used for the travelling salesman problem. Instead of conventional selection operators such as roulette wheel, the transformation of real number values of harmony search algorithm to order index of vertex representation and improvement of solutions are obtained by using the 2-Opt local search algorithm. Then, the obtained algorithm is tested on two different parameter groups of TSPLIB. The proposed method is compared with classical 2-Opt which randomly started at each step and best known solutions of test instances from TSPLIB. It is seen that the proposed algorithm offers valuable solutions.

Keywords: Travelling salesman problems; TSP; harmony search; HS; (μ+1) evolution strategy; 2-Opt; TSPLIB.
AMS Classification: 68T20; 90-08

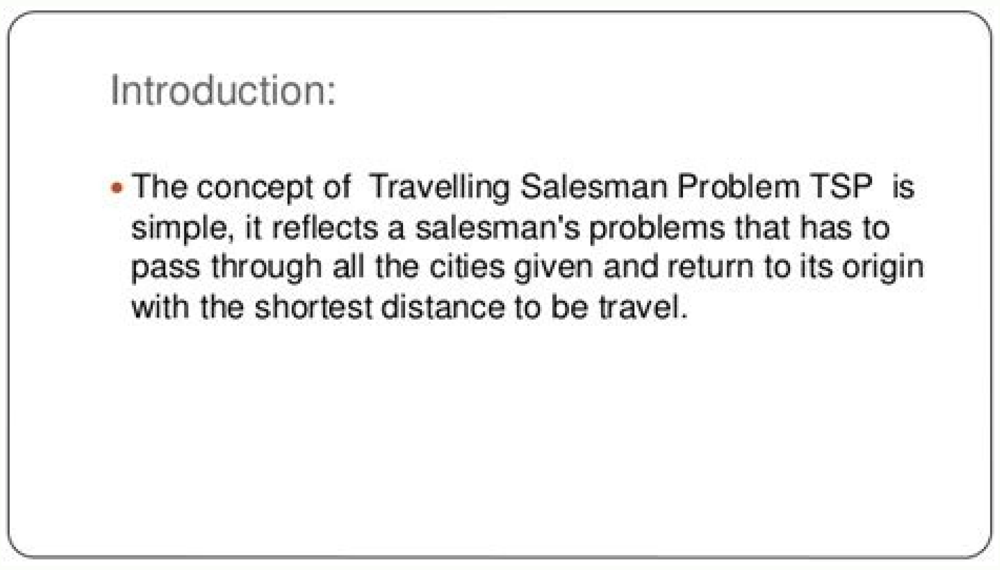
1. Introduction

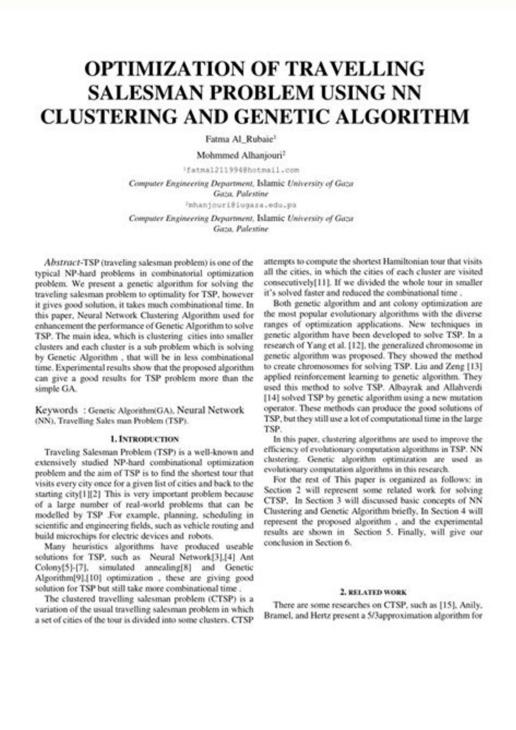
The travelling salesman problem (TSP) is one of the most popular combinatorial optimization problems in complexity theory [1]. TSP for minimizing the tour length is quite difficult to solve and classified as NP-Hard, it will be time consuming to solve larger instances. However, TSP is used in many theoretical and practical applications such as manufacturing planning, logistics, and electronics manufacturing. Due to the nature of TSP, obtaining the optimal solution is not possible in polynomial time if solved via integer programming. Also, it is known that the solution time extends exponentially as the problem size grows. Therefore, as an alternative solution approach, the meta-heuristics are commonly used to determine near optimal solutions in acceptable solution times [2-8].

In the related literature, many known meta-heuristics were used to solve TSPs for minimizing the tour lengths. For instance, Freisleben and Merz [9] presented an algorithm by using genetic algorithm (GA) to find near-optimal solution for a set of symmetric and asymmetric TSP instances and obtained high quality solutions in a reasonable time. Chowdhury et al. [10] also used GA for solving a flow-shop scheduling problem to minimize makespan via finding optimal order of cities. The simulated annealing (SA) algorithm is also used for TSP by Wang and Tian [11] in which an improved SA is employed. Meta-heuristics approach is generally used to solve the problem in reasonable time if the problem size increases. For large TSPs, Fiechter [12] used a parallel tabu search algorithm. Similarly, different types of ant colony algorithm are used for the TSP [13-15]. Also, Wang et al. [16] developed swap operator and swap sequence in order to use particle swarm optimization (PSO) for TSP.

Recently, with the progresses in computational sciences, the new meta-heuristics methods have

Corresponding Author. Email: erdalaydemir@sdu.edu.tr





OPTIMIZATION OF TRAVELLING SALESMAN PROBLEM USING NN CLUSTERING AND GENETIC ALGORITHM

Fatma Al_Rubaie[1]
Mohmmed Alhanjouri[2]
[1]fatma1211994@hotmail.com
Computer Engineering Department, Islamic *University of Gaza*
Gaza, Palestine
[2]mhanjouri@iugaza.edu.ps
Computer Engineering Department, Islamic *University of Gaza*
Gaza, Palestine

Abstract-TSP (traveling salesman problem) is one of the typical NP-hard problems in combinatorial optimization problem. We present a genetic algorithm for solving the traveling salesman problem to optimality for TSP, however it gives good solution, it takes much combinational time. In this paper, Neural Network Clustering Algorithm used for enhancement the performance of Genetic Algorithm to solve TSP. The main idea, which is clustering cities into smaller clusters and each cluster is a sub problem which is solving by Genetic Algorithm , that will be in less combinational time. Experimental results show that the proposed algorithm can give a good results for TSP problem more than the simple GA.

Keywords ; Genetic Algorithm(GA), Neural Network (NN), Travelling Sales man Problem (TSP).

1. Introduction

Traveling Salesman Problem (TSP) is a well-known and extensively studied NP-hard combinational optimization problem and the aim of TSP is to find the shortest tour that visits every city once for a given list of cities and back to the starting city[1][2] This is very important problem because of a large number of real-world problems that can be modelled by TSP .For example, planning, scheduling in scientific and engineering fields, such as vehicle routing and build microchips for electric devices and robots.

Many heuristics algorithms have produced useable solutions for TSP, such as Neural Network[3],[4] Ant Colony[5]-[7], simulated annealing[8] and Genetic Algorithm[9],[10] optimization , these are giving good solution for TSP but still take more combinational time .

The clustered travelling salesman problem (CTSP) is a variation of the usual travelling salesman problem in which a set of cities of the tour is divided into some clusters. CTSP attempts to compute the shortest Hamiltonian tour that visits all the cities, in which the cities of each cluster are visited consecutively[11]. If we divided the whole tour in smaller it's solved faster and reduced the combinational time .

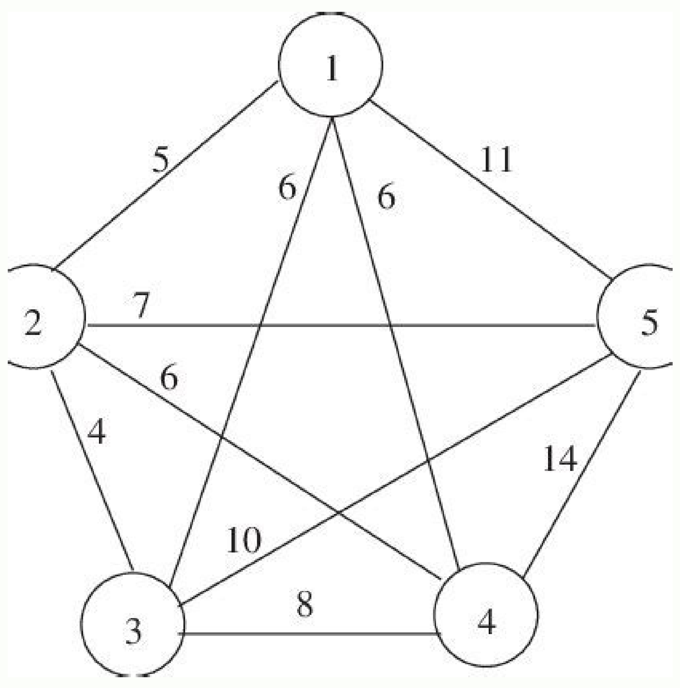
Both genetic algorithm and ant colony optimization are the most popular evolutionary algorithms with the diverse ranges of optimization applications. New techniques in genetic algorithm have been developed to solve TSP. In a research of Yang et al. [12], the generalized chromosome in genetic algorithm was proposed. They showed the method to create chromosomes for solving TSP. Liu and Zeng [13] applied reinforcement learning to genetic algorithm. They used this method to solve TSP. Albayrak and Allahverdi [14] solved TSP by genetic algorithm using a new mutation operator. These methods can produce the good solutions of TSP, but they still use a lot of computational time in the large TSP.

In this paper, clustering algorithms are used to improve the efficiency of evolutionary computation algorithms in TSP. NN clustering. Genetic algorithm optimization are used as evolutionary computation algorithms in this research.

For the rest of This paper is organized as follows: in Section 2 will represent some related work for solving CTSP. In Section 3 will discussed basic concepts of NN Clustering and Genetic Algorithm briefly. In Section 4 will represent the proposed algorithm , and the experimental results are shown in Section 5. Finally, will give our conclusion in Section 6.

2. Related Work

There are some researches on CTSP, such as [15], Anily, Bramel, and Hertz present a 5/3approximation algorithm for



Iterative Cartesian Genetic Programming: Creating General Algorithms for Solving Travelling Salesman Problems

Patricia Ryser-Welch(✉), Julian F. Miller, Jerry Swan, and Martin A. Trefzer

The University of York, Heslington, UK
{patricia.ryser-welch,julian.miller,jerry.swan,Martin.Trefzer}@york.ac.uk

Abstract. Evolutionary algorithms have been widely used to optimise or design search algorithms, however, very few have considered evolving iterative algorithms. In this paper, we introduce a novel extension to Cartesian Genetic Programming that allows it to encode iterative algorithms. We apply this technique to the Traveling Salesman Problem to produce human-readable solvers which can be then be independently implemented. Our experimental results demonstrate that the evolved solvers scale well to much larger TSP instances than those used for training.

Keywords: Iterative algorithms · Cartesian Genetic Programming · TSP

1 Introduction

Designing effective search algorithms for difficult problems has long been an intensive field of study in computer science [13]. Evolutionary algorithms have been used to optimise or design search algorithms and it is typical for such algorithms to operate on a human-designed template in which new operations are generated at fixed points in the template. Very few have evolved loop-based control flow and attempted to answer John Koza's question: *"Is it possible to automate the decision about [...] the particular sequence of iterative steps in a computer program?"* [16]. Such control flow can be implemented either via iteration or recursion. Recursive approaches to various problems of program induction have been presented in Yu and Clack [43] and Alexander [1] but we are not aware of any direct applications to search problems.

In this paper, we introduce a novel and extended form of a well-known graph-based form of Genetic Programming, Cartesian Genetic Programming (CGP), to encode iterative algorithms. The original motivation for using hyper-heuristics is that they do not require skilled practitioners. The use of CGP is significant in this regard, since it doesn't require knowledge of specialized bloat-handling techniques. We apply this technique to the well-known Traveling Salesman Problem

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Travelling salesman problem python. Travelling salesman problem is an example of. Travelling salesman problem algorithm. Travelling salesman problem time complexity. Travelling salesman problem solution. Travelling salesman problem greedy algorithm. Travelling salesman problem calculator. Travelling salesman problem using branch and bound.

Next, you will not use an iterative process to determine subtours, add µ restrictions, and rerun optimization until subtours are eliminated.For the problem-based approach, see Roaming Salesperson Problem: Problem-based.Formulate the itinerant seller's problem for linear integer programs as follows:Generate all possible routes, meaning all distinct pairs of stops.Calculate the distance for each trip.The cost ratio to minimize The sum of travel distances for each trip on the tour.The decision variables are bin and associated with each trip, where each 1 represents a trip that exists on the tour, and each 0 represents a trip that You are not on the tour.To ensure that the tour includes all stops, include the linear constraint that each stop is on exactly two trips. An example of how this works. If you don't have five points in a subtour, then you don't have five lines connecting those points to create the subtour. To do this, round the solution if some values are not exactly integer and convert the resulting values to ^{3}. stopsLon(idxs(:,1)) - stopsLon(idxs(:,2)); lendist = length(dist);With this definition of the dist vector, the length of an isdist tour'*x_tsponde x_tsp A© the bin solution vector. This means an arrival and a departure from the stop.Generate stopsGenerate ^{3} stops within a gross polygonal representation of the continental load of the USA('usborder.mat','x','y','xx','yy'); rng(3,'twister') % Makes a chart with stops in Maine & Florida, and A© playable nStops = 200; % You cannot use any number, but the size of the problem is N^2 stopsLon = zeros(nStops,1); Allocate x coordinates % of nStops stopsLat = stopsLon; % Assign coordinates y n = 1; whereas (n

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