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Finding Shortest Path from each Depot using Clustering and BBO Technique

Kamaljeet Kaur
M.Tech Student of Guru Kashi University

Mandeep Kaur
Assistant Professor Guru Kashi University

Abstract-This paper is based on BBO (Biogeography based optimization)Technique comes under Swarm Intelligence. Optimization technique can be used to solve the problem of max-min Multiple Depots Vehicles Routing Problem.This technique focuses on minimizing the travelled distance of vehicles from depots to the cities. To get this level of optimization TSP technique has been used.

Index Terms- Input Image for 13 cities and 3 depots cities,clustering and Swarm Intelligence.

I. INTRODUCTION

Travelling salesman problem (TSP) is a combinatorialOptimization problem is used to serve geographicallyRepresented cities with Depots to get shortest distance. This came into existence in 1959. TSP is mainly used in transportation, tourism, Logistics, path optimization etc. There is one centralDepot which is further connected to cities to find the shortestPath amongthem. TSP is closely related to VRP. It contains many VRPs with common starting and end points of cities from depots.Main aim is to minimize the Travelling cost by minimizing the total distance travelled by the vehicles. TSP is also called **Single Depot Travelling salesman Problem(SDTSP).**

An extension of this algorithm is **Multi Depot Travellingsalesman Problem (MDTSP)** which implicates number ofdepots instead of only one. In TSP demands at the city nodes vary due to various factors, suchas location and temporal seasonal factors. A network routingtopology generated by solving min-max MDVRP results in a setof daisy-chain network configurations. Vehicles should startfrom the depot and then return back to the depot after visiting an ample amountof cities. Every city has a demand which varies Stochastically. Vehicles aremoved from respective cities and one city is served by onlyone vehicle. Considerations that should be keptin mind for implementing MDTSP:

1) Vehicle should start and end its route at the depot.
2) A city is visited exactly once by the vehicle in each cluster.
3) Total cost of travelling should beminimized.

Nearest neighbor function

a) Each city is assigned to the nearest depot.
b) Routes are made by traversing the vehicles over the cities (initial solution is made).
c) Local improvement method is applied to the routes initially formed in order to get better results.

Constraints are imposed on the vehicles:
Distance constraint: includes that a vehicle can travel a certain amount of distance.

1.1 Biogeography Based Optimization

Biogeography Based Optimization technique is used to solve the travelling salesman problem. BBO is a probabilistic techniquefor solving computational problems introduced by Dan Simon in 2008.This technique is based on the theory of biogeography where Biogeography is the study of the geographical distribution of biological organisms. This optimization algorithm works on the basis of two concepts-migration and mutation. With this article we provide a survey on the theoretical results on biogeography based optimization and its modified approaches. BBO is population based evolutionary algorithm (EA) motivated by the migration mechanisms of ecosystems. It is an example that a natural process can be modeled to solve general optimization problems. The mathematics of biological genetics inspired the development of genetic algorithms (GAs), and the mathematics of biological neurons inspired thedevelopment of artificial neural networks.

II. PROPOSED WORK

The area of research is swarm intelligence under which BBO technique is chosen. In travelling salesman problems,Shortest path is to be find by moving to all cities from depots after calculating probability the nearest city to respective depot is to be captured. The one that is closer and has more probability is chosen as the nearest city to that depot under which this paper will be extending SDTSP to MDTSP. HereMDTSP is solved using BBOtechnique. In traditional MDTSPattempt was made to reduce the total distance travelled whereasin this case attempt is being made to reduce the maximumdistance travelled by the vehicle.

This is done by first makingclusters based upon the distance of cluster from the depot.Number of routes should be equal to or less than the number ofdepots. More number of routes increase the number of vehiclesrequired thus reducing the quality of solution. Customers areassigned to different routes. The distance is calculated by finding probability of each city from all depots.Finallyeach cluster is treated as an individual SDTSP in which BBO isused to find the shortest path such that the distance and thecapacity constraints of the vehicle are not violated. Desirability and distance areinversely proportional to each other.The probability of visitingthe city is calculated

Once desirability value is calculated for each city movingto the other one, now probability value can be calculated usingthe desirability as one of the parameter. Probability is denoted by
*P*which tells the probability of visiting the next city whichtraversing the route.

III. SIMULATION RESEARCH

The flowchart of the proposed algorithm is shown in figure

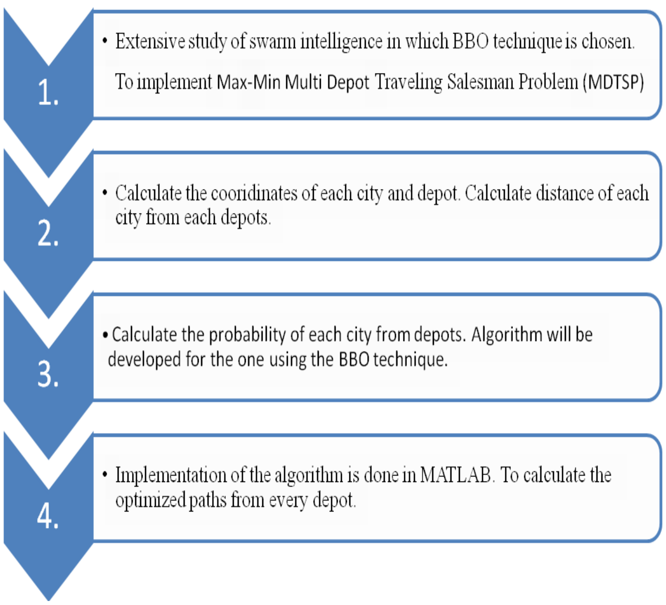

Fig:1. Flow Chart

IV. ALGORITHM

Step 1:- InitializeDataValues for the ClusteringTechnique

While(! nclusters) do

TSP and BBO End-while

Step 2:- Calculate the distance between each city (m) and depot (n).

$$D[m][n] = \sqrt{(X_{ci} - X_k)^2 + (Y_{ci} - Y_k)^2}$$

Step 3:- Calculate the HSI of each city.

Step 4:- Find the Probability to select best path for each city and depot.

For c = 1 to m do

If SIVs belongs to m.

Then HSI is high

Else check for next.

End

Step 4:- Construction of Route from every depot.

counter ← 1

for c = 1 to m do

r ← random {1; . . . ; p}

a[c].tour[counter]← r

a[c].city[r] ← 1

End-for counter = counter + 1

V. RESULTS

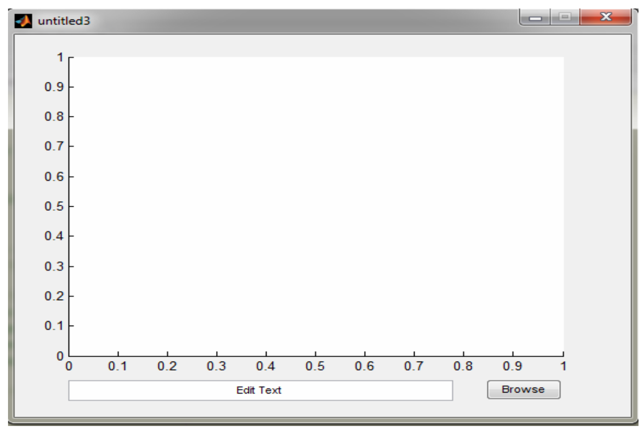

Fig: 2. Browse Image

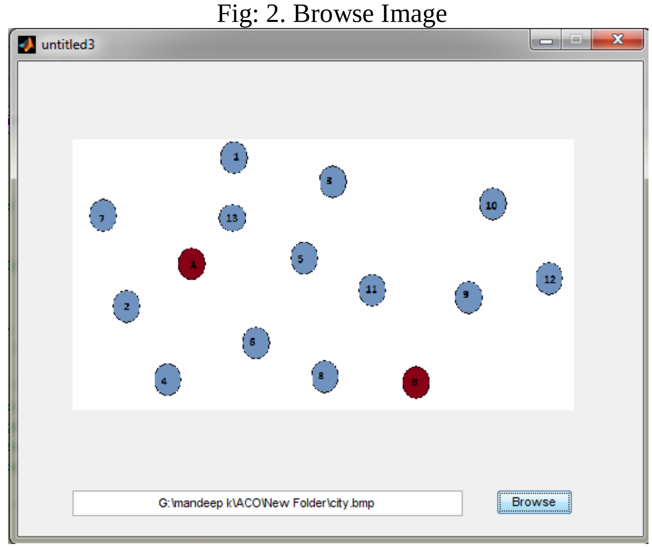

Fig: 3. Identify Cities and Depots

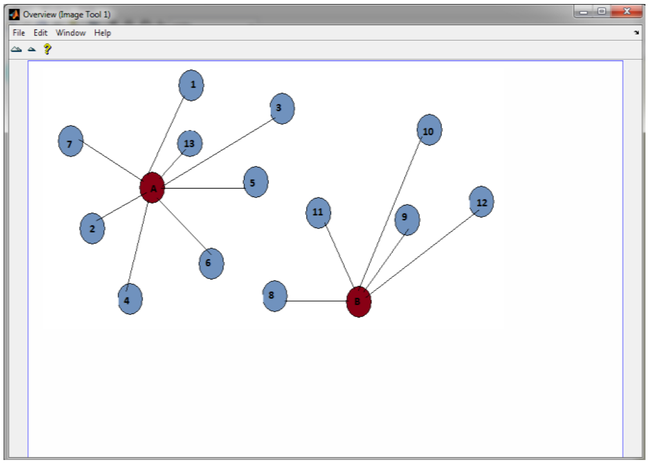

Fig: 4. Apply clustering Technioque

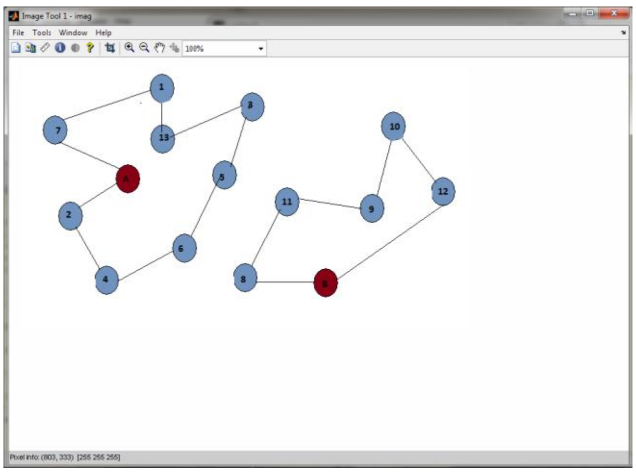

Fig: 4. Find the Shortest Path from each Depot

From Depot A:
A-2-4-6-5-3-13-1-7-A

From Depot B:
B-8-11-9-10-12-B

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