Pune Institute of Computer Technology,

Dhankavdi,Pune

DEPARTMENT OF COMPUTER ENGINEERING

A

Project Report

On

"Travelling Salesman Problem using Genetic Algorithm"

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In

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INTRODUCTION

Given a asset of cities and distance between every pair of cities, the travelling salesman problem is to find the shortest possible route that visits every city exactly once and returns to the starting point. The problem is solved using genetic algorithm and displays a plot of the best route found.

OBJECTIVE

To Apply Genetic Algorithm for given TSP problem.

H/W AND S/W REQUIREMENTS

Hardware Requirements: PIV, 2GB RAM, 500 GB HDD, Lenovo A13-4089Model

Software Requirements : Anaconda with Python 3.7

THEORY CONCEPTS

These algorithms can be implemented to find a solution to the optimization problems of various types. One such problem is the Traveling Salesman Problem. The problem says that a salesman is given a set of cities, he has to find the shortest route to as to visit each city exactly once and return to the starting city.

Approach: In the following implementation, cities are taken as genes, route to be followed is the chromosome. The fitness score which is equal to the inverse of path length of a given route.

Operators Used:

1. Selection – Tournament selection without replacement
2. Crossover – Order crossover with window size 3
3. Mutation – Swap mutation

Algorithm:

1. Initialize the population randomly.
2. Determine the fitness of the chromosome.
3. Until done repeat:
    1. Select parents.
    2. Perform crossover and mutation.
    3. Calculate the fitness of the new population.
    4. Append it to the gene pool.

Advantages of GA's

• Does not require any derivative information (which may not be available for many real- world problems).

• Is faster and more efficient as compared to the traditional methods. • Has very good parallel capabilities.

• Optimizes both continuous and discrete functions and also multi-objective problems. • Provides a list of "good" solutions and not just a single solution.

• Always gets an answer to the problem, which gets better over the time.

• Useful when the search space is very large and there are a large number of parameters involved.

Limitations of GA's

• GAs are not suited for all problems, especially problems which are simple and for which derivative information is available.

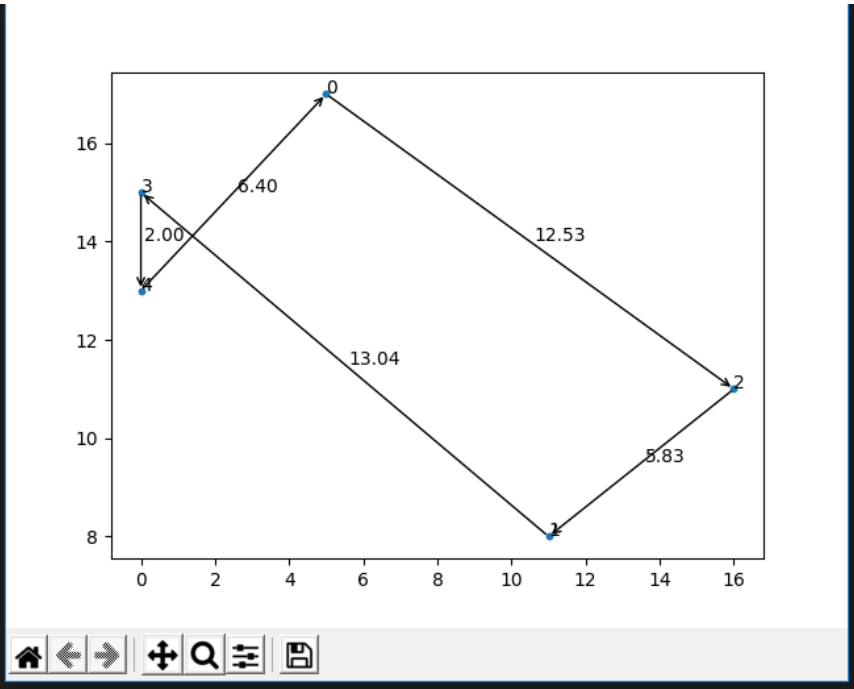
• Fitness value is calculated repeatedly which might be computationally expensive for some problems.

• Being stochastic, there are no guarantees on the optimality or the quality of the solution.

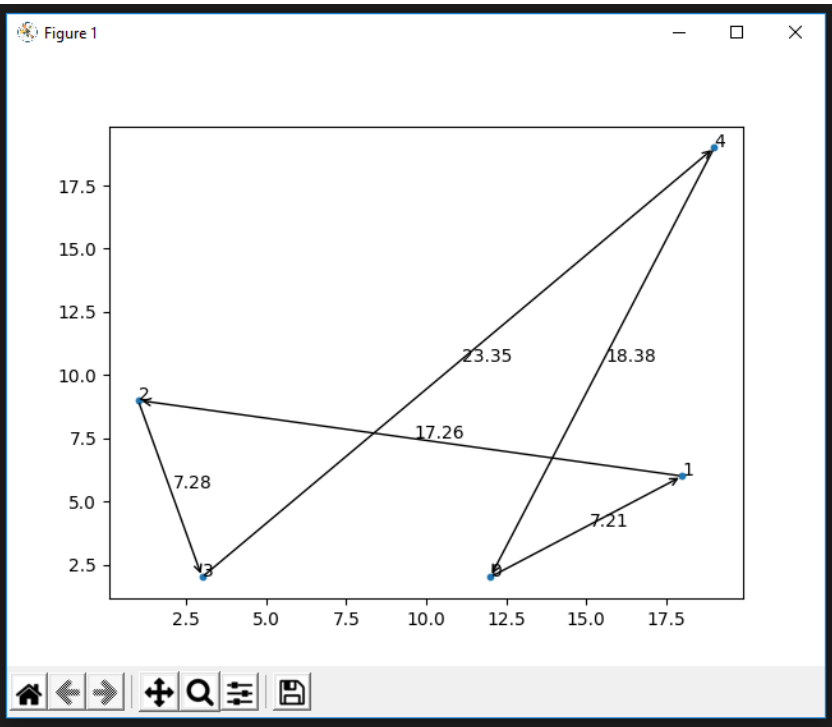
• If not implemented properly, the GA may not converge to the optimal solution.

SCREENSHOTS

```
Fittest Individual:  0.04160985096659808

Fittest route:  [3, 4, 0, 2, 1]

Cost: 39.80244502882511
--------Generation  96 -----------

Fittest Individual:  0.04160985096659808

Fittest route:  [3, 4, 0, 2, 1]

Cost: 39.80244502882511
--------Generation  97 -----------

Fittest Individual:  0.04160985096659808

Fittest route:  [3, 4, 0, 2, 1]

Cost: 39.80244502882511
--------Generation  98 -----------

Fittest Individual:  0.04160985096659808

Fittest route:  [3, 4, 0, 2, 1]

Cost: 39.80244502882511
--------Generation  99 -----------

Fittest Individual:  0.04160985096659808

Fittest route:  [3, 4, 0, 2, 1]

Cost: 39.80244502882511
[0, 3, 4, 1, 2]   37.82912676171604
```




```
--------Generation  95 -----------

Fittest Individual:  0.027375047297633466

Fittest route:  [4, 0, 1, 2, 3]

Cost: 73.4839003125483
--------Generation  96 -----------

Fittest Individual:  0.027375047297633466

Fittest route:  [4, 0, 1, 2, 3]

Cost: 73.4839003125483
--------Generation  97 -----------

Fittest Individual:  0.027375047297633466

Fittest route:  [4, 0, 1, 2, 3]

Cost: 73.4839003125483
--------Generation  98 -----------

Fittest Individual:  0.027375047297633466

Fittest route:  [4, 0, 1, 2, 3]

Cost: 73.4839003125483
--------Generation  99 -----------

Fittest Individual:  0.027375047297633466

Fittest route:  [4, 0, 1, 2, 3]

Cost: 73.4839003125483
[0, 1, 4, 2, 3]   57.12087753258779
```



CONCLUSION

Hence ,Successfully studied and practically implemented Travelling Salesman Problem and learnt Genetic Algorithm for optimization.