Swarm Intelligence

Mahadi Hasan Mithun(ID: 1930432)

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Abstract

Swarm intelligence is inspired by the collective behavior of social insects such as birds flocks, ants. In this project, we are solving TSP using genetic algorithms. Visit a city exactly once and return to the starting city following this approach to find the shortest route. Swarm intelligence plays a significant role in the artificial intelligence field.

1 Introduction

Mainly, swarm intelligence means working together and finding the shortest path to their destination. Their destination refers to the nest and food source. The principle of swarm intelligence is based on studying collective behavior in organizing themselves. Traveling salespersons have problems finding the shortest possible path that must be visited a set of cities and return to starting city. Transportation planning where TSP applies the significant rule in the real world.

2 TSP and its application

TSP finds the most efficient route. To deliver food to customers in different locations traveling salesperson problem (TSP) helps to find the most efficient route to deliver. TSP saves time and money by optimizing routes.

3 Objective of the project

Using genetic algorithms to find the shortest path and compare its effectiveness with other algorithms which are hill-climbing algorithms. Another aspect of the objective of this project is to give input from different sizes of populations and look at the genetic algorithm's performance. .

4 Description of genetic algorithm

Generating the initial population of chromosomes. Chromosomes are created randomly. Chromosomes are selected based on fitness value. This algorithm principle is 'survival of the fittest'. Two-pair chromosomes produce offspring chromosomes. Small random changes in offspring chromosomes are called mutations. Mutation maintains a diversity of populations. Genetic algorithms have five components that generate random numbers, the fittest candidate of population selects for reproduction, crossover fittest pair chromosome, and mutation.When crossover occurs in the genetic algorithm, it produces offspring based on parent1 and parent2 chromosomes. The first part chromosome of parent1 produces the first parts of the child chromosomes and the second part of the child chromosome is produced from parent2. If any node matches which taken before from parent1, and that node exists in parent2 that node is never added from parent2. Any missing node is taken from parent1 in producing children. When mutation occurs swap nodes between them.

In genetic algorithm uses a group of potential solution on the other hand simulated annealing tires to find the best solution by slowly. Genetic algorithm effect for different solution possibilities on the other hand simulated annealing is practical for complex problem scenarios.

5 Experimental setup

In this project, use used berlin52, att48, and pr76 files and also used berlin52.opt, att48.opt and pr76.opt. The optimal tour distance is taken from Berlin52.opt, att48.opt, pr76.opt those files. Using different population sizes (50, 100, 250, 500) genetic algorithm is constructed. To make sure the figuring is efficient set the maximum iteration limit for each run. Using the formula $error_{rel} = \frac{opt-best}{opt} \times 100\%$, for calculates relative error.

6 Result

I got different solutions at different times. I observed when population size increases error rate decreases which means the quality of the best solution is liable to get better. Also observed are mutation rate changes and their effect on the genetic algorithm. When the mutation rate increases, this variation results from more significant changes to their genetic characteristics.

In my experiment, we clearly see in figure 2 that the relative error rate is decreasing when population size is increasing. Also observed that increasing number of generation we find best shortest distance quickly. In figure1 found best distance is 160720.43 where the optimal distance is 106228.18 also observed for 50 generations best distance is above 400000. Mutation rate significant effect on the number of chromosome changes but it does not have any effect on finding the shortest distance.

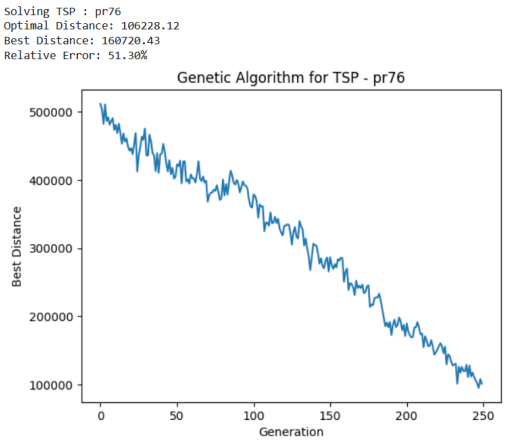

Figure 1: Generation vs Best distance

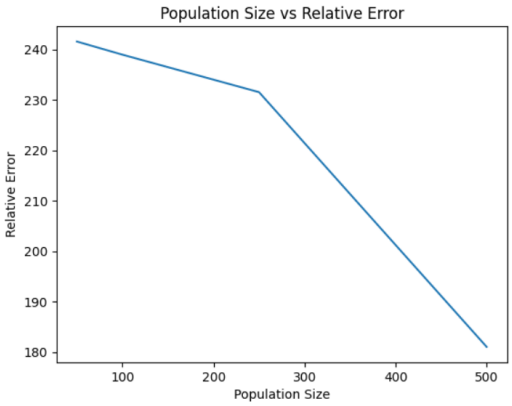

Figure 2: Population vs Relative error

7 Conclusion

Genetic algorithm, simulated annealing, and other algorithms are used to solve traveling salesperson problem. Algorithm effectiveness depends on the specific characteristics of the problem. Genetic algorithm are able to progress different solutions. It finds the shortest route between cities and helps to find efficient solutions.

References

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