

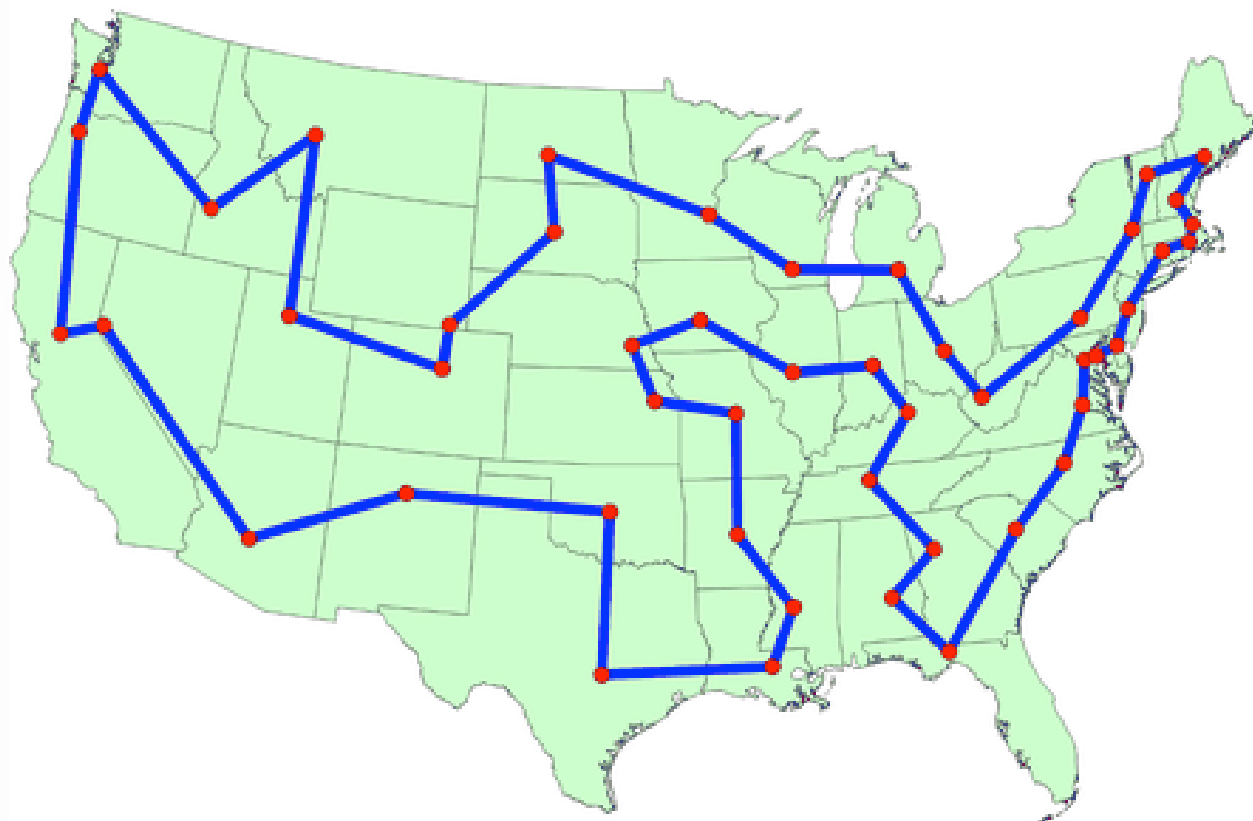


MEF UNIVERSITY

Solving TSP Problem with Genetic Algorithm

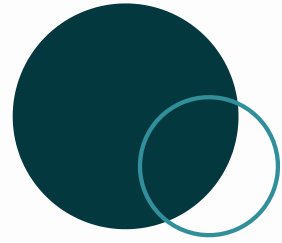
Presented by Ibrahim Onur Serbetci

WHAT IS TSP PROBLEM?



- One of the most famous problems in mathematics
- It's hard to solve computationally
- $D(V_i, V_{i+1})$ is distance between two cities
- Min of target function is objective function

$$T_d = \sum_{i=1}^{n-1} D(V_i, V_{i+1}) + D(V_n, V_1)$$



ENCODE

Assuming that the number of each city is an integer $1, 2, 3, \dots, n$.

For example,

$\{1, 3, 4, 2, 6, 9, 10, 8, 5, 7\}$

INITIAL POP

A random function is used to generate an initialization population.

$$A(0) = \{X_1^0, X_2^0, X_3^0, \dots, X_n^0\}$$

FITNESS FUNCTION

Whether the individual evolution of a population is a better solution to the problem, that is, to see its adaptability, the standard of evaluation is the value of the fitness function.

$$F(R_i) = 1 / [\sum_{i=1}^{n-1} D(V_i, V_{i+1}) + D(V_n, V_1)]$$

* R_i represents the path i .

SELECTION OPERATION

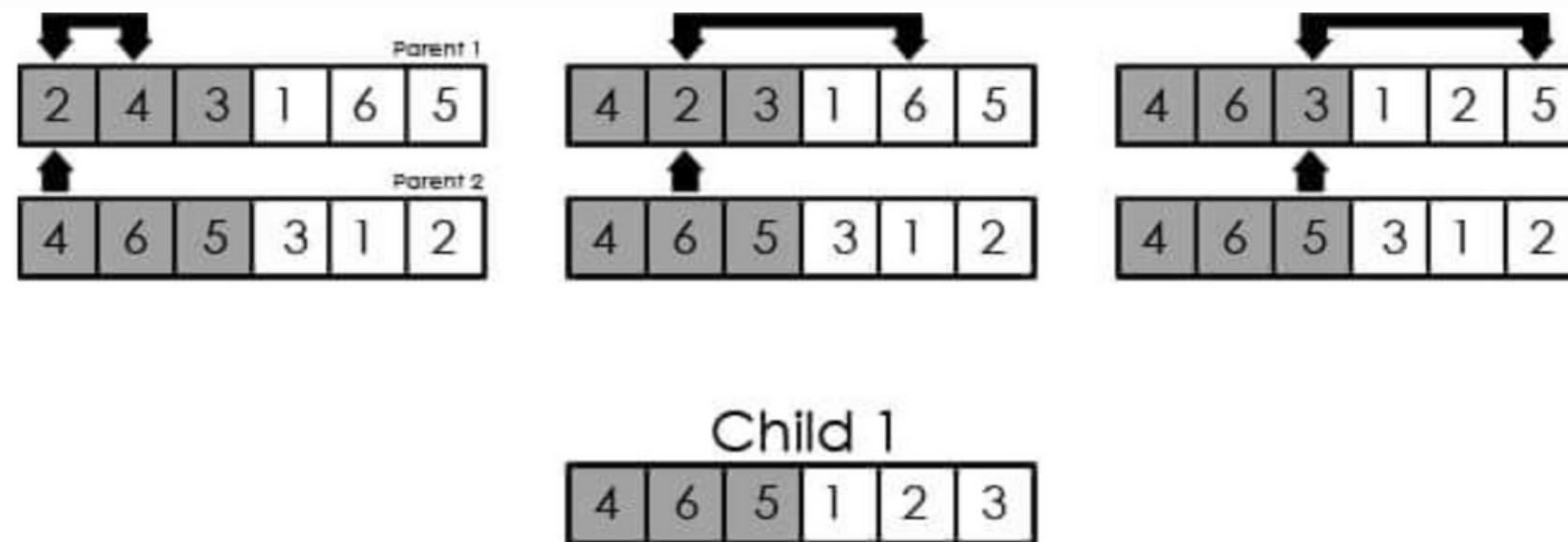
The selection operation is to generate a new population with higher values of the fitness function from the current population by a certain selection probability.

$$p_i = F(q_i) / \sum_{i=1}^n F(q_i)$$

* q_i represents the each genome in current population.

CROSSOVER OPERATION

Partial crossover method can ensure that the high-quality chromosomes can be inherited to the next generation, which is conducive to improving the performance of genetic algorithm.





SIMULATION EXPERIMENTS AND RESULTS

IN TWO LANGUAGES

Runned in two programming languages which are python and java then results are saved.

NOTICEABLY DECREASING

Objective function is decreasing meanly 17,72%.

Run	Pop size	Max number of iterations	Runtime(sec)	Target Funct. at initial pop	Target Function	Diff%	Language
1	29	100	2,2909379	5269	4317	18,07%	Py
2	29	500	12,0883127	5480	4574	16,53%	Py
3	29	1000	32,6733381	5219	4327	17,09%	Py
4	29	2000	94,33845214	4802	4243	11,64%	Py
5	29	3000	172,9644581	5227	4345	16,87%	Py
6	29	5000	468,1480129	5149	4392	14,70%	Py
7	100	180441	24,5158520	4856	3961	18,43%	Java
8	100	303750	43,143024	4760	3828	19,58%	Java
9	100	475494	55,36978	4971	3819	23,17%	Java
10	100	500000	63,4167300	4709	3714	21,13%	Java
Average			96,8948898			17,72%	

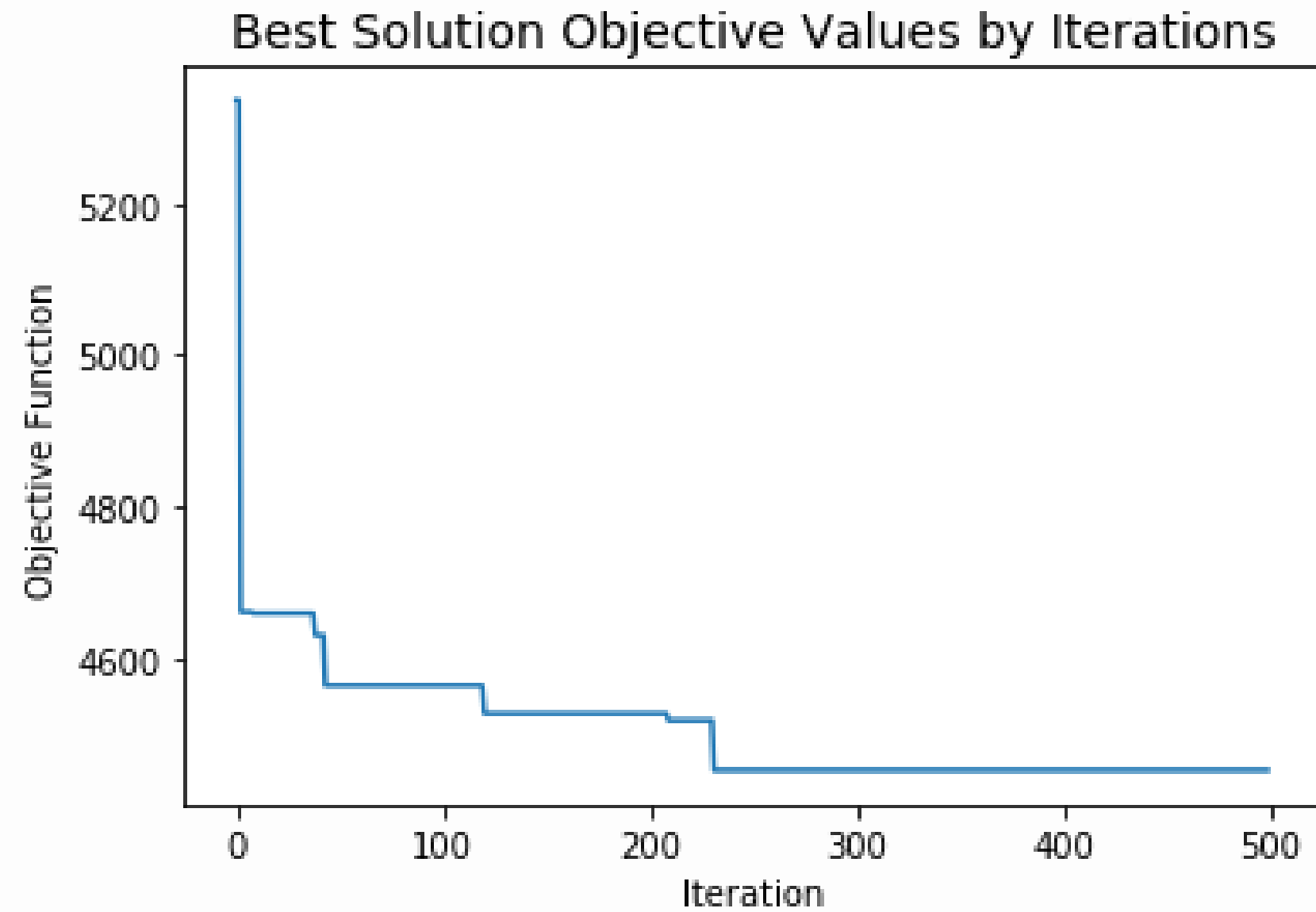
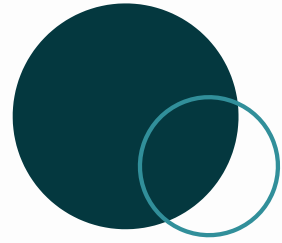
FIGURE 1. RUN SOLUTIONS BY DIFFERENT PARAMETERS

TARGET

Target function result is decreasing by genetic algorithm.

RUNTIME

Average runtime is 96,89 seconds.



RESULT

In 500 iteration run, target function result is decreasing exponentially and stalling more than 250 iterations.



REFERENCES

Fu, C., Zhang, L., Wang, X. and Qiao, L., 2018. Solving TSP problem with improved genetic algorithm.

Stack Abuse. 2020. Traveling Salesman Problem With Genetic Algorithms In Java. [online] Available at: <<https://stackabuse.com/traveling-salesman-problem-with-genetic-algorithms-in-java/>> [Accessed 22 April 2020].

The background is a solid teal color. It features several white geometric elements: a vertical line on the left side, a horizontal line near the top right, and a small white square in the top right corner.

THANK YOU!

IBRAHIM ONUR SEBETCI