

Experiment 2 Application of Genetic Algorithm

1. Experimental Purpose:

- 1) Be familiar with and master the principle, process and coding strategy of genetic algorithm
- 2) Use genetic algorithm to solve function optimization problem
- 3) Understand the process of solving the TSP problem and test the impact of major parameters on the results.

2. Experimental Principles:

Traveling Salesman Problem (TSP Problem) is one of the most famous problems in mathematics. Suppose a traveling merchant wants to visit n cities. He has to choose the route he wants to take. The limit of the route is that he can only visit each city once, and he has to return to the original city. The goal of path selection is to obtain the path with the minimum distance of all paths. The TSP problem is a combinatorial optimization problem. This problem can be proven to have NPC computational complexity. Therefore, any method that can simplify the solution of this problem will be highly evaluated and concerned. The basic idea of genetic algorithm is based on imitating the genetic process of biological genetics. It represents the parameters of the problem in terms of genes and the solution in terms of chromosomes (represented in binary code in computers), resulting in a population of individuals with different chromosomes. This group competes for survival in problem-specific environments, and the fittest have the best chance of surviving and producing offspring. The offspring inherit the best characteristics of the parent generation randomly and continue this process under the control of the living environment. The chromosomes of the population will gradually adapt to the environment, constantly evolve, and finally converge to a group of similar individuals most adapted to the environment, that is, to get the optimal solution of the problem. Genetic algorithm is required to solve the shortest path of TSP problem.

3. Experimental Content:

- 1) Solve the TSP optimization problem with the genetic algorithm, and analyze the algorithm performance of the genetic algorithm for solving TSP problems of different sizes.
- 2) For the same TSP problem, analyze the influence of population size, crossover probability and mutation probability on the algorithm results.

4. Requirements for Experimental Report:

- 1) Draw a flow chart of the genetic algorithm to solve the TSP problem.
- 2) Analyze the algorithm performance of genetic algorithm for solving TSP problems of different scales.
- 3) For the same TSP problem, analyze the influence of population size, crossover probability and mutation probability on the algorithm results.
- 4) Try to hand in the source code.