Solving the dynamic travelling salesman problem with the use of evolutionary computation

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The subject of travelling salesman problem is always a hot topic. Analyzed ways to solve travelling salesman problem for a acceptable time. It was implemented system with the base on general algorithm of evolutionary computing.

Keywords – travelling salesman problem, genetic algorithm, evolutionary computation, REST technologies.

Introduction

The paper cosinders the feature of using evolutionary computing in solving travelling salesman problem. The traveling salesman problem has attracted much attention from mathematicians and programmers because it is easy to describe this task but it is difficult to effectively solve it. Simplicity of the task of salesman is misleading - the problem is one of the most intensively studied problems in the field of computational mathematics. The importance of solving the travelling salesman problem lies in the fact that it is used in very diverse areas, such as: routing vehicles, designing microprocessors, production planning, data clustering, reconstructing curves.

Routing of vehicles is a particularly important area for today, as the number of online purchases has increased significantly and the number of deliveries has increased accordingly. It is therefore important to maximize the time and distance of deliveries, which in turn reduces fuel consumption and emissions of harmful substances into the atmosphere.

Applying the travelling salesman problem in designing microprocessors allows you to increase the density of elements on the crystal, which in turn opens two development strategies: reducing heat loss by reducing the area of the microprocessor but in this case, the performance remains at one level; otherwise you can increase the performance by leaving the area of the microprocessor stable.

Genetic algorithm

In many areas of application of the travelling salesman problem there are additional restrictions: resources or time that makes finding a solution to a task much more difficult. In the theory of complexity of calculations, the salesman problem is classified as a class of NP-complete problems. Thus, it is assumed that there is no ideal algorithm for solving this problem. In other words, the running time of any algorithm that solves the salesman problem exponentially increases with the increase in the number of cities.

For application of the travelling salesman problem, the use of precise methods is not feasible. Therefore, the best way to solve this problem is to use evolutionary algorithms, since they allow a short time to find a solution that will be close enough to the exact one.

Genetic algorithm is a heuristic search algorithm used to solve problems of optimization and modeling by random selection, combination and variation of selected parameters using mechanisms created on the basis of biological evolution.

The algorithm of the program system is depicted on Fig. 1.

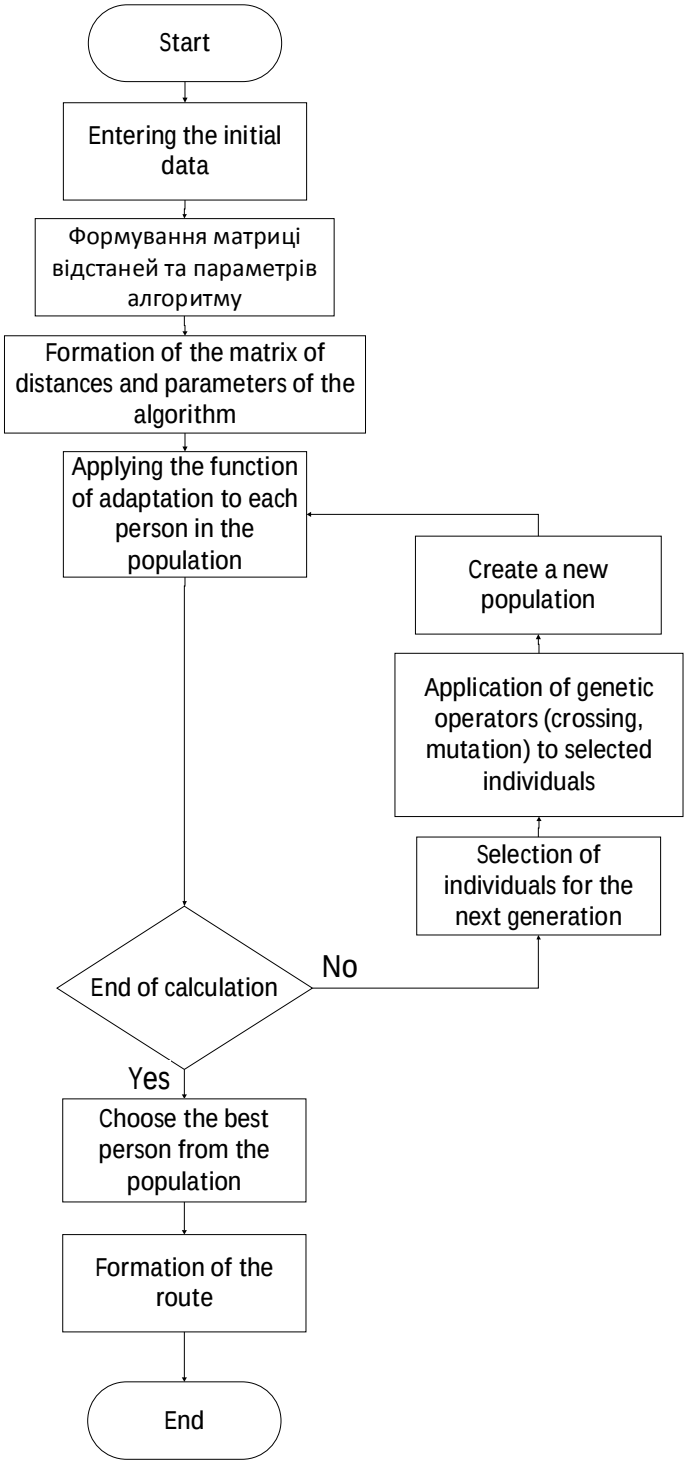

Fig.1. Block diagram of the system`s algorithm.

The advantages of the genetic algorithm over other algorithms used to solve the salesman problem are its simplicity, ability to work with many parameters and flexibility in implementation. The simplicity of the algorithm lies in the fact that it actually reflects the natural evolution of problem-solving methods.

The software system will allow you to calculate the salesman's task using a genetic algorithm at an acceptable time.

The structure of the system for solving the salesman problem with the use of the genetic algorithm can be divided into two subsystems.

The first subsystem, the subsystem of the calculation, is designed to find the best route between user-defined points using a genetic algorithm using genetic operators and a function of the device to determine the length of the route using the distance matrix created using the data initialization subsystem. The subsystem is depicted in Fig. 2.

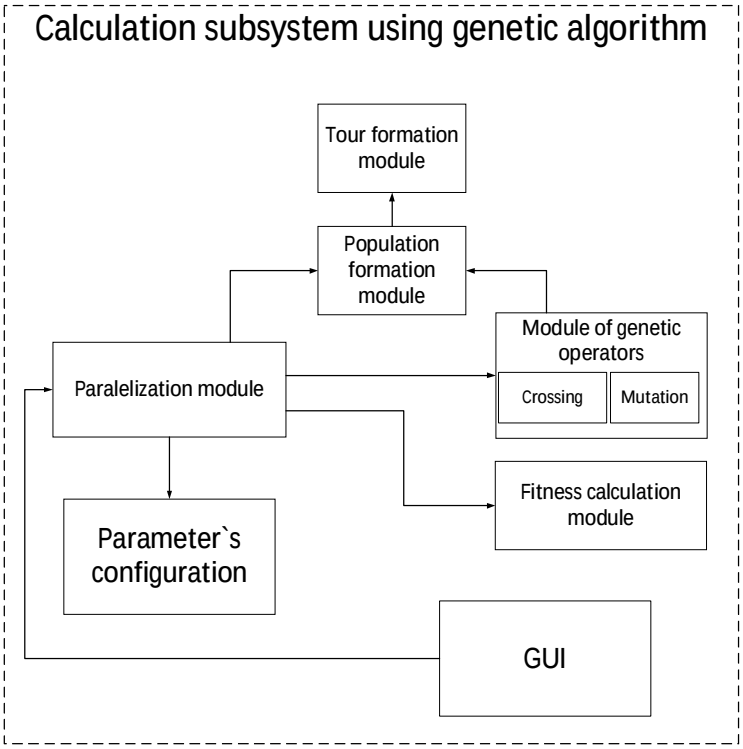

Fig.2. Subsystem of calculation of the software system.

The second subsystem, the subsystem of initialization of data, is responsible for creating the matrix of distances and geocods by generating requests to the Google Maps API and passing the results to storage in the corresponding object in the computing subsystem. The subsystem is depicted in Fig. 3.

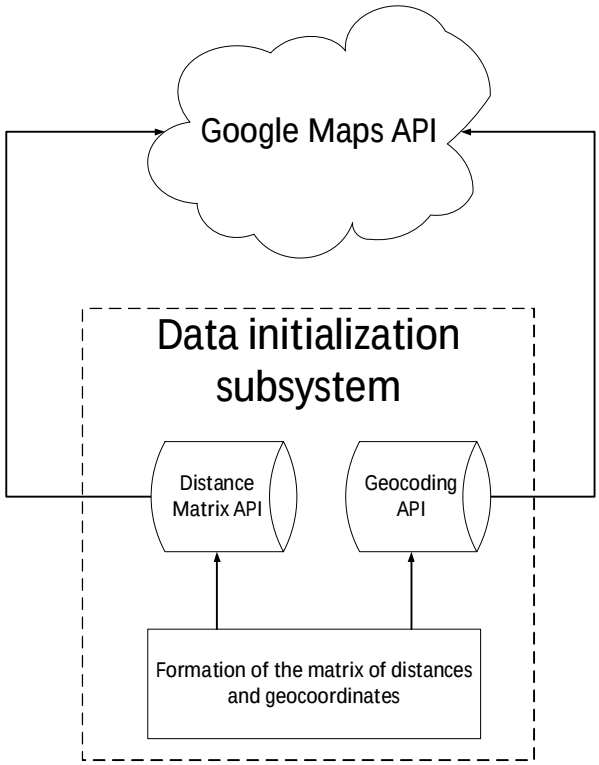

Fig.3. Subsystem of data initialization.

Conclusion

In this paper the analysis of the travelling salesman problem is carried out. The solution of the travelling salesman problem with the use of the genetic algorithm is proposed. The analysis of the travelling salesman problem and an overview of the application of the travelling salesman problem in various fields are carried out. The software system for solving the problem is developed.

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