Monte-Carlo Methods - The Traveling Salesman Problem

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***Abstract*—In this project, we made a study of TSP[1] algorithm. For this study we used the Simulated Annealing as a solution for this problem. The objective of this study, it is to obtain the zero cost for the TSP, for that we injected a zero costs on a distance matrix, for a particular path. We use a Matlab code provided by the professor.**

1. Introduction

The code provided by the professor, is divided in three parts, first part, is a function (*traveling*) that use a rand function of Matlab (generate a random values with uniform distribution between 0 and 1) for obtain a initial route and start one process that search change locally each route and accept one route, if the length of this it is lower than the previous route. The second part of the code, is a function (*traveling2*) that use the simulated annealing method. The third and last part of code, is main program, this generate randomly the positions of cities, calculate the distance matrix D, and invoque the first function (*traveling*) and second function (*traveling2*) to solve the problem.

As was said before, this project is based on Monte-Carlo Methods, more properly the simulated annealing method, starting with the code provided by the professor, we injected a costs 0 in a distance matrix, per example for a n=5 cities and assumed that the distance matrices is D, we injected cost 0 for D(i,i+1), D(i+1,i), D(1,n) and D(n,1).

Then we made a several tests, with differents n (number of cities), number of processes and we analyzing the results, basically the frequency that the code obtain the best solution.

2. Case of Study

2.1. Traveling Salesman Problem [1]

Given a list of cities and a matrix with the distance between a pair of cities, the TSP ask the following question: *What is the shortest possible route that visits each city exactly once and returns to the origin city?*

In the Theory of computational complexity the TSP is a problem that belongs to the class of NP-Complete problems. Thus, the worst-case running time, increases exponentially with the number of cities.

The TSP has several applications, such as logistics. planning and the manufacture of microchips. In these applications, the concept of city, represents customers, soldering points, or DNA fragments, for example. The concept distance represents traveling times or cost, similarity measure of a DNA fragment.

2.2. Simulated Annealing

3. Results Analysis

4. Conclusion

References

[1] Traveling salesman problem. https://en.wikipedia.org/wiki/Travelling_salesman_problem.

1. Traveling Salesman Problem