

Final Year Project

An investigation into the mathematical and evolutionary
methods of solving the Travelling Salesperson Problem

Alex Campbell

Introduction

The Travelling Salesperson Problem (TSP) is an NP-Hard problem which is commonly found in combinatorial optimisation, theoretical computer science and operations research. It's a simple problem on the surface which simply states that "Given a list of cities and distances between each pair of them, what is the shortest possible route that visits each city exactly once and returns to the origin city?" [1]

This question appears deceptively simple, however with large sets of cities the search space becomes incredibly large, leading to a time complexity of $O(n^2 * 2^n)$ [2] which is simply infeasible for these large data sets.

As such many people decided to go for a more heuristic approach towards solving the TSP problem, by using evolutionary algorithms. As such instead of trying to find the optimal solution with an infeasibly long time span, we would settle for a 'good enough' solution with a much lower time complexity, however since TSP is a combinatorial optimisation problem it is much more difficult than continuous optimisation, with higher chances of falling into local optimum rather than the global optimum.

Appendices

References

- [1] Travelling Salesman Problem
https://en.wikipedia.org/wiki/Travelling_salesman_problem
- [2] A New Exact Algorithm for Traveling Salesman Problem with Time Complexity Interval ($O(n^4)$, $O(n^3 * 2^n)$), Yunpeng Li, 2014
<https://arxiv.org/abs/1412.2437>